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PARTS I and II

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of the

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PART I

C O N T E N T S

PDR The PAKISTAN DEVELOPMENT REVIEW

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PART II

C O N T E N T S

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50:4 Part I (Winter 2011) pp. 277–278

Inaugural Address

ABDUL HAFEEZ SHEIKH

Dr Rashid Amjad, President Pakistan Society of Development Economists and Vice-Chancellor PIDE, distinguished guests, ladies and gentlemen, it gives me great pleasure to address the 27th Annual General Meeting and Conference of the Pakistan Society of Development Economists (PSDE).

I am pleased to note that the Society has been instrumental in promoting scholarly research and debate on critical socio-economic issues facing Pakistan, and that the Pakistan Institute of Development Economics (PIDE) has played a vital role in promoting and nurturing the Society since its inception in 1982. The Society has not only upheld and galvanized the profession of development economics in Pakistan but has also helped inspire new ideas for the greater development and prosperity of Pakistan.

Ladies and gentlemen, I am happy to see that when I address you today Pakistan's economy is again showing distinct signs of recovery and we hope to achieve a growth rate of 4 to 5 percent this year which should help lift us to a much higher growth trajectory in the future. Despite the heavy headwinds that we have had to face, our government took important fundamental economic decisions of which we can be justly proud.

First and foremost we reversed the anti-agricultural bias that had been the hallmark of previous regimes through incentives to farmers, including higher prices. This policy has paid rich dividends in terms of providing food security at a time of global scarcity as well as a positive impact on the standards of living in our rural areas, where the majority of our population resides. Second, our government launched for the first time in Pakistan's history, direct income support for the poor through the Benazir Income Support Programme. Our government has increased expenditure on social protection programmes more than seven fold since we took over. There is growing evidence to show that the Benazir Income Support Programme has provided an effective safety net for the poor and the vulnerable. Third, our government took the historical decision to empower the Provinces and through this strengthen the federation by the adoption of the 18th Constitutional Amendment and the unanimous passage of the 7th NFC award. We remain confident that by providing more resources at the provincial level, amongst others, there would be significant improvements in the delivery of much needed education, health and social services. Fourth, we have given the highest priority to accelerate development in Balochistan, FATA and other less developed regions by allocating more resources for them at the federal level. Fifth, rather than relying on aid and loans, the government believes in trade as an engine of growth. It is in this context that we have opened up our economy to more trade with our immediate neighbours in South Asia as well as with Europe and other major international markets.

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Let me also clearly state here that the aim of ensuring macroeconomic stability remains the overarching goal of our economic policies despite a difficult economic environment. This is essential to revive and sustain robust business activity. We will adopt prudent monetary policies and take decisive steps to reduce the fiscal deficit through increasing revenues as well as cutting down on non-development expenditures. This should act as a dampener to inflationary pressures as well as help revive economic growth.

I am acutely aware that continuing energy shortages remain a major hurdle in reviving economic growth as well as a hardship for consumers. The cost of this has unfortunately been highest for small scale producers who cannot afford alternative energy sources. There are no short-cuts to solving the energy problems, given the long gestation time for setting up new generation capacity. Also, the government has to ensure a balance between rising global oil prices and the capacity of our people to bear higher energy costs. This further complicates the problem and despite what you economists may say defies easy solution. We are giving the highest priority to solving the energy crisis through short-term measures of raising power generation from existing plants through modernisation and restructuring, including more transparent and effective management and delivery mechanisms. We are also very hopeful of positive results from the Thar Coal gasification project being undertaken by the Planning Commission. The Bhasha-Daimer Dam and other hydro-projects shall provide more long term solutions to the current energy shortages.

The theme of this year's Conference "Economic Growth and Development: New Directions" is both timely and relevant at the national as well as the global level. The worst global financial crisis as well as the ensuing recession has shaken the faith in self-correcting markets and the current international financial infrastructure. Indeed, there is a growing feeling globally that a system driven by unchecked greed can only accentuate inequality and concentrate wealth in a few hands. This has indeed led many people to question such a system as well to actively demonstrate against it in many parts of the world.

Our moral philosophy as enshrined in the principles of our religion and our constitution teaches us the importance of ensuring a just and socially equitable system that provides equal opportunity for all as well as social welfare for the needy and the vulnerable. Our government has actively pursued these principles in the framing of our economic policies. Our government has also adopted a new growth strategy that draws on the most recent advances in economic thinking. The most fundamental of which is that human capital embodied in an educated and skilled workforce is the major engine of economic growth in highly competitive global markets.

In the end, let me say that ensuring effective implementation of the economic reform programme is a major challenge to which policy-makers, practitioners and academics must actively contribute. In this, you economists and especially the many young economists I see present at this Conference have a major role to play. I wish you all success in your deliberations, and look forward to the recommendations of this scholarly body for moving this country forward on the path to greater development and prosperity.

Thank You.

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50:4 Part I (Winter 2011) pp. 279–283

The Presidential Address

Economic Growth and Development: New Directions

RASHID AMJAD

Finance Minister, Dr Abdul Hafeez Sheikh, Dr Nadeem Ul Haque, Patron of the Pakistan Society of Development Economists and Deputy Chairman Planning Commission, Past Presidents and Distinguished Members of the Society, Excellencies, Ladies and Gentlemen:

It is my pleasure to welcome you all to the 27th Annual General Meeting and Conference of the Pakistan Society of Development Economists.

On behalf of the members of the PSDE, I would like to thank you, Finance Minister for having spared your precious time to open this important meeting. I would like also to especially thank our members and guests who have come from different parts of the country and from different continents to participate in the Conference. We are extremely pleased to see here today many young students of Economics and Development—Pakistan's future economists and development specialists—who I am sure are enthusiastic to learn from the many leading economists attending this Conference of the critical issues and economic challenges that we face at the national, regional and global levels.

Let me join Dr Muslehud Din in welcoming Professor Ashwani Saith, Professor of Economics at the International Institute of Social Studies, The Hague and former Professor of Development Studies at the London School of Economics, who will be delivering the Mahbub Ul Haq Memorial Lecture; Professor Asim Ijaz Khwaja, Professor, Kennedy School, Harvard University who will be delivering the Gustav Ranis Lecture; Dr Jomo Kwame Sundaram, Assistant Secretary General, United Nations and former Visiting Professor, Harvard University, who will deliver the Allama Iqbal Lecture; and Dr Atif Mian, Associate Professor, University of California, who will be delivering the Quaid-i-Azam Lecture this year. We are also very pleased to have with us Dr Gerardo della Paolera, President of the Global Development Network (GDN) who will be participating in a panel discussion on economic reforms and competitiveness as well as presiding over the Mahbub Ul Haq Memorial Lecture. Dr Paolera, we are sure

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that this visit of yours to Pakistan will help to strengthen links between the Global Development Network and its many members in Pakistan as well as with other economic institutes participating in this Conference.

In addition, we are very happy that PSDE will be hosting at this Conference together with the International Growth Center (IGC), jointly run by the University of Oxford and London School of Economics, an invited lecture by Dr Surjit Bhalla, an eminent economist who has formerly worked at the World Bank.

I am also very happy to announce that in continuation of the tradition started last year by the Pakistan Society of Development Economists (PSDE), the Society will be honouring this year Dr Parvez Hasan, former World Bank Chief Economist, Asia Region, and former Chief Economist, West Pakistan whose writings on East Asia's economic performance and on the Pakistan Economy and broader development issues are well known to all of us.

Ladies and Gentlemen, the theme of this year's Conference: "*Economic Growth and Development: New Directions"* was sparked by the adoption by the National Economic Council earlier this year the Planning Commission's New Growth Framework for Pakistan. This framework spells out urgent major economic and institutional reforms that need to be taken, as well as identifies future drivers of economic growth which must be harnessed, if Pakistan is to move decisively towards a higher growth trajectory—nearer 7 to 8 percent—from the average of around 5 percent in the last sixty years.

But clearly as we see from the world around us it is not just the Pakistan economy which seeks new directions and a new paradigm for growth and development. The recent global financial meltdown and ensuing deep recession and the current impasse in development economics calls for fresh thinking and new ideas.

The global financial crisis, sparked by the sub-prime mortgage crisis in a small state in the United States, engulfed financial institutions and markets throughout the world as these toxic assets permeated seamlessly undetected through the global financial system. This made it difficult to distinguish which financial portfolios were contaminated and which were not and resulted in unprecedented defaults by major global financial players. It has now spread from the financial to the real economy resulting in a collapse of economic growth and a steep rise in unemployment.

The public reaction to this crisis was also unprecedented. "Occupy Wall Street" became not just a slogan but a movement that questioned the market driven capitalistic system itself and the unflinching pursuit of "greed" that seem to be its driving force. There was growing outrage at the huge bonuses handed out to what are now termed as the 1 percent (in fact 0.1 percent) who took so called "risks", but as it turned out that these "risks" were not difficult to take, as these were at the expense of ordinary people's assets who lost out when these "risks" failed to mature.

This societal crisis which questions the very fundamentals of the market driven system and indeed the very roots of the capitalism itself will be reflected on by Prof. Ashwani Saith in the Mahbub ul Haq lecture today. I am sure it will spark a lively debate.

The impact of the financial crisis on the Western industrialised economies has not yet run its course as can be seen by the continuing saga of the "Euro". In the United States markets appear to be calmer but a lack of a political consensus on how to manage the national debt still makes for the possibility of a double-dip recession.

But let us now turn to the economic challenges that we face on our own doorsteps.

Ladies and Gentlemen,

Let me first reiterate that Pakistan's best-kept secret is its "resilient economy" which has managed to improve, though modestly, the standards of living of the vast majority of its people over the last sixty years. Over this period, it has grown at a respectable average growth rate of 5 percent and managed a per capita growth of around two and a half percent. Pakistan's economy has more than once proven its critics of doom and gloom wrong and has repeatedly shown its capacity to bounce back after being subjected to economic shocks or natural disasters.

A "resilient economy" growing at an average rate of 5 percent over many decades would even till recent years been viewed as satisfactory if not praiseworthy. But measures of economic growth performance have now changed drastically.

First, has been the unprecedented growth of nearer 8 to 9 percent achieved by the East Asian economies, followed by China and more recently, by India. Judged by the performance of these economies, Pakistan's growth performance appears almost anaemic and lacklustre. In a highly competitive global economy, to keep pace with your competitors, you too must grow as fast as them to attract high levels of investment, adoption of new technology, innovation and productivity growth, for these provide the competitive edge in global markets.

Second, given its very high population growth, Pakistan's labour force is growing at an unprecedented rate of around 3.5 percent. Based on historical employment elasticity estimates (which new capital-intensive technologies are further reducing) Pakistan must grow nearer 8 to 9 percent if it is to absorb this high growth of labour force. Otherwise resulting high unemployment and frustrated youth can threaten the entire socio-economic edifice as we have witnessed in the recent "Arab Spring". The dynamics of job creation as an interaction between households and aggregate demand is the theme of Prof. Atif Mian's Quaid-i-Azam Lecture.

Thirdly, while the global economic recession was successfully deflected by most South Asian economies, Pakistan's vulnerable macroeconomic situation severely limited its capacity to adjust and was therefore badly hit. Today, Pakistan finds itself in the midst of a deep stagflation with unprecedented low economic growth rates and double digit inflation, even if we remain somewhat hopeful that the economy will show some improvement during this 2011-12 fiscal year.

These important developments and current economic situation has forced us to rethink our fundamental economic paradigm which has driven economic growth in the past and which is now showing to be running out of steam.

The new directions and reforms the Pakistan economy must take to break out of its current stagflation and move to a higher, sustainable and inclusive growth path is clearly the most pressing challenge that economists must address and therefore has been chosen as the topic for this Conference.

Let me spell out very briefly some of the key issues which I feel are critical if Pakistan is indeed to move to a higher and sustainable growth path.

First and foremost Pakistan must take advantage of the demographic dividend which we are witnessing today and which will run till the early 2040s. This "youth bulge" with 60 percent of the population under twenty five years, offers enormous opportunities in a world with an aging population. But unless we slow down our current growth rate of population this dividend will not only be sharply weakened but as I have said earlier result in rising unemployment and simmering frustration. Slowing down population growth and ensuring rapid and higher growth to absorb the labour force must therefore be given the highest priority.

Second, we must refurbish the Indus Water Irrigation System, the largest in the world—the strong heart of the country's economy—if we are to take advantage of the secular change in the international terms of trade in favour of food grains and commodities. These shifts, which are not just cyclical, make agriculture (both farm products and livestock) more profitable and offer enormous opportunity to bring prosperity to our people, especially the majority living in rural areas. Sadly, this irrigation system has been neglected and run down and needs not just resources to refurbish but institutional reforms and competent management to run efficiently.

Thirdly, Pakistan's Achilles heel remains its low growth rate of exports in relation to its import needs resulting in frequent balance of payment crisis and recurring stop-go cycles. To be competitive in global markets we must possess economically efficient and globally competitive firms and industries. This cannot be done on the basis of continuing subsidies and high and unending protection to even some of our oldest industries (e.g. textiles). A carefully phased out tariff reform must replace the existing jungle of vested interest driven protection, (though SROs) which is sapping our competitive strength.

Fourthly, we must in the face of continuing global uncertainty and lack of progress on the WTO Doha Round do what fast growing regions like ASEAN have done and open up regional trade amongst SAARC countries and most importantly with India. This will provide a much needed boost to economic growth and trade in the region. It is heartening to see that careful but decisive steps like the granting of MFN status to India are in the pipeline.

Fifth, we need to give the highest priority to protecting our environment especially give the increasing proof of being amongst those countries to be badly hit by climate change. As Anatolov Levine in his book "Pakistan a Hard Country" convincingly argues Pakistan's future is not threatened as much as by the current insurgency in some parts of the country as it will be by climate change. If this rising threat is not countered by a well mapped out strategy climate change will eventually dry out the Indus Basin River System which is the heart of Pakistan's economy. We look forward to hearing our distinguished speaker Dr Jomo Kwame Sundaram on this topic in a global context.

Sixth, we must invest in our people and impart quality education at all levels which is still woefully inadequate both in terms of resources allocated and quality imparted. The cutting competitive edge in global markets is increasingly based on human capital or the education and skill levels of its work force which above all drives entrepreneurship and innovation. This is a subject which Dr Asim Khwaja will deal within in the Gustav Ranis Lecture tomorrow.

Seventh, and last I strongly believe that we should call a spade a spade and attack corruption at the highest levels rather than continue to take refuge under this wooly concept of “good governance”.

I thank you all for your patient hearing.

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50:4 Part I (Winter 2011) pp. 285–294

The Quaid-i-Azam Lecture

Household Balance Sheets, Aggregate Demand and Unemployment

ATIF MIAN and AMIR SUFI

U.S. households accumulated debt at an unprecedented pace between 2001 and 2007. In the aftermath of the housing downturn, deleveraging by highly indebted households is the most important factor responsible for the current economic slump. The deleveraging process has led to sharp drops in both aggregate demand and employment. We argue that meaningful policies aimed at facilitating debt-reduction for under-water homeowners in the short run, and replacing non-contingent debt with contingent-debt in the long run are essential for a robust and sustained recovery.

I am honored to be given this opportunity by the Pakistan Society of Development Economists to deliver the Quaid-i-Azam Lecture at the annual general meeting in Islamabad.[1] My lecture—which is based on research over the years with Amir Sufi of University of Chicago Booth School of Business—is divided into three parts.

First, I discuss the magnitude and nature of household debt accumulation in the U.S. over the past decade. Second, I show how the timing and severity of the current economic collapse is closely related to the deleveraging of U.S. household balance sheets in the aftermath of the housing market downturn. Deleveraging by highly indebted households forces them to cut back on consumption. The resulting loss in aggregate demand is responsible for a majority of the jobs lost during the 2007-09 recession. Finally, I discuss the type of reforms needed to resolve the U.S. household leverage crisis and put the economy back on track.

1. THE ACCUMULATION OF U.S. HOUSEHOLD DEBT

The increase in household leverage prior to the recession was stunning by any historical comparison. From 2001 to 2007, household debt doubled from $7 trillion to $14 trillion (see Figure 1). The household debt to income ratio increased by more during these six years than it had increased in the 45 years prior. In fact, the household debt to income ratio in 2007 was higher than at any point since 1929. Recent data suggest that over a quarter of mortgaged homes in the U.S. are underwater relative to their mortgage value.

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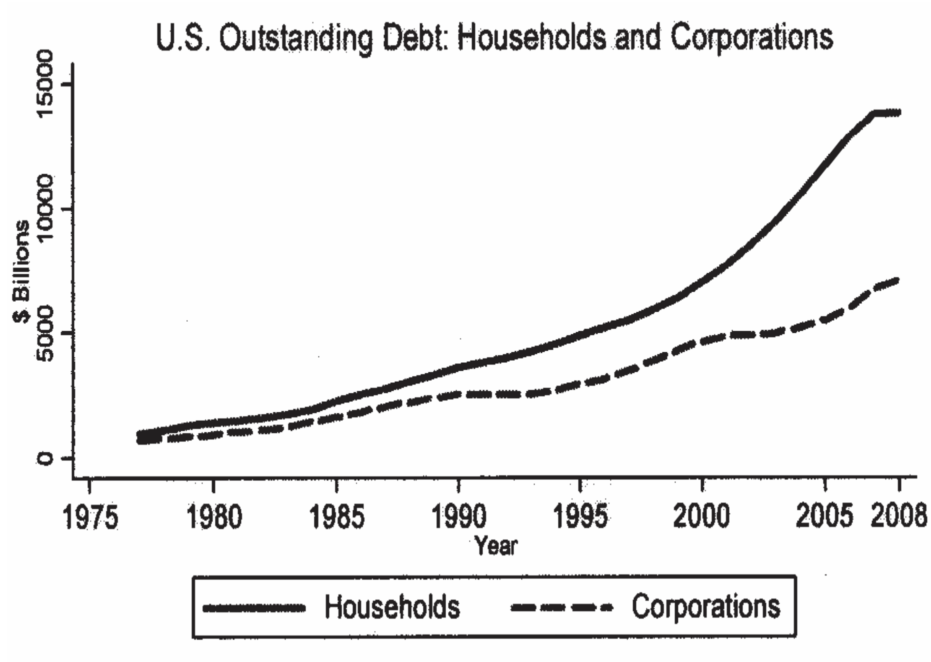
Authors' Note: The research cited in this lecture is available at: http://faculty.haas.berkeley.edu/atif/research.htm. This lecture was also presented as testimony on Oct 4th, 2011 by Atif Mian before the U.S. Senate subcommittee on the U.S. macro-economic situation.

[1]Lecture delivered by Atif Mian.

Fig. 1. Total Household Debt in the U.S.



Why did U.S. households borrow so much and in such a short span of time? What kind of households borrowed the most? I explore this question in a couple of papers with Amir Sufi [Mian and Sufi (2009 and 2011a)]. Our explanation for the increase in household debt begins with the dramatic expansion in mortgage originations to low credit quality households from 2002 to 2007. Mortgage-related debt makes up 70 to 75 percent of household debt and was primarily responsible for the overall increase in household debt.

We argue that the primary explanation behind the dramatic increase in mortgage debt was a securitisation-driven shift in the *supply* of mortgage credit. The fraction of home purchase mortgages that were securitised by non-GSE institutions rose from 3 percent to almost 20 percent from 2002 to 2005, before collapsing completely by 2008. Moreover, non-GSE securitisation primarily targeted zip codes that had a large share of subprime borrowers. In these zip codes, mortgage denial rates dropped dramatically and debt to income ratios skyrocketed.

An important lesson regarding mortgage expansion during the 2000's is that the expansion does *not* reflect productivity or permanent income improvements for new borrowers. In particular, mortgage credit growth and income growth were *negatively* correlated at the zip code level from 2002 to 2005, despite being positively correlated in every other time period back to 1990. Mortgage credit flowed into areas with declining incomes at a faster pace.

One consequence of the rapid increase in supply of mortgage credit was its impact on house prices. As credit became more easily available to households that were historically rationed out of the credit market, house prices began to rise. Moreover, the increase in house prices was not uniform across the U.S. House price appreciated faster in areas that had difficult-to-build terrain, i.e., where housing supply was inelastic. While this mechanism does not explain all of the cross-sectional variation in house price growth across the U.S., it does explain a major proportion of it.[2]

The increase in house prices had a large impact on further encouraging the accumulation of debt by households. In Mian and Sufi (2011a) we focus on the feedback effect from house prices to household borrowing by analysing individual level borrowing data on U.S. household that already owned their homes in 1997 before mortgage credit expanded. We find that existing homeowners borrowed 25 to 30 cents against the rising value of their home equity from 2002 to 2006.

The home equity-based borrowing channel is strongest for low credit quality borrowers, borrowers with high credit card utilisation rate, and younger borrowers. Moreover, home-equity borrowing was not used to purchase new properties or to pay down expensive credit card balances, implying that the new debt was likely used for real outlays such as home improvement and consumption. Overall, we estimate that the home-equity based borrowing channel can explain 50 percent of the overall increase in debt among homeowners from 2002 to 2006.

To summarise, rapid increase in the supply of securitisation-driven mortgage credit in early 2000's induced U.S. households particularly those in subprime neighbourhoods to accumulate debt. The expansion in credit supply also fuelled a remarkable increase in house prices and U.S. homeowners borrowed aggressively against the rising value of their houses. While overall debt increased by 7 trillion dollars, the increase was not uniform across the U.S. Household leverage growth was concentrated in areas with relatively inelastic housing supply, and among younger households and households with low credit scores.

2. HOUSEHOLD DELEVERAGING, AGGREGATE DEMAND, AND UNEMPLOYMENT

(a) The Beginnings of the Crisis

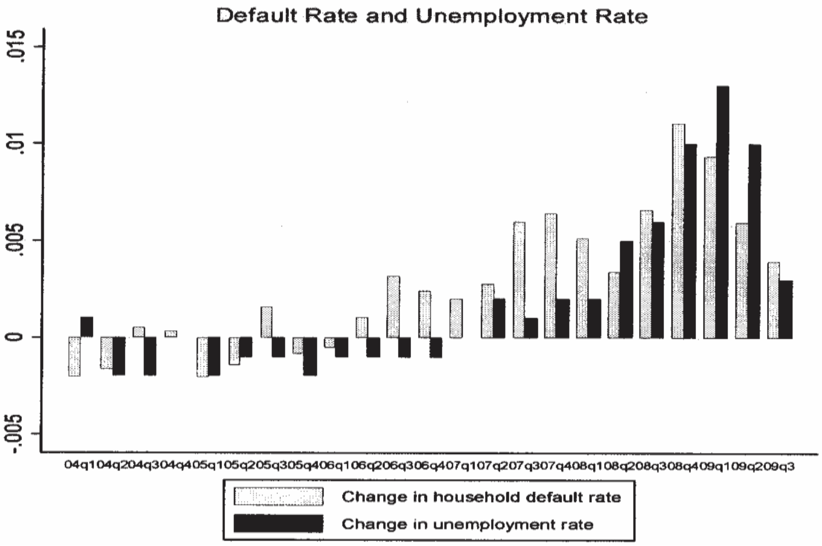
The accumulation of debt by households with largely stagnant real wages was not sustainable. Markets began to realise this towards the second half of 2006 as mortgage delinquencies crept up. In fact many of the first set of borrowers to default were those who could not even afford to carry their first few months of mortgage payments. Unable to refinance or sell their homes at a higher price, many homeowners began defaulting on their loan obligations.

Figure 2 plots the quarterly change in mortgage defaults and unemployment, and shows that default rates kept increasing for five straight quarters before there was an increase in the unemployment rate in the second quarter of 2007. This evidence is suggestive of the causal role that high household leverage and a weak housing market played in generating employment and output declines [see Mian and Sufi (2010) for details]. The next section shows more direct evidence of this channel.

[2]In particular, cities in Arizona and Nevada are important outliers. See Mian and Sufi (2009 and 2011a) for more details.

Fig. 2. Household Defaults and Unemployment

The figure plot quarterly change in household mortgage delinquency rate and unemployment rate. Household default rate data come from Equifax and the unemployment data are from the Bureau of Labour Statistics.



(b) Deleveraging and Aggregate Demand

How has the sharp rise in household debt from 2002 to 2007 affected economic recovery? When a large class of consumers see the value of their houses decline and realise that they can no longer rely on further borrowing to sustain their standard of living, they go into a “de-leveraging mode”. Deleveraging refers to the process where consumers stop relying on more credit for consumption and start making efforts to pay down existing debt to more manageable level. The scale of this problem can be judged from a recent study by Core Logic that reports that almost a quarter of homeowners who are current on their mortgages are under-water.

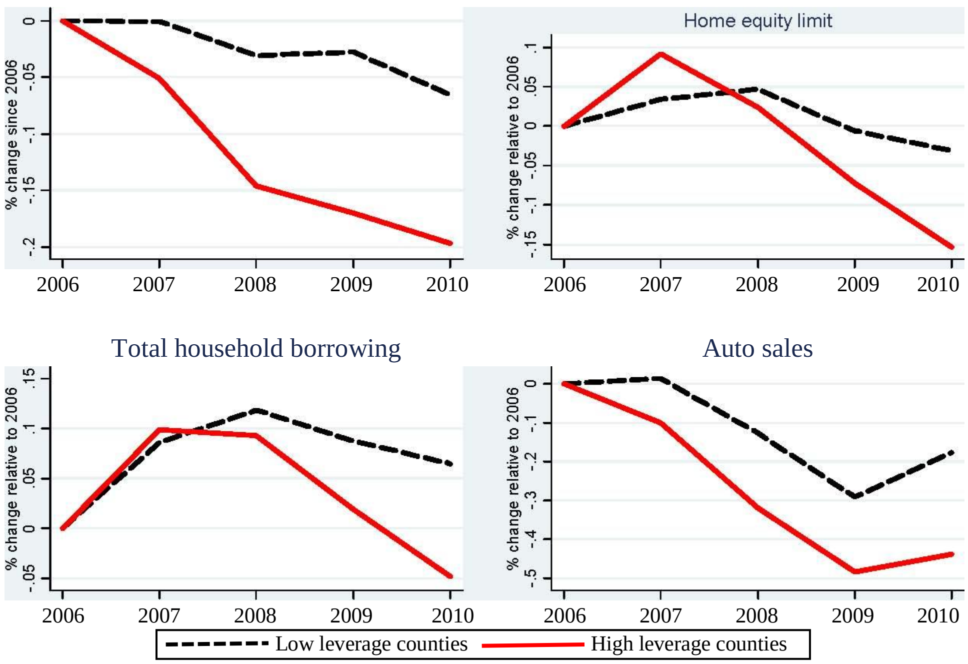
Once a large fraction of homeowners start cutting back on consumption as a result of deleveraging, there is a reduction in aggregate demand and the economy goes into a recession. Interest rates fall to help slowdown the fall in consumption and output. However, whether interest rate drop is sufficient to halt aggregate demand decline depends critically on the extent to which lenders (i.e. savers) increase their consumption in response to declining interest rates. If—as has been the case in the current slump—even an interest rate of zero fails to boost consumption sufficiently for the lending class, aggregate demand will fall and the economy goes into a recession.

I explain below how this deleveraging—aggregate demand channel is responsible for the large drop in U.S. output and employment. As noted earlier, the accumulation of leverage across the U.S. differed widely, depending in part on the elasticity of housing supply in an area. There are thus important differences across the U.S. in the extent to which a given area has suffered from the deleveraging shock. These differences are illustrated in Figure 3 that comes from Mian and Sufi (2011c).

Figure 3 splits U.S. counties into four quartiles based on the debt to income ratio as of 2006. High (low) household leverage counties are counties in the top (bottom)

Fig. 3. Deleveraging and Consumption

This figure plots house prices, home equity limits, household borrowing, and auto sales for high and low household leverage counties in the U.S. from 2006 to 2010. High and low household leverage counties are defined to be the top and bottom quartile counties based on the debt to income ratio as of 2006. Quartiles are weighted by the outcome variable in question as of 2006 so that both quartiles contain the same amount of the outcome variable as of 2006 (for house prices we weight by population).



quartile of the 2006 debt to income distribution. The top left panel shows that high household leverage counties experienced much more severe house price declines during the recession and afterward. House prices declined from 2006 to 2010 by 40 percent in these areas.

The decline in house prices represented a severe credit shock to households. As the top left panel shows, home equity limits from 2007 to 2010 declined by 25 percent in high leverage counties. The shock to credit availability translated into lower household borrowing. From 2007 to 2010, debt in these counties dropped by 15 percent, which translates into $600 billion.

The deleveraging shock also translates into aggregate demand. The lower right panel shows that consumption—as proxied by sale of new automobiles—drops significantly more in high leverage counties. High household leverage counties experienced a drop in auto sales of 50 percent from 2006 to 2009, with only a slight recovery in 2010. Mian, Rao, and Sufi (2011) show that the pattern in auto sales in Figure 3 also holds for consumption across other goods, including furniture, appliances, grocery, and restaurant spending. Moreover, within high leverage counties, the drop in auto sales is significantly higher in more subprime neighbourhoods that are hit larger by the deleveraging shock.

The magnitude of the drop in these variables is far smaller in counties with low household leverage before the recession. As of 2010, house prices were down only 10 percent, home equity limits had dropped only 8 percent, and household borrowing was down only slightly relative to the 2008 peak. Auto sales dropped sharply even in low leverage counties, but the drop was much less severe and the recovery in 2010 is stronger.

(c) Deleveraging and Unemployment

Figure 3 shows evidence of weak consumer demand for durable goods in high household debt counties. How does the sharp decline in consumption in high leverage areas affect aggregate unemployment? Answering this question with geographical variation has been difficult given an obvious barrier: the goods consumed in one part of the country are not necessarily produced in that area. For example, if Californians sharply reduce auto purchases because of excessive leverage, the decline in auto purchases will likely reduce employment in Michigan. Given this cross-state effect, one would underestimate the effect of household leverage on employment if one only examines job losses in high leverage areas such as California.

However job losses in goods and services that are non-tradable and hence must be produced in the city where they are consumed do not suffer from this problem. We therefore split consumption goods into those consumed locally (non-tradable) and those consumed nationally (tradable), and use the impact of deleveraging shock on local non-tradable employment to back out the total effect of deleveraging and reduced aggregate demand on employment [see Mian and Sufi (2011c) for details].

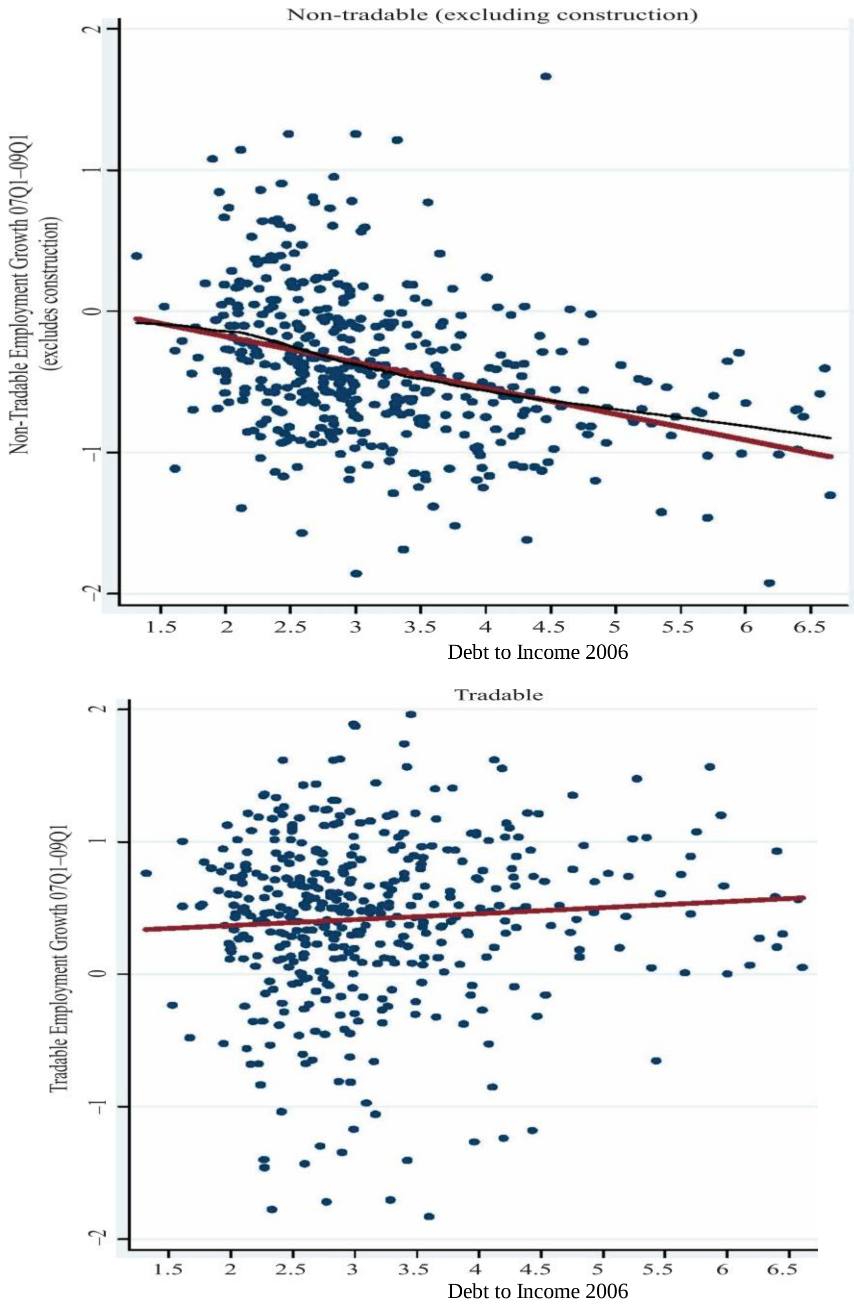
The central insight of our approach is that one can estimate the aggregate effect of household deleveraging on unemployment by examining how non-tradable employment varies across counties with varying degrees of deleveraging shocks. We classify industries as non-tradable if they are focused in the retail or restaurant business. Given that high leverage counties are those with a large boom and bust in residential investment, we explicitly remove construction from the non-tradable sector. In other words, our non-tradable industry category does not include construction or any other real estate related business.

The first step of the empirical methodology is to estimate the effect of deleveraging on employment in industries producing non-tradable goods. The left panel of Figure 4 show a very strong and quantitatively large relation between household leverage measured as of 2006 and employment declines in non-tradable industries from 2007 to 2009. For example, going from the 10th to the 90th percentile of county distribution by leverage increase job loss as a fraction of total employment in the county by 4.4 percentage points.

The right panel of Figure 4 repeats the analysis for employment losses in the tradable sector and shows that there is no relationship between county deleveraging shock and job loss in the tradable sector. The reason for this is that losses in the tradable sector are distributed equally across the U.S. as mentioned earlier. However, we can use the relationship between job losses and deleveraging shock in the non-tradable sector to back out the number of nation-wide jobs that have been lost in the tradable sector due to the deleveraging shock and resulting decline in demand.

Fig. 4. Deleveraging and Employment across Counties: Non-Tradable and Tradable Industries

This figure presents scatter-plots of county level employment growth from 2007Q1 to 2009Q1 against the debt to income ratio of the county as of 2006. The left panel examines employment in non-tradable industries excluding construction and the right panel focuses on tradable industries. The sample includes only counties with more than 50,000 households. The thin black line in left panel is the non-parametric plot of non-tradable employment growth against debt to income.



We do this calculation carefully in Mian and Sufi (2011c) and perform a number of checks to ensure that the number we compute is driven by the deleveraging—aggregate demand phenomena and not any alternative explanation. The total number of job losses that we can conservatively attribute to the deleveraging—aggregate demand channel is staggering. We estimate that deleveraging of the household sector accounts for 4 million of the 6.2 million jobs lost between March 2007 and March 2009 in our sample. In other words, 65 percent of total jobs lost in the U.S. are due to deleveraging and the drop in aggregate demand as a result of it.

3. POLICY CHOICES

The analysis above identifies the deleveraging—aggregate demand channel as the most important mechanism responsible for economic downturn and job losses in the American economy. The sharp drop in consumer demand in areas that accumulated the most leverage and large employment losses associated with the drop in consumer demand highlight the economic importance of the deleveraging—aggregate demand channel.

Unfortunately the current deleveraging cycle in the U.S. is painfully slow. How long will this cycle last? Despite more than three years since the start of this cycle, the amount of debt paid off or written down remains stubbornly small. Out of the 7 trillion dollars accumulated over 2001–2007, only about one trillion has been paid down or written off. U.S. household balance sheets remain highly levered by historical standards. The most recent monthly auto sales data also continue to show significant weakness in consumer demand among high leverage counties.

In the face of the very slow deleveraging process and its high economic cost, we urgently need policies that help reduce leverage for highly indebted households without forcing them into costly actions such as bankruptcy and foreclosures.[3] The threat of foreclosure and losing one's home may force many underwater homeowners to continue paying their mortgage bills but the resulting drop in aggregate demand hurts everyone. Indeed most recent data from Core Logic suggests that a quarter of U.S. homeowners owe more than their house is worth, and yet continue to make mortgage payments.

The dilemma for efforts to reduce household indebtedness is that from a lender's perspective it is not in their interest to write down debt that continues to be serviced on time. But as my analysis highlights, the *collective* consequences of such "individually rational" actions are quite unpleasant. If a large number of financially distressed homeowners cut back on consumption in order to protect their homes and continue paying their mortgages, the aggregate demand and employment consequences hurt everyone.

An obvious policy proposal to facilitate leverage reduction is principal write-down on underwater mortgages. While the government did initiate some related programmes in the past, they have been largely ineffective in achieving the desired goal. To be sure, there are complicated legal issues pertaining to mortgage debt restructuring. Similarly any orderly mechanism of debt restructuring should minimise unwanted disruptions in

[3]Foreclosures is a very costly mechanism to reduce indebtedness, especially in the current environment. In a recent paper, Mian, Sufi and Trebbi (2011), we show that foreclosures significantly reduce the value of homes in the neighbourhood of foreclosed home and lower house prices have a negative feedback effect on local consumption and investment.

the banking and financial system. These are difficult and complex problems, but not impossible to address and require collective regulatory and legislative action.

While the focus of my discussion has been the recent U.S. economic downturn, the relationship between high household leverage and long economic slumps is not limited to our current experience. In his seminal paper, Fisher (1933) described the role that high household indebtedness and the process of deleveraging played in perpetuating the Great Depression. More recent empirical work by scholars such as Mishkin (1978), Olney (1999), and Eichengreen and Mitchener (2003) further supports this view of the Great Depression. Evidence from Japanese and European recessions [e.g. King (1994)] also highlights problems associated with leverage.

Our collective experience from historical recessions as well as the most recent global slump point to a fundamental weakness in the modern financial system: its inability to distribute downside risk equitably and efficiently across the population. The tendency to rely too much on debt-financed economic activity implies that in the event of a negative economy-wide shock, most of the financial pain is pushed on a particular segment of the population (i.e. the borrowing class). As the recent U.S. experience reminds us, pushing most of the downside risk on one segment of the population is seriously damaging for the overall economy.

Going forward, in order to avoid deep economic slumps resulting from an over-levered household sector, we need to put in place contingencies that will automatically write down the value of outstanding debt if the overall economic environment is sufficiently negative. There is a lot to think through here before implementing a particular policy. However, it is practically feasible to re-design debt covenants by introducing contingencies for economic downturns.

For example, mortgage principal can be automatically written down if the local house price index falls beyond a certain threshold. Since such contingencies are written on aggregate states of nature, they do not suffer from the standard moral hazard criticism. Lenders will obviously price such contingencies in before extending credit, but it is a price that benefits borrowers and the economy in the long run. If we had such contingencies present in the current mortgage contracts, we could have avoided the extreme economic pain due to the negative deleveraging—aggregate demand cycle.

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The Allama Iqbal Lecture

A Global Green New Deal for Economic Recovery: Addressing the Financial, Climate, Food, Jobs and Development Crises Together?

JOMO KWAME SUNDARAM

ایک ہی صف میں کھڑے ہوگئے محمود و ایاز
نہ کوئی بندہ رہا اور نہ کوئی بندہ نواز

These immortal lines from Allama Iqbal make me very humble standing before you today to deliver the Allama Iqbal lecture.

Mr Chairman, Mr President, Excellencies, ladies and gentlemen, friends all, thank you very much for this honour and opportunity to speak to you on a very difficult subject. I would like to emphasise that, thanks to Professor Naqvi, this is not the first time I am appearing before the Pakistan Society of Development Economists, but it certainly is the first time, thanks to Dr Rashid Amjad, I have been invited to give this very distinguished lecture. Both men are very distinguished in their own right; they are people whom I have greatly respected over the years.

Professor Naqvi's contributions, particularly on ethics and economics, and the challenge of rethinking Islam reminds me of Allama Iqbal's *Reconstruction of Islamic Thought* and the relevance of it for the challenges facing the world today, as highlighted by Professor Saith's lecture yesterday. The lines from Iqbal that I began with are very relevant, of course, to the whole question of inequality.

I met Dr Rashid Amjad about three decades ago in the context of his work at the ILO. Over the decades, he provided sterling leadership in very different and changing circumstances. In a sense, it is his absence from the ILO today that is particularly felt because we face a very unique situation in the world today where, unfortunately, various forces seem to have successfully conspired to prevent a strong economic recovery. This is the subject of the lecture I would like to deliver.

CRISIS AND RECOVERY

The challenge of economic recovery reminds us to think back about what opportunities have been missed, the roads not taken. I would like to remind you of the Asian crisis, which mainly involved East Asia between the years 1997 and 1998. Contrary to most media and academic references to the Asian crisis, it was remarkably

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short, marked by, what is called, a V-shaped recovery—contrary to the IMF's prognoses then of a protracted collapse. Note the contrast with the current crisis and the views of most pundits in 2008-2009. It is important to recognise that the IMF's Independent Evaluation Office itself has made self-criticisms about the poor policy advice and unnecessary conditionalities imposed on countries which sought emergency loans then, and how these slowed down the economic recovery.

Unfortunately, after the crisis, we saw continued financial liberalisation and globalisation, including major increases in capital flows, which have played an important role in contributing to the current crisis. In East Asia itself, unfortunately, we did not learn sufficient lessons. We continued to sterilise these flows, which have reduced the purported gains of capital inflows, and developed huge buildups of reserves; this, in a sense, is fundamentally problematic because it contributes to the problem of global imbalances. These reserves have been built up for self-protection, or what is called 'self-insurance' by some. They reduce vulnerability, and are seen as part of the reason why developing countries in general, especially those in Asia, have done relatively well following the 2008-2009 crisis.

The crisis, as you all know, began with the collapse of the US housing market, after a market bubble which was clearly unsustainable, made possible by US Fed policy on credit availability, particularly for the subprime mortgage market. I have to be rather immodest in saying that the UN Secretariat, together with our UNCTAD colleagues in Geneva, as well as the Bank of International Settlements, were the only international organisations who had warned of the likelihood of the crisis following the inevitable bursting of the housing market bubble, but unfortunately, very little heed was paid to us.

The US financial crisis of 2008-2009, which began from the subprime mortgage sector in 2007, soon spread very quickly. There was so much money tied up in various types of securities, which meant that the banking system, which had been responsible for much of these loans, became severely distressed. This, in turn, resulted in massive asset price deflation as liquidity dried up after excessive and inappropriate lending to various asset markets, not only the housing market, but also the stock market. All this, as we all know, has led to a significant recession.

Over the last three decades or so, the system has become more fragile; part of the reason is that various safeguards—that we used to have in the macro financial system, which ensured counter-cyclicality in both institutions as well as instruments—have been very much eroded over the last three decades through deregulation by states at the behest of powerful financial interests, often encouraged by the international financial institutions; consequently, the system has become far more pro-cyclical.

It is now common in some Western circles to blame the Asians for the crisis, and to claim, as has been said in recent years, that this was an Asian induced crisis. Why? Because Asians were accumulating reserves unnecessarily and excessively; but to claim that Asian export success and reserve accumulation caused the crisis is one-sided, to say the least. Very often, of course, these reserves were in the form of US Treasury bonds or other US dollar assets. We have to recognise that, at root, the Bretton Woods system was flawed in the sense that it did not really do anything to deter issuers of major currencies from being able to use the international monetary system to their own advantage. It was this, rather than the alleged Asian tendency to over-save, which was at the root of the problem.

The crisis led to a sharp recession in the year 2009. The mechanisms are all quite well known now, and it led to a generalised financial crisis and recession, not only in the US, but also elsewhere. The asset price deflation, credit crunch and significant deleveraging caused economic contraction, less investment, less growth, less jobs and less consumption, all of which, in turn, have contributed to a vicious circle, which may be termed a deflationary spiral. This deflationary spiral led to depressed domestic demand and the collapse of various asset markets, with negative wealth effects all round. Contraction or reduced growth of world trade has been very problematic for developing economies which have been forced or have chosen to become more open in recent decades, thus accelerating globalisation over the previous three decades. National economies became less well integrated and domestic production capacities and capabilities collapsed in the face of cheaper imports, but most economies could not produce much to export beyond primary commodities, especially minerals and other natural resources.

Thus, the crisis has spread throughout the world, albeit in a very uneven fashion. Financial contagion also involves various elements. It is important to recognise at least three distinct vectors by which contagion has spread. There are important vectors or transmission channels within the financial sector, within the real economy, and between the financial sector and the real economy that have contributed to the crisis.

The baseline scenario in the UN's 2012 *World Economic Situation and Prospects* suggests a slight dip in 2012-2013, but more alarming is the prospect of a double-dip recession triggered by the Euro zone crisis. This baseline scenario assumes that the Euro zone crisis will soon resolve itself, but the prospects for this are bleak, to say the least. Thus, the possibility of a downside scenario is serious, and unfortunately, the downside scenario, rather than the baseline scenario, may be more significant in the period ahead. Even the IMF has revised its own forecast downwards a couple of days after we released our forecast.

There are two major challenges; first, we need a strong sustained recovery effort, and this can come about through no means other than fiscal stimulus. There is no choice. Secondly, these recovery efforts need to be much more coordinated because if we all think that we are going to recover on the basis of everybody else bearing the pain, it is simply not going to happen. Similarly, recovery on the basis of exports is simply not going to happen. Consequently, we need far more macroeconomic policy coordination. Unfortunately, however, the mechanisms for that coordination simply do not exist in the world today. In the last three years, much of the world has looked to the G20 to provide leadership and a solution, but unfortunately, the G20 has not been able to make any significant advance in terms of coordination for economic recovery since the London Summit of April 2009.

Most of us would like to think that a crisis will lead to reform, and that when you have problems and make mistakes, you learn from them. But if we look at what happened in the 1997-1998 Asian crisis, unfortunately, few lessons seem to have been learnt. One year after the Asian crisis began, President Bill Clinton called for a new international financial architecture, but little progress has been made since then, more than a decade letter. My old Professor Robert Triffin used to describe the situation after the collapse of Bretton Woods in 1971 as a 'non-system' but, unfortunately, that non-system continues to prevail because what we have seen is that various new developments in the four decades since 1971 have basically modified earlier arrangements in an *ad hoc* fashion. There has been no attempt to rethink what is needed in the new situation that we have faced since the collapse of the old system in 1971. No wonder, the Asian countries chose to self-insure with reserve accumulation, a lesson learnt the hard way from the 1997-1998 Asian crisis.

Also, it is now generally acknowledged that the various policy responses are inadequate and often characterised by double standards with more contractionary policies recommended for the South. We also find that regulation is inadequate and sometimes inappropriate in a very fast changing world. International cooperation has improved to some extent, with the relative decline of the G7 and its supersession by the G20 meeting at the leaders' level. However, after some significant achievements in April 2009, we have only seen relatively modest progress since then. The IMF did play a fairly positive role during 2009, but then endorsed the premature turn to fiscal austerity demanded by powerful European governments even before economic recovery was secure.

Despite quantitative easing, most companies have limited access to credit, reducing investment and job creation. Easy credit before the crisis enabled over-investment in most sectors, such as housing, believed to be profitable. The resulting over-capacity now discourages further private investment in these sectors. With inequality and unemployment higher, while incomes and domestic markets are shrinking, everyone expects to recover by exporting! Developing countries, long urged to export, are now told to produce for the domestic market and to import more after much of their previous productive capacity has been eroded.

With greater openness, many emerging market economies feel obliged to accumulate huge reserves for self-protection in the face of greater financial volatility associated with freer capital flows. Although financial globalisation has not enhanced growth, it has clearly worsened volatility and instability. Meanwhile, "policy space" for economic recovery has been diminished since the crisis. Public investment and basic social protection can help create millions of jobs. But the presumption that public investment crowds out private capital continues to deter state-led recovery efforts despite strong evidence to the contrary.

Many developed economies have had far greater fiscal deficits historically than now, and not only during wartime. Such deficits have financed strong, sustained and inclusive growth, not only in their own economies, but also abroad; e.g. the US Marshall Plan was central to post-war European reconstruction and recovery. Governments used massive funds to bailout selected, supposedly strategically important banks raising government debt rapidly. In turn, this huge debt has become the pretext for the turn to fiscal austerity ostensibly demanded by financial markets. Meanwhile, Eurozone countries are also constrained by their lack of exchange-rate flexibility.

Among international organisations, only the UN has championed a coordinated, strong, sustained and inclusive recovery effort. It is very important to recognise that whenever there is a lag in recovery efforts, the recovery is being delayed. The ILO's International Institute for Labour Studies has shown that when there is a lag of three months, recovery is slowed down by an average of nine months. So the lag since mid-2009, of more than three years, will delay recovery for an even longer period.

In the last two decades, there has been another troubling development, of output recovery without job recovery. In the case of the 1991 downturn in the US, for example, output recovery took about nine months, but job market recovery took two and a half years. With the 2001 downturn, output recovery took nine months again, but job recovery took four years. Therefore, we see a greater lag as far as job recovery is concerned, which is very troubling. In developing countries, the only way to overcome poverty is through creating decent work and productive employment opportunities. Therefore, the failure of job recovery and the phenomenon of job-poor growth have very serious implications.

FOOD SECURITY

As you know, food prices have become much more volatile in the recent period. For example, food prices rose in 2006, and especially in 2007. Then from the second half of 2010, food prices rose and then declined until the middle of 2011. There is a debate going on as to why food and other commodity prices have become much more volatile; this may be summed up as a debate between the so-called fundamentalists and those emphasising the 'financialisation' of commodity futures and options markets. In my view, this is a false debate: fundamental factors are important, but we also need to take account of the consequences of 'financialisation'.

One of the major factors affecting the so-called fundamentals is the advent of biofuels. In the interest of trying to mitigate global warming, there has been increasing encouragement of the production of biofuels, both bio-ethanol, especially in the US, as well as bio-diesel, especially in Europe, using vegetable oils. Secondly, recent oil price spikes have become more frequent, partly because of the situation in West Asia following the invasion of Iraq.

Food prices have become much more subject to market volatility. In recent years, commodity futures and options have become a new asset class. As other financial assets have fallen in value, funds flooded these markets, pushing up prices. Changing speculative investment strategies and rapid responses to changing market conditions have thus exacerbated commodity price volatility, including food and fuel.

Financialisation has therefore had complex implications. For example, there has been a massive increase in investment in commodity futures and options markets, in Chicago and Minneapolis in the United States, as well as in other countries. In the past, such investments did play a countercyclical, price-smoothening role. More recently, however, the huge infusion of funds, often running away from Wall Street and other traditional financial markets because of the collapses and greater uncertainties in financial markets, has raised the prices of commodity futures and other options, which have inevitably affected contemporary spot prices as well.

Secondly, there has been increased speculation because investors are not content with the traditional types of speculation, such as buying futures and options in anticipation of weather changes and other changes that might affect output. Instead, they are now using all kinds of new ostensibly mathematically sophisticated investment strategies and methodologies. For example, in 2007-2008, one other very important element, besides the flight from Wall Street to Chicago, was what is called indexed investment. For instance, the model used might require correlated investments to offset risk or maximise profitability. Hence, when much more capital was brought in, which is precisely what happened, all prices have gone up. For various reasons, the price increases have been higher for minerals compared to agricultural commodities.

But it also means that when there is disinvestment, all prices come down and often, very fast, as the speed of response becomes important for cutting losses or making the most from frequent trading. And very often, in such a market, there is a great deal of information asymmetry. One does not know what is happening; so, very often, people make decisions on the basis of whom they had lunch with, the rumours they picked up at or after work, as they hang around to socialise, etc. The result is that there are much greater and more rapid changes in investment positions, resulting in far greater volatility.

With the financial crisis, there has been greater interest in asset diversification, moving away from old types to new types of financial assets. Consequently, commodity futures and options became a new type of financial asset class. Another major development over the last three decades, since Mrs Thatcher and Mr Reagan, has been the reduced and different role of government. The government's role has been reduced in agriculture generally, for example, with much less resources going to food agriculture compared with the 1960s' and 1970s' Green Revolution.

There has also been much less government sponsored agricultural research, resulting in much more private ownership and control of profitable innovation by a few large agro-business corporations. When China had serious problems with what is called brown hopper, the government went to the International Rice Research Institute (IRRI) in Los Banos in Philippines hoping to get some assistance. There, they found only one professional entomologist and six lab assistants, a small fraction of the human resources during IRRI's heyday in the 1960s and 1970s. So, the technical capabilities are often simply gone, rather than devolved to the national level. While requiring many personnel, there are very few other mechanisms that have been proven to be more effective than extension services in terms of farmers' learning and adoption of new farming techniques.

Economic deregulation has been very important in recent decades. Countries seeking national level food security have been pressured to abandon such ambitions. Market liberalisation has been encouraged instead, ostensibly to replace 'inefficient' domestic food production with cheaper imports, even if from subsidised sources, such as most OECD economies. In many countries, especially in Africa, there was a dismantling of marketing boards, with devastating effects. In many countries, there has been a great deal of pressure to reduce controls on food prices.

But the continued supply of food at affordable prices is now increasingly under threat. While the world food market has become more oligopolistic, with a few dominant transnational corporations, there have been declines in agricultural productivity growth among smallholders due to reduced public investment in agricultural infrastructure, research and extension. At the same time, there has been farmland loss to urbanisation and other purposes. There has been significant environmental degradation, including deforestation, with inevitable adverse effects on crop output. Also on the supply side, climate change has been very important, with great effects on weather. For example, there was a drought in Australia, a major wheat producer, which lasted a decade. The availability of other food has also been threatened, e.g. with overfishing.

On the demand side, there has been population increase in Asia and most other parts of the world. Where there have been increased incomes as well, this has affected consumption preferences. There has also been a greater preference for meat, which also has implications for the amount of food available for human consumption as more food is used for animal feed. At the same time, there has been excessive food consumption by about a million people, resulting in obesity, malnutrition and other health problems, as well as greater wastage of food, especially in the West. The World Health Organisation estimated that in 2006, there were one billion overweight adults globally, with 300 million considered obese, while according to the Red Cross, 1.5 billion people worldwide were obese in 2010. Also, more maize, sugar and vegetable oils are being used for biofuels, raising the prices of these agricultural commodities. All this has meant various new pressures that have raised prices, while increased prices are the major cause of hunger and under-nutrition.

The data for the last two decades suggest that poverty has been going down over the last two decades; the MDG target for 2015 is said to have been achieved by 2010. However, the FAO and others suggest that in the past decade at least, except for the year 2010, hunger and under-nutrition have been going up. The World Health Organisation estimated that in 2006, 800 million did not have enough to eat while the Red Cross estimated 925 million undernourished in 2010. To say the least, it is rather strange for poverty to be going down, while hunger is going up at the same time. After all, the poverty line is supposed to be defined by what it takes to avoid being hungry.

Obviously, something is amiss. Furthermore, what is considered to be the consumption level to avoid being hungry has been adjusted downwards in some countries. It appears that the dollar-a-day poverty line, set two decades, was a statistical convenience. There is a great deal of evidence from all over the world that with the equivalent of a dollar a day, you cannot avoid being hungry in most societies. We also know from some recent randomised tests, a methodology which has become very popular in recent years, that people, rich or poor, do not necessarily ensure that their nutritional status is the greatest priority; very often, they do not have the information to ensure that, even if it their priority. Hence, hunger and under-nutrition remain serious problems that we need to continue to pay attention to.

CLIMATE CHANGE

It is quite indisputable, especially in developing countries, that climate change, global warming in particular, is having very serious implications for development. Most of the historical build-up of greenhouse gases in the atmosphere can be attributed to the industrialised economies. And in the contemporary period as well, richer people and countries are responsible for much more greenhouse gas emissions per capita. The question is whether we recognise different historical and contemporary responsibilities, given the different stages and trajectories of development of countries in the world.

Clearly, we need to do two things. First, we need to reduce emissions, particularly in the rich countries. But there is now an attempt in the climate negotiations, concluded in Durban in December 2011, to suggest that we all have equal responsibilities in this matter—contrary to the UNFCCC principle of common but differentiated responsibility. On this matter, almost alone, we are all equal in this world, and therefore, should all bear the burden of reducing global warming equally! This is the principle that developing countries have united to resist. But this view has become increasingly influential, espoused especially by Mr Todd Stern, the chief US climate negotiator. By this logic, China, which has a population five times that of the US, has to reduce its greenhouse gas emissions by as much as the US. Second, there is no doubt that we also need to slow down greenhouse gas emissions in developing countries.

The current fad is for ostensibly market-led approaches. For example, you will hear in most discourses that the solution is very simple. All you need is to impose a 15-20 percent carbon tax that will reduce fossil fuel use that will somehow lead to what is required. But what are the consequences of such an approach? The consequences will include, for example, the carbon tax being imposed on everybody. So the problem of energy poverty, of poor people not having access to modern energy, becomes more serious as we raise the cost of energy to them. Consequently, we have a situation where poor people in Asia, Africa and other parts of the world often use biomass, such as firewood, dung, etc., as a source of fuel. But the greenhouse gas emissions from such use of biomass are generally greater. Thus, by worsening the problem of energy poverty, you also worsen the problem of greenhouse gas emissions, something not well recognised.

The United Nations' *World Economic and Social Survey* for 2009 argued in favour of an investment-led approach. The policy implications are quite significant. It means that major investments—for example, in renewable energy—must be frontloaded in order to accelerate the transition to renewable energy generation as the new basis for economic development. Such an approach is consistent with the international community's commitment to sustainable development—in other words, ensuring *economic development*, especially for developing countries, particularly the poorest ones; *social progress*, e.g. by providing a universal social protection floor; and *environmental sustainability*, in this context, by keeping average global temperature increases to no more than two degrees Celsius. This is why we strongly favour an investment-led approach to achieve both climate change and development goals.

GLOBAL GREEN NEW DEAL

In early 2009, the UN Secretary-General Ban Ki-moon proposed a Global Green New Deal (GGND) to accelerate economic recovery, job creation and sustainable development. The GGND envisaged cross-border public-private partnerships to address climate change and food security challenges. Front-loading massive, multilaterally cross-subsidised public investments in developing countries in renewable energy and sustainable smallholder food agriculture should induce complementary private investments. After all, market forces alone will not generate the investments needed for climate change mitigation as well as affordable nutrition for all.

As noted earlier, following years of easy credit and over investment before the crisis, the world now faces underutilised over-capacity in most profitable economic sectors. In this situation, only well-coordinated cross-border public investments can fund needed 'green' public goods and induce complementary private investments, e.g., through public-private partnerships, to address these global challenges. Besides contributing to sustained economic recovery, such investments would also enhance climate change mitigation while advancing developing countries' developmental aspirations and ensuring affordable food security. The Green Revolution of the 1960s—with considerable government and international not-for-profit support—increased crop yields and food production in wheat, corn and rice, requiring a second Green Revolution for other food crops, especially water-stressed agriculture in arid areas.

Multilateral cooperation for global recovery has been disappointing since the 2009 G-20 London and Pittsburgh summits. For example, there has been little meaningful progress on the Global Jobs Pact since then. As a result, the past three years have witnessed little progress toward a strong, sustained and inclusive recovery. Instead, creeping protectionism has gone well beyond the familiar terrain of trade. Although inclusive multilateralism has been battered by various challenges, including its seeming messiness and slow progress, it remains the best option for various reasons. The United Nations system must be bolder, but powerful interests must also allow, or better still enable it to play a bigger role.

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Honouring Parvez Hasan

RASHID AMJAD

It is indeed a privilege for me to join Dr Naved Hamid in paying tribute to Dr Parvez Hasan, an outstanding economist recognised for his work on development economics, on the economy of Pakistan, and the East Asian economies. The Pakistan Society of Development Economists honours him today for his contribution to economics, to the development of the Pakistan economy and to the economic profession in Pakistan.

Dr Naved Hamid has recalled Dr Parvez Hasan illustrious career. In my tribute to Dr Parvez Hasan I want to put his life and career in the broader context of the times he lived in and the important institutions in which he served and their development to which he contributed.

To me the life of Dr Parvez Hasan, as so wonderfully captured in his recently published autobiography, "My Life My Country—Memoirs of a Pakistani Economist", is a story which covers not only the creation and early years of Pakistan's independence but is the story of its nascent years and the rise of the profession of economists in Pakistan. It is also the story of three remarkable economists, whose lives and careers were closely intertwined and of three great institutions which were to play a pioneering role in the economic development of Pakistan as well as in laying the foundation of serious analytical and applied research on emerging economic issues confronting the country.

To start with the first, both during the years of the British Raj and well after the creation of Pakistan, the preferred career of young brilliant educated men (there were very few if any women) was to join the Indian Civil Service (ICS), that later became the Civil Service of Pakistan (CSP) and now the DMG (District Management Group). It was not very different in Dr Parvez Hasan's time in the 1950s. Most of his class fellows at Government College Lahore—Aftab Ahmed Khan, Masood Nabi Noor, Masood Zaman, Syed Munir Hussain and later Asif Rahim took the CSS competitive examination and joined the Civil Service of Pakistan. Dr Parvez Hasan who had the distinction of obtaining a First Class First in M.A Economics from Government College Lahore, decided because of his immense interest in the subject, to take a different path ("a road less travelled by")—to follow a career of a Professional Economist—against the tide—but it reflected his confidence in himself as well as in his capability as an economist.

Dr Parvez Hasan joined the Research Department of the State Bank of Pakistan in the late 1950s. Here he was joined by Dr Moinuddin Baqai, a First Class in Economics, from the Punjab University and later by an economist who was to win international renown, Dr Mabub-ul-Haq. Around the careers of these three outstanding economists you could easily weave the story of Pakistan's economic development in its first two decades. These three became close friends and if there was a rivalry it was a healthy one. As Dr Parvez Hasan mentions in his memoirs that he was determined to finish his PhD in Economics in two years at Yale (where Prof. Robert Triffin was one of his supervisors) as Dr Mahbub-ul-Haq has done so earlier! Dr Parvez Hasan in the second half of the 1960s, after a stint with the Saudi Arabia's Monetary Agency, was to become the Chief Economist of West Pakistan, while Dr Haq and Dr Baqai worked at the Pakistan Planning Commission, the former as Chief Economist in the 1960s and

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the latter at senior position of Joint Chief Economist in the 1960s and later as Secretary/Chief Economist of the Planning Commission in the 1980s.

The story of Dr Parvez Hasan is also the story of three institutions which were to play a pioneering role in economic research and in steering and influencing the course of Pakistan's economic development. First and foremost, the State Bank of Pakistan which was set-up soon after independence, the Planning Commission some times later in 1953 and the Pakistan Institute of Development Economics (PIDE) in 1959.

The close interaction between these three institutions can be seen not only in terms of career moves of professionals between the first two but also the intellectual fraternity between the economist of these three institutions.

Dr Parvez Hasan, might not recall, but one of his first publication was in the Winter 1960 *Pakistan Digest* (the forerunner of *The Pakistan Development Review*) titled, "The Investment Multiplier in an Underdeveloped Economy", and later his Working Paper, "Deficit Financing and Capital Formation in Pakistan", was published by PIDE. The latter was a compulsory reading for any student doing research on the Pakistan economy for many decades—indeed even now.

Dr Hasan's close association extends not only to the PIDE but I may add the Pakistan Society of Development Economists which honours him today after it was setup in the early 1980s. I recall meeting him at many of its meetings where he presented his research findings (including that on debt management) and presided over its technical sessions. Two years ago he was invited by the PSDE to deliver the prestigious Gustav Ranis Lecture.

During his participation in the PSDE Annual Meetings I was especially struck to find him surrounded and immersed in serious discussions with younger economists who were also presenting papers at the Conference. His approach was never patronising but professional—as one economist to another—even if one was just starting his career and the other was at his pinnacle and an established authority on many key aspects of economic development.

Here I would also like to especially mention one of the outstanding contributions of Dr Parvez Hasan to the still nascent literature on the Pakistan economy. There were some good books on the Pakistan economy which covered in detail its different facts (Dr S. M. Akhtar's classic comes to ones mind). But these books tended to be factual rather than analytical. Here Dr Parvez Hasan's book, "Pakistan Economy at the Cross-Roads", was a trial blazer that led to a stream of books on the Pakistan economy like Dr Ishrat Hussain's "Pakistan: An Elitist State". They say the world is a global village and when we pay tribute to Dr Hasan as a professional Pakistani economist we honour him also as a "global economist". He had earlier worked at the Saudi Arabia Monetary Agency but later he joined the World Bank as Chief Economist, East Asia, where he was closely involved in shaping the economy of China, Republic of Korea and other East Asian countries. This led him to writing many well known books on these countries' development experience.

I would also like to mention here Mrs. Hasan who has travelled with him all the way from Washington D.C. to participate in this august ceremony and who has as acknowledged in his memoirs been a pillar of strength throughout his career.

So we honour you today, Dr Parvez Hasan the outstanding economist but also Dr Hasan the person—modest, honest, straightforward, and above all one who does not mince his words and he speaks the truth.

As we honour him today we can see two of his closest friends, both economists, Dr Mahbub-ul-Haq and Dr Baqai looking down from the heavens and saying, "How wonderful! Parvez certainly deserved this honour and recognition".

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The Mahbub Ul Haq Memorial Lecture

The Obfuscation of Inequality

ASHWANI SAITH

Inequalities reflect hierarchies of power, and both tend to protect and reproduce their privileged positions regardless of the force of intellectual and ethical arguments against its unacceptable manifestations. Part of the reason lies in the difficulties of data and method, but they also arise from the theoretical frameworks used to evaluate the instrumental implications of alternative states of inequality. But even when some consensus can be achieved, it tends to break down at the final hurdle of disagreements at the ethical level on the intrinsic aspects of equality and inequality. Not surprisingly then, effective struggles against inequality are waged more in fields and on the streets than in academic journals.

As the evidence mounts of exceedingly high, and generally increasing, levels of inequality, so too do intellectual interventions that deny, dissemble, deflect or defend the inequality on both instrumental and intrinsic grounds. The power of these interventions lies usually less in their ability to illuminate than in their capacity to obfuscate; the effect in all cases, is to provide intellectual and moral legitimacy to prevalent inequalities. As exercises in persuasion, they are addressed to the opposition, viz., the silent majority, if not the vast masses, who, not by choice but rather by descent, find themselves at the wrong end of these inequalities, and to those who challenge the economic and social justification or desirability, especially of extreme, as well as the wrong kinds of, inequality. But simultaneously, as exercises of affirmation, the apologist argumentation speaks to those at the nirvana end of the spectrum, and attempts to create a climate of self-assurance, social esteem and moral legitimacy for the super rich, and to assuage and dispel any gnawing twitches of guilt that, heaven forbid, might have crept unnoticed into their minds through an unguarded route.

Tawney's wry words, directed at an earlier era, unfortunately still seem to hold: "the rulers of mankind maintain side by side two standards of social ethics, without the risk of their colliding. Keeping one set of values for use, and another for display, they combine, without conscious insincerity, the moral satisfaction of idealistic principles with the material advantages of realistic practice".[1]

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[1]Tawney (1931) quoted by Cohen (1991: 263) in his Tanner Lectures.

Some deny the evidence of high, and often rising, inequality with convoluted and controversial empirics; others question the intrinsic salience of equality; yet others defend inequality as a regrettable necessity of vital instrumental powers; another strand justifies it as proof of a free society; and some again develop an extreme case arguing, in Ayn Rand fashion, in favour of extreme inequality. The litanies are: actually, things are getting more equal; when this sounds incredible, that inequality, really, is not too high; or, that it has not increased; and, even if it has, it is good for the poor (also perhaps for the rich, we are allowed to presume); and even if it isn't provably good for the poor, it is not bad for them; and in any case, and here comes the bottom scriptural line from the texts, it is intrinsically, morally justified. Across the full span, the arguments usually make no distinction between kinds, sources, or degrees of inequality.

The trouble in the current neo-liberal era, though, is that even the most ingenious dissembling cannot manage to keep Tawney's two standards—the professed and the real—from colliding. Defence and apologia for inequality, including its extreme forms, become increasingly aggressive and disingenuous, with all beneficiaries—be they politicians, policy makers, plutocrats or professionals—putting in a good word for it, rather like the claims for Mrs Beecham's powders of yore. An inordinate amount of energy seems to have gone into masking grotesque truths behind camouflaging cosmetics. But lately there are signs in the stratosphere of a rising political anxiety as the message comes home that despite the litanies of hype and spin, you cannot fool even yourself—let alone the excluded masses—all the time. The demands of the realpolitik oblige the captains of capitalism to nod visibly, if nominally, in deference to the ideals of equity and inclusiveness, while rejecting it as far as politically possible in practice. Alongside, however, their academic ideologues have of late adopted an aggressive stance that defends even high and rising inequality as both instrumentally justifiable and intrinsically just. What follows engages with selected strands of such intellectual apologia.

Libertarian Fundamentalism: Inequality is Good, Period

The core position that inequality is natural, good and justified, and needs no interventions, is perhaps patented by Hayek and Friedman, the gurus of contemporary neo-liberalism. For one, their fundamental concern was with "negative liberty" where individuals were deemed to be free of control by the state, which was viewed as the oppressor; they were not seriously bothered by notions of "positive liberty" which endowed individuals and citizens with the capacities to participate as equal citizens and to achieve higher levels of individual and group development and fulfilment. Whatever emerged as the eventual outcome from establishing negative liberty was deemed optimal. And if inequality was an outcome of such liberty, so ought and must it be. "Liberty … is even bound to produce inequality in many respects. This is the necessary result and part of the justification of individual liberty; if the result of individual liberty did not demonstrate that some manners of living are more successful than others, much of the case for it would vanish." (Hayek cited in inequality.org.) Further: "we must face the fact that the preservation of individual freedom is incompatible with a full satisfaction of our views of distributive justice." Chile, under the democratically elected Allende, violated the Hayek-Friedman conditions of liberty; but was deemed an outstanding success worthy of congratulation under the dictator Pinochet.

"To a hard-core libertarian, there is nothing problematic about income distribution in a market economy. The market's distribution of income is what it is, and that is all there is to it. Whether such a distribution is equal or unequal is neither here not there. Friedman liked to pose as hard-core libertarian, and yet he was also quite willing to allow for government intervention to reduce poverty. This creates some tension in his writings on the subject of economic inequality, where the liberal while "he will regard private charity directed at helping the less fortunate as an example of the proper use of freedom", he may also "approve state action toward ameliorating poverty as a more effective way"; "he will do so with regret, however, at having to substitute compulsory for voluntary action" [Friedman (1962); quoted in Cole (2008), p. 249]. On grounds of this exception, his sympathetic interpreter prefers to call him "a compassionate liberal" rather than a non-liberal.[2]

But Friedman does reveal the early limits of this compassion: in an interrogation over poverty and its measurement, he prefers to set the bar for the poor at 10 percent of the population; if charity does not work enough, state action directed at these 10 percent could be "regretfully" contemplated; the other 90 percent had to take their chances and outcomes in the open market, and whatever emerged would be right.

Hayek and Friedman sing from the same hymn sheet;[3] no basis for any universal right other than to liberty; no need for interventions in educational disparities through public provision or in wealth inequalities through interfering with the free flow of private inheritance, and, of course, hostility to all forms of state intervention—with the exception of Friedman's qualified support for programmes of poverty reduction. The socialist system predictably comes under frothy, if ill informed, attack.

These extreme positions cannot be attributed to neoclassicism the core concern of which is to allow the market to do its work efficiently without interventions that distort. This still leaves the possibility of interventions in the pre-, or post-, market domains, which change initial conditions, such as the distribution of assets, or specific outcomes, such as poverty, through non-distortionary means; it remains possible to retain social radicalism in the pre-market, or post-market, both, or neither domains. James Meade, the egalitarian free-trader, was simultaneously a radical neoclassical and a neoclassical radical. He had a privileged public school education, was secretary and treasurer of the Eugenics Society over 40 years, held neo-malthusian positions as argued through his work on Madagascar, was a dyed in the wool free trade theorist who wrote the GATT formative framework. "Meade of course was a free trader", but he was also "an egalitarian, both in his ideas and in his life. He felt that economics should concern itself not only with the size of the cake but with how unequally the cake was distributed" [Layard (1995)]. Like Hayek and Friedman, and reflecting his involvement with eugenics, "Meade was very conscious of the wide differences between people, both in their genetic make-up and in the

[2]This basic income floor for all citizens could be achieved through the Negative Income Tax measure that Friedman espoused.

[3]In Hayek's wisdom: "There is, of course, neither greater merit nor any greater injustice involved in some people being born to wealthy parents than there is in others being born to kind or intelligent parents" (in *Equality, Value and Merit*); in Friedman's words: "Is there any greater ethical justification for the high returns to the individual who inherits from his parents a peculiar voice for which there is a great demand than for the high returns to the individual who inherits property?" [Friedman (1962), pp. 161-162, quoted in Cole (2008), p. 241].

opportunities life offered them. He was worried that technical change would reduce the less able members of society to penury. The only solution was an effective system to redistribute income" [Layard (1995)]. He was increasingly willing to sacrifice efficiency for the second-best, to qualify notions of liberty with the need for social equity, and was increasingly attracted to the idea of some version of basic citizen's income. His classic intervention [Meade (1964)] makes a powerful case for inheritance duties and for a universal framework for education in order to break the vicious cycle that reproduced the cumulative advantages of birth and wealth. But then, even as a neo-classical, he had a different social imagination from the fundamentalist philosophical positions of Hayek and Friedman, the libertarians.

Set a neoclassical to swat a neoconservative: "Libertarians are not just bad emotional cripples. They are also bad advice givers. I refer of course to the views of both Milton Friedman and Friedrich Hayek. The "serfdom" they warn against is not that of Genghis Khan or Lenin-Stalin-Mao or Hitler-Mussolini. Rather, they warn against the centrist states of the modern world. Think only of Switzerland, Britain, the US, the Scandinavian countries, and the Pacific Rim. Why do citizenries there report high indexes of "happiness" and enjoy broad freedoms of speech and belief?" So said Samuelson (2008), politically a self-avowed believer in the "dynamic moving centre."

"Inequality is Good, It Induces Charity!"

We owe this new one to the eminent Professor Jagdish Bhagwati who, whether right or wrong, is never less than entertaining.

"If a thousand people become millionaires, the inequality is less than if Bill Gates gets to make a billion all by himself. But the thousand millionaires, with one million each, will likely buy expensive vacations, BMWs, houses in the Hamptons, and toys at FAO Schwarz. In contrast, Gates will not be able to spend his billion even if he were to buy a European castle a day, and the unconscionable wealth would likely propel him, as in fact it has, to spend the bulk of the money on social good." [Bhagwati (2004), pp. 66-67; quoted in Panagariya (2008), p. 160].

Following in his mentor's slipstream.[4] Panagariya contends, even in the Indian context widely acknowledged to be characterised by high and rising inequalities, that inequality is "a lesser problem", and that "from the policy perspective, preoccupation with inequality is largely a diversion" [Panagariya (2008), p. 157]. This position represents a somewhat more fundamentalist defense of inequality.

This new and valiant defence of top-end inequality is based implicitly on an assumption that the marginal propensity to donate rises with income. This empirical assumption would appear to be uncontroversial if not incontrovertible—but wait a minute, is it valid? "The bottom line about the relationship between philanthropy and income is that it's surprisingly counterintuitive"; surveys in the US showed that households with incomes below \$20,000 gave 4.6 percent of their incomes to charity, compared to 2.5 percent for those between \$50,000 and \$100,000; and 3.1 percent for households earning over \$100,000 [Brooks (2008)].[5] This general pattern and especially

[4]Panagariya holds the Jagdish Bhagwati Chair on Indian Political Economy at Columbia University, where Bhagwati himself is a professor.

[5]The figures cited are from the 2000 Social Capital Community Benchmark Survey in the US.

the contrast between rich and poor is apparent in other surveys too.[6] And amongst the poor, working poor households showed rates of donations over three times those for non-working poor households. So if the idea is to induce charity, Professor Bhagwati might do better perhaps by reversing the tax cuts for the rich; making them pay their taxes; and increasing wages.

There is other implicit and unwanted baggage that is smuggled in by way of premises. Bill Gates might wish to spend his wealth on social good, but an Aaronovitch might prefer to spend it on his Chelsea football club, Mallya on his IPL cricket and F1 motor racing teams; and Ambani on his humble new abode of $2 billion; others, on buying the customised services of politicians and bureaucrats, judges and journalists, the police and whoever and whatever else necessary, to propel their fortunes further up the wealth ladder; yet others, of the Gordon "greed-is-good" Gekko variety, might set this unused money to seek out yet more money through "innovative" financial schemes and instruments, conveniently side-stepping, or subverting, inconvenient regulatory mechanisms through the use of their wealth-derived power. There is much accumulated evidence countering Keynes' pithy remark that "it is better that a man should tyrannise over his bank balance than over his fellow citizens"; it should be possible to enjoy the wit without ingesting it as wisdom, since it is obsession over the former that usually leads to the oppression of the latter.

Utopia, the 15-deck, 971-foot, most-luxurious-in-the-world cruise ship, with 200 private residences, described as a "platform for learning, cultural exchange and philanthropy", will travel on a perpetual tour—oh, how exhausting, my dear—of cultural centres and sporting events—from the Cannes Film Festival and Monte Carlo Grand Prix to the Olympics, the Brazilian Carnival and Hong Kong's Dragon Boat Festival. The boat's big sales pitch, however, is philanthropy. The ship's Philanthropy Office will keep a database of the philanthropic interests of all the residents in order to connect them with other donors and to organise events around the world tied to their favourite causes. It also will create philanthropic programmes for the children of the owners and host charity balls and events on board. The ship will have a "Wall of Fame" honouring the charitable achievements of its owners. "This project is not just about people spending on themselves and living a luxurious lifestyle on the ship," Mr Robb said. "It's also about travelling with purpose and meaning." [Frank (2009)].

But what to do once you've scaled the Antillan heights and gone and done your globe cruising bash? Are there new worlds even beyond the dream decks of *Utopia*?

The answer comes from the recently elevated Baron Stanley Fink, ex-CEO of Citibank, co-treasurer of the Conservative Party, described as the godfather of the British hedge fund industry. Toynbee and Walker (2008) report from their observations at a breakfast event for High Net Worth Individuals organised by the Charities Aid Foundation, where the host was Boris Johnson, and the main speaker fittingly was Stanley Fink.

"What do you do now you've got all the toys? You've already got all the houses, yachts, cars and jets and you can use, so what comes next is charity" [Toynbee and

[6]A non-profit organisation specialised on charities, estimated for 2001, that households earning less that $25,000 annually donated 4.2 percent of their incomes while those with earnings over $75,000 gave away 2.7 percent [Warner (2010)].

Walker (2008)]. "I get invited to places I'd never have seen otherwise" said Fink, "listing eye-popping names and places his philanthropy had taken him, from No 10 upwards"; a day at the set of the latest Bond movie, dinner with Mikhail Gorbachev, being crooned by Elton John, or entertained by Prince … The vocal and unequivocal message, according to the observers was: "charity is the passport to the in-crowd; give and ye shall meet celebs; giving was the ultimate door-opening lifestyle accessory."

This was the acknowledged "Godfather" of hedge funds transferring his cumulative wisdom to the awestruck flock of the children of new inequality. He was speaking from solid, personal, life experience of course: after years at the helm of the 225-year old Man Group with assets under management of $75 billion, he left in 2008 to devote his energies to his philanthropic and related passions; he donated a million pounds to the Conservative Party, soon became its co-Treasurer; bankrolled Boris Johnson's successful Mayoral election against Ken Livingstone in London; led a working group on environmental markets for the then shadow chancellor George Osborne [Clark (2008)]; raised GBP 80 million for the Conservatives to overturn Labour at the general elections; and was titled by the Tories as Baron Fink in 2011. He has since returned to the world of fast finance, this time in partnership with Lord Levy, made (in)famous by the (very) British titles-for-cash scandal for which he was thrice questioned, arrested and eventually predictably released. The pairing seemed superficially odd, since Lord Levy, known widely as Lord Cashpoint, was the tory Godfather's opposite number in the Labour Party, having been *their* prime hunter and gatherer of donations. What perhaps overrode their ostensible political divide was their deep loyalty to the Jewish community; both were Jewish stalwarts and held extensive positions within Jewish civil society; while there had been concerns over Lord Cashpoint's intimate links to Israeli politics, the Godfather had a son working as part of the Israeli political establishment, and he had explicitly cited his distaste for Ken Livingstone not just due to his politics, but more on grounds of what he perceived to be his unfriendly stance towards British Jewry; religion makes for strange bedfellows, and clearly runs thicker than politics.

"I believe that the purest philanthropy is totally altruistic, ideally with anonymity between donor and recipient. However, for philanthropists to change the world, they need to be evangelistic to encourage other rich businessmen to multiply the effects. In this regard, if people promote it and build businesses around it—so much the better—provided that it leads to more philanthropy" [Stanley Fink (n.d.) Lazagaleta]; which, in turn leads to further evangelism, promotion and business building.

Bhagwati (2010) questions the merit of corporate social responsibility; instead, he is an advocate of private social responsibility—much in line again with the Friedmanite position. But beyond this, there are various other fundamental issues that the Bhagwati proposition glosses over. A libertarian might well prefer this model of charity-driven "social good" to state policies of social development financed through taxing the wealthy. But, warts and all, a government's actions are framed by constitutional limits, and remain accountable to an electorate; no such safeguards apply to donors going good as they deem to see it. NGOs and similar organisations, including those widely admired, usually function outside such constraints, and have therefore been rightly subjected to a similar criticism of being above formal democratic accountability. The dangers are far greater when it is an individual plutocrat one is dealing with rather than a social movement or NGO. And yet further, such powerful donor entities usually have the mission, and the capacity, to subvert, amend or re-write the agendas of cash-strapped governments of poor countries, and similarly impecunious international development agencies that can provide the "partnership" guaranteeing access, legitimacy and influence. Surely, at this moment, the Gates money pulls far more weight in global agenda setting in the health sector than the WHO. But, as Toynbee and Walker ask: "they control the business sector, so why not social policy as well?" Apart from the obvious questions of ability, expertise, experience and orientation, there are important issues of democratic accountability and constitutionality at stake.

A minimal reflection is also called for on motivations driving charity. It is too easily assumed that this reduces purely to the altruistic and solidaristic motive of helping fellow human beings. In the middle ages, paupers knew they could extract some metal from the wealthy seeking redemption or an easier squeeze through the eye of the needle by giving alms to the poor. In Jean Paul Sartre's satirical deconstruction: "the reason why the poor exist is to provide the rich with an opportunity to display their generosity". But there could be other intangibles you might wish to buy with charity—things you might never have bought with churning out yet another version of windows: it buys you fame of a different kind, it buys your saintliness, acceptance as a giver, a sacrificer, a healer. And you have a life with much more meaning than would be possible perpetually fighting off the competition and anti-monopoly law suits. You buy something Microsoft, or a hedge fund cannot buy: "public goodness", a halo. Windows and hedge funds are on the income side of the line; charity is on the expenditure side. Money might not buy you love, but charity is the commoditisation of virtue.

Naturally, the less taxes the rich are made to pay, the more the state will be cut down to size, and the more the rich will retain to exercise their generosity. This part of the Friedman-Bhagwati vision seems to be on track, as is indicated by the tax cuts for the rich, the slicing of governmental social service budgets; on the eve of the 2007 crisis, tax consultants estimated that of the UK's 54 billionaires, at least 32 paid no taxes at all; and, the top decile of income earners paid a small percentage of their total income in tax than those in the bottom decile [Toynbee and Walker (2008)]. For the US, the super rich were not all super donors: of the top 50 most-generous donors on the ranking generated for 2010 by *The Chronicle of Philanthropy*, only 17 appeared in Forbes list of the 400 wealthiest Americans [msnbc.com (2011)]. However, "the problem is that the exceptional philanthropy of the superwealthy few does not apply to the many more people defined as rich in the current debate over the Bush tax cuts—individuals earning over $200,000 and couples with revenues over $250,000. For decades, surveys have shown that upper-income Americans—are particularly undistinguished as givers when compared with the poor, who are strikingly generous" [Warner (2010)]. In the UK, the Charities Aid Foundation pointed out "that the same few names get recycled in the media, giving an erroneous impression that philanthropy is on the rise"; in reality, for 2007, a bonanza year for bonuses, there was a fall in high-level donors [Toynbee and Walker (2008)].

And it seems that charity is a fair-weather friend that tends to shirk and shrink when times are bad. In UK, according to the Charities Aid Foundation, the last recession saw a fall in giving by 64 percent, while demand rose by 90 percent [Toynbee (2009)]; "what a disaster if the welfare state were seriously dependent on haphazard generosity" [Toynbee (2009)]. Of course, the flip side of someone's disaster is another's bonanza.

US families donate more than twice as much per capita than those in the most generous European countries [Brooks (2008)]; on the other side, US social security systems are highly porous in comparison with the relative strength of the European social policy framework, and this even after a couple of decades of erosion under the neo-liberal onslaught there. Perhaps the Europeans convert their socially charitable instincts into an egalitarian and universalistic framework of basic entitlements, while the American poor provide the opportunity to the rich to simultaneously show off their wealth and idiosyncratic charity in the organised glare of media coverage.

"A Regrettable Necessity!" said the Fat Cat

And several have argued an instrumental defence of inequality on the grounds that it leavens the wheels of commerce and creates the wealth that then might trickle down to the poor. This has been read as *carte blanche*, almost literally, on how far inequality should or could be allowed to go and be accepted. Last year, the annual bonus of one young manager of a top hedge fund was more than the total national income of a list of poor countries. The rulebook of the neo-liberal game tells us that controlling inequality would preempt growth; slay the goose called inequality, and there will be no more proverbial golden eggs.

"We have to tolerate inequality as a way to achieve greater prosperity and opportunity for all," Brian Griffiths, an adviser to Goldman Sachs International who once served as a special adviser to Margaret Thatcher, was reported as regurgitating at a panel discussion on the place of morality in the marketplace. But a more grammared version of this position could seek qualified philosophical support in the Rawlsian "difference principle" which would condone inequalities if these made the worst off better off.[7] Cohen, citing John Stuart Mill in support, rejects this: "Rawls's lax application of his difference principle means "giving to those who have." He presents the incentive policy as a feature of the just society, whereas it is in fact, and as Mill says, just "highly expedient" in society as we know it, a sober "compromise with the selfish type of character" formed by capitalism. Philosophers in search of justice should not be content with an expedient compromise" [Cohen (1991), pp. 67-68)].

However, to begin with, and to take a step further, any philosophical, or sophist, defence of inequalities on the basis of the difference principle would require that there be a prior demonstration that they deliver the promised goods, i.e., that, in Cohen's terminology, they are a damage limitation device in the field of justice. But what if this cannot be convincingly established? What if there are cogent grounds to argue that prevalent incentive structures rewarding the super rich actually function as a mechanism of damage causation? The empirical premise on which the difference principle could become a justification of inequalities needs first to be confirmed; what really is the pathology linking such incentives and the observed outcomes?

[7]Cohen (1991: 66), in his *Tanner Lectures*, critiques the use of the Rawlsian position when used to legitimise inequalities as being "just": "the policy of paying productive people plenty to get them to produce so that badly off people will be better off is rational when productive people are resolved to serve only if they are richly rewarded. But their stance is then unjust by the very standard which the difference principle itself sets. Accordingly, on a strict view of Rawlsian justice, the difference principle in its lax interpretation, which does mandate the incentives policy, is not a basic principle of justice but a principle for handling people's injustice. It is not a basic principle of justice, since it confers benefit on market maximisers who offend against justice. We might call it a principle of damage limitation in the field of justice".

The incentives-for-the-rich-are-actually-good-for-the-poor homily is anodyne till you fill in the blanks: inequality favouring whom, why, how much, with what effect? If an intrinsically valuable attribute has to be sacrificed for the instrumental, it might be wise to do the sums to see if you are getting value for money. The answers to be had in the real marketplace to these principled questions make sorry, and often sordid, reading.

On the substantive issue of the dysfunctionality of inequality as an incentive to industrial and managerial innovation, the views of the Samuelson (2008) might be apposite.

"Using markets is not the same thing as unregulated capitalism so beloved by libertarians. Such systems cannot regulate themselves, either micro-economically or macro-economically. Wherever tried they systematically breed intolerable inequalities. And instead of such inequality being the necessary price to encourage dynamic progress via technological and managerial innovations, it instead breeds dysfunctional shortfalls in what economists call "total factor productivity. Convincing proof of these points can be found in the deterioration in the US from 2001 to 2008. As CEO pay rose respective to median employee pay—from a more normal 40 to 1 ratio up to and beyond 400 to 1—industrial progress deteriorated rather than accelerated."

The position is considerably worse when it comes to the banking and financial sector. Except from the bankers themselves, and their lobbied political backers, the overwhelming stance of the economics profession has been to ridicule the defence that the extreme reward and bonus systems were justified in terms of necessary incentives.

Testifying before Congress, Stiglitz (2010:2) argued "it is hard to find evidence of any real growth associated with the so-called innovations of our financial system, though it is easy to see the link between those innovations and the disaster that confronted our economy". His testimony repudiates any notion of a rational link between performance and pay in the sector; the incentive structures were "flawed", "poorly designed", and perverse leading to "short-sighted behaviour and excessive risk taking"(p.4); "the discussion on incentive pay was simply a charade: pay was high when performance was good, but pay was also high when performance was poor"; "only the name changed, e.g. from "incentive" bonus to "retention" bonus" (ibid.: 5); "bankers were more innovative in figuring out ways of exploiting American consumers and extracting fees than they were at designing products that would help consumers manage the risks they face" (ibid.:6). "management was rewarded for higher returns, whether those returns were produced by merely increasing risk or by truly outperforming the market. Anyone can do the former; the latter is almost impossible. Again, no wonder that all the financial wizards took the easier route—and it was this excessive risk that helped bring capitalism to the brink" (4). In the meantime, before, during and after the crisis, top hedge fund managers regularly took home over a billion dollars a year in bonuses, with the top "earning" operator making over $4 billion in 2009, while there were between 2.5 and 3.5 million home foreclosures in 2010, remaining on a rising trend from the point of the crisis.

Another kind of misallocation of scarce resources is poignantly referred to by Stiglitz in closing his testimony: "In this modern era of a finance-dominated economy, unfortunately, a disproportionate share of our most talented youth went into finance, lured by the outsized compensation.[8] The costs to our society of this misallocation are incalculable." [Stiglitz (2010), p. 8].

"The result of flawed incentives, perhaps even worse in the aftermath of the crisis, can be called ersatz capitalism, with losses socialised and profits privatised; it is an economic system that is neither fair nor efficient" [Stiglitz (2010), p. 7]. The only issue one can raise with Stiglitz's damning testimony is whether these properties can be ascribed to the ersatz, or to the inherent, nature of capitalism.

The extreme inequalities causing and accentuated by the incentive structure might were obviously regrettable, but they were far from being a necessity. Keynes, as so often, said it rather well: "Speculators may do no harm as bubbles on a steady stream of enterprise. But the position is serious when enterprise becomes the bubble on a whirlpool of speculation."[9]

"Its Absolute Poverty, Not Inequality, Stupid!"—Or Is It?

In the context of the Millennium Development Goals, Jeffrey Sachs, the centre-forward of the UN MDG team, has publicly asserted—though the basis of this proclamation remains impossible to verify—that the leaders of the developing world effectively withdrew from earlier radical stances on inequality of incomes and wealth, and simply sought the support of the west to the more specific agenda of the reduction of forms of absolute poverty.[10]

One Dutch minister for development cooperation declared that the poor woman in the Jakarta slum should not be concerned about overnight millionaires generated by the stock exchange, so long as she had the money to send her child to school.

"It's about poverty, not inequality", she announced. "We must focus on absolute, not relative, income levels; … to a poor widow living in the slums of Jakarta, it does not matter that some Indonesian millionaires become billionaires overnight on the stock exchange; what matters to her is whether she can find a job to feed her children and send them to school."[11]

The speech can be admired for its breathtaking simplicity; it must be assumed that the Dutch minister can read the mind of the Indonesian widow. We are also invited to take temporary leave of our faculties and accept the assumption that the lives and actions of these billionaires have no interface with those of slum dogs and widows.

It must be assumed that the Dutch minister could read the minds of Indonesian widows; and also that there is no deeper causal connection between the sudden billionaire and the impoverished slum-dweller. But what if the excluded do wish to have a more just

[8]"Many hedge funds are run by teams of pointy-headed rocket scientists, but Renaissance Technologies Corp. might be able to run its own space programme. The 68-year-old Simons, who has a PhD in mathematics from UCB and has taught at MIT and Harvard University, has packed his enterprise with math and computer whizzes. These quantitative specialists use arcane programmes to trade the globe's most liquid securities rapidly and frequently, using lots of leverage." [Finfacts (2006), p. 3].

[9]http://www.independent.co.uk/news/world/americas/friedrich-hayek-darling-of-the-right-isreborn-in-the-usa-2017267.html

[10]Televised lecture delivered at the SID Conference in Amsterdam, October 2005.

[11](Agnes van Ardenne van der Hoeven, "It's about poverty", Speech at the launch of the UNDP *Human Development Report 2005*; 5 September 2005. www.minbuza.nl.

society with more efficient and equitable generators and distributors of wealth than the overnight stock exchange? And what if the undeserved good fortune of the speculator is an outcome of the same neoliberal policy paradigm that accounts for the equally undeserved exclusion of the poor widow from a job, and her children from school? [Saith (2006), p. 1185].

Not surprisingly, another broadside against any preoccupation with inequality comes from Anne Krueger, when a deputy managing director of the IMF.

"Some anti-globalisers allege that the gains of globalisation are not universally shared. Inequality of outcomes is said to be the Achilles Heel of globalisation. This characterisation is misleading in several respects. At the very outset, one has to wonder about the preoccupation with inequality. As Chinese Premier Deng Tsiao Ping famously remarked: "I have a choice. I can distribute wealth or I can distribute poverty." Poor people are desperate to improve their material conditions in absolute terms rather than to march up the income distribution. Hence it seems far better to focus on impoverishment than on inequality. And there is no doubt that growth reduces the incidence of impoverishment. Empirical studies show clearly that the incomes of those at the bottom of the income distribution rise one-for-one with growth" [Krueger (2002)].

Kreuger presumably bases herself on the findings of Dollar and Kray's (2001a, 2001b) propagandistic intervention that makes this claim. She also seems to be on the wrong side of data with regard to the increase in inequality under globalisation; more worryingly she seems to suggest that raw economic growth is distributionally neutral, with the poor sharing proportionately in the increments. She betrays no recognition of the array of terminal critiques and counter-arguments that challenge and reject these conclusions on grounds of doubtful data, questionable method, and untenable policy interpretations: Easterly (2002) argues inequality does cause underdevelopment; Ravallion (2005) finds that "inequality *is* bad for the poor"; Rodriguez and Rodrik (2000) challenge the use of cross-national method and evidence; Foster and Szekely (2001), and Ravallion (2001) provide pertinent critiques of the use of general means to track low incomes; Gundlach, de Pablo and Weisert (2001) reject the policy deductions with respect to the claimed relative unimportance of education for the poor; Nye, Reddy and Watkins (2002) develop a comprehensive critique, as do Lubker, Malte and Weeks (2002), with the latter concluding that Dollar and Kray's "empirical work is based on theoretically unsound equations; the data are seriously flawed; and the policy variables are not defined appropriately, nor are they tested in a consistent manner", thus rendering the conclusions "unsafe"; others go further [Douthwaite (2000)]; the bottom line, as an acid commentary puts it, is that "misleading studies are bad for the poor".[12]

Instead, she seems to suggest that the rest of the world should take its cue on irrelevance of inequality from the case of China and its premier, without confirming that the Chinese growth experience is part of the package deal on offer for followers of her, and his, advice. Like Ardenne and Sachs, Krueger displays a gratuitously patronising stance towards "the poor" who, she double-guesses, are not really interested in the justness of the society of which they are members, only in their daily bread. Such rush to rashness calls for repentance, especially in the face of the cumulative evidence of the last two decades.

[12]http://www.brettonwoodsproject.org/art-15464

A variation on this theme was offered by (the late) Arjun Sengupta, a senior Indian economist and protagonist of a rights-driven approach to development, when he argued recently[13] that it would be fine to leave the top 20 percent undisturbed to enjoy their wealth, and for government policy to focus separately on the bottom 80 percent. This position conveys an impression that the two sub-economies and populations, the rich and the poor, occupy independent, unconnected countries, if not worlds. But do they?

"Spiteful Egalitarians"—Anti-Pareto Party Poopers!

Consider Martin Feldstein's use of the Pareto Principle in defence of inequality. We should take note, since he was the CEO and President of the National Bureau of Economic Research (NBER) for three decades, and also served as the chairman of the Council of Economic Advisers to President Reagan at a historic point of inflexion in policy regimes.

"Some see inequality as so intolerable that they regard increasing the income of the wealthy as a "bad thing", even if that increased income does not come at anyone else's expense. Such an individual, whom I would describe as a "spiteful egalitarian", might try to reconcile this with the Pareto principle by saying, "It makes me worse off to see the rich getting richer. I don't have fewer material goods, but I have the extra pain of living in a more unequal world." I reject such arguments and stick to the basic interpretation of the Pareto principle … I am interested only in evaluating changes that increase the incomes of high-income individuals without decreasing the incomes of others. Such a change clearly satisfies the common-sense Pareto principle: it is good because it makes some people better off without making anyone else worse off. I think such a change should be regarded as good even though it increases inequality" [Feldstein (1999:1)].[14]

Leaving not much to doubt, he asks his readers to "imagine the following: Later today, a small magic bird appears and gives each *Public Interest* subscriber $1000. We would all think that this is a good thing. And yet, since *Public Interest* subscribers undoubtedly have above average incomes, that would also increase inequality in the nation. I think it would be wrong to consider those $1000 windfalls morally suspect" [Feldstein (1999:1)].

One imagines that Feldstein would be equally happy if that small magic bird made a mistake and delivered $1000 windfalls to every non-subscriber of *Public Interest*. This would make all the *poorer* people better off without making the rich worse off. One must also assume that his position would be the same if the bird was larger in size and able to drop $1 million windfalls on every manager of an equity fund or every mortgage sub-prime banker. Essentially, Feldstein finds nothing wrong with increased top end inequality *per se*; he does not wish to make his answer contingent on the rationale for the receipt—just a windfall from a small magic bird! Is he in cloud cuckoo land?

Like others, Feldstein relies on the overworked ghost of Pareto, attempt to ethically legitimise extreme inequality in the current growth process so long as the poor

[13]Comments made at International Seminar on the Defining Poverty in India, Patna, July 2007.

[14]There are many dedicated evangelists of such positions; see, for instance, Bhalla (2004): "My own take on discussions on inequality is that it is equivalent to the "economics of envy"; what should really concern us is the growth in incomes of the poor."

do not lose out in absolute terms; anyone rejecting this position he then pejoratively, almost biblically, labels a 'spiteful egalitarian'. But if Pareto's ghost could borrow a voice, it might point out that Pareto might be equally contented with the diametrically opposite scenario, where all the benefits of new growth went entirely to the poor, so long as the rich did not suffer a drop in incomes!

In reality, it is notoriously difficult to specify a position where the pure Paretian principle really applies, since any significant intervention, within a static framework, in one part of the economy or society has consequences and ripple effects elsewhere that reconfigure distributional outcomes. Within a growing economy, there are many outcomes possible, all of which could meet the basic Paretian criterion, and hence the actual choice is made by other means and processes, usually through the exercise of power by those that have enough of it.

There are good reasons for agreeing with Waldman (2007) when he says, "there is no such thing as Pareto optimality" argues Waldman (2007). "The availability of public goods for which superior private substitutes can be purchased is nearly always diminished with increasing inequality".

Two effects operate. First, as the rich exercise a Hirschmanian prerogative to exit from the consumption of specific public goods in favour of superior private substitutes, effective loyalty support for that public good atrophies, and this leads to an erosion of the supply of "inferior" public goods consumed by the poor, indeed ensuring that the public goods do indeed become even more inferior in quality in absolute terms. This would apply to education, to health, to infrastructure, to law and order, to public utilities such as electricity, water, and transport. In turn, this restructuring in favour of the rich creates a dynamic force that further exacerbates the initial inequalities. Second, as the overall composition of demand is reoriented by increased inequality, the demand for some goods and services decline, and this leads to a loss of economies of scale, leading either to a reduction of provision, or of increased prices, as for instance when richer people take to cars, and privatised rail companies cut out routes now rendered non-viable; or as an area of a metropolis is gentrified, the erstwhile poorer residents can no longer afford to continue to live there with rising tax rates and prices of utilities; or cereals becoming more expensive for the poor as land shifts to the cultivation of more profitable uses catering disproportionately to the demands of the rich, such as livestock or bio fuels.

There is yet another serious reason for rejecting the Paretian justification of inequality arising from the operation of political power. Power in society takes inherently relational and hierarchical forms, as one class acquires power in relation to others. A significant increase in inequality also the political power in the hands of the richer groups then becomes the basis for the exclusion of others. Since power is fungible, this effect extends across a wide range of social, economic and political phenomenon. With the increase in inequality, the rich get incremental motivation as well as capacity to protect its privileges. Very early, Oskar Morgenstern "pointed to this situation as one limitation to the doctrine of Pareto optimality.[15, 16]

[15]See his "Pareto Optimum and Economic Organisation", in Norbert Kloten, *et al.* (eds.), Systeme und Methoden in den Wirtschafts und Sozialwissenschaften, Tubingen: J. C. B. Mohr (1964), p. 578, cited in Hirschman (1973/1981), p. 55.

[16]For seminal critiques of an axiomatic nature, see Sen (1970a, 1970b).

"Lie Back and Think of Kuznets!"

"Do nothing, just hold your breath, and wait for the Kuznetsian U-curve process to take hold; inequality will self correct." A touch of historical determinism is used as reassurance in favour of retaining a status quo marked by high and rising inequalities, and to caution against interventions even as the share of the poorer sections slides down the slippery downside slope of the U curve.

This attractively lazy option, it turns out, is indeed too good to be true. The downhill slide is well documented, but the climbing out of the trough has to be taken somewhat more on faith; on the rare occasions where countries have clawed their way up the slope, there has been hard work to do, aided by various circumstantial factors. There is also a misreading of the hidden role of the social agency and politics embedded in the Kuznetsian process, which is too well nuanced, historically and process rooted, to be reduced to a mechanical, auto-piloted ride. These issues are well discussed by Palma (2011).

The issues to explore in developing economies are how the wide range of structural, economic, cultural, technological and political factors—which, in particular combinations, delivered the U-curve over a century in a group of European countries—are configured and interact at present. What forms do the various drivers of the original U curve take? And do they have the pulling power to drag the income shares of the poorer sections up the steep side of the curve? How is the process playing out in contemporary South Asia, for instance?

An adapted Kuznetsian analytical frame helps elicit some pertinent structural contrasts. The classical cases of European industrialisation involved a successful Lewisian process of structural change in the composition of both the GDP as well as the workforce, accompanied by a mature process of urbanisation. A rural residual workforce and population, of different dimensions, remained but in most cases, this was a small minority. This facilitated the provision of public goods, especially infrastructure, public health and education, information to most of the population, with significant externalities for the poor even when many of these interventions might have been driven by the motivations of benefiting the elites. The early start also implied that this structural change fed into tightening labour markets which, in turn, induced labour mobilisation and organisation, with trades unions emerging as effective enhancers of the bargaining capacity of the working classes. The combined effect registered gains in the rewards of labour. This steady industrial transformation also shored up the fiscal reach and capacity of the state for financing social and infrastructural interventions on a substantial scale. This expanded state capacity was converted into varying degrees of state willingness to undertake the task of social provisioning by a combination of motivations and pressures. An argument can be made that the new material prosperity of the elite induced a secular change in social norms that became more accommodative of working class needs and demands, a process that was no doubt assisted by effective labour struggles. Alongside this was the new pressure for such change inherent in nascent democratisation, which brought the previously excluded working classes into the political game as potentially effective players. Special factors and crises strengthened and accelerated these tendencies: the Great Depression, the war, and the processes of post-war societal and economic reconstruction within states that had learned some crucial Keynesian lessons.

The welfare states thus had deep roots even though their fulfilment was manifested only in the post-war era, with a period of maturity and prosperity in the 1960s and 1970s, the decades collectively labelled as the 'golden age of capitalism'. Thus, the universalisation of socio-economic security, within the limits of capitalist society and economy, was successfully negotiated, constructed, defended and sustained in varied forms of a new social contract or social corporatism. It is also worth noting that these welfare regimes tended to follow models of social provisioning that were not just virtually universal in reach, but also relatively uniform in their design, though obviously there were notable variations in the specific templates followed by different countries.

A comparison of contemporary South Asian structural features with those highlighted earlier in terms of their being pivotal in the rise of the modern welfare states in the northwest, is sobering. While savings and investment rates have risen across the board, overall growth rates have not responded systematically; the labour force growth rate is a multiple of what it was in the other group; the share of the modern manufacturing sector is miniscule in most LDCs and remains stalled, while informality is the norm in the economy. The urban share of the population has boomed, but perhaps prematurely, reflecting more the unattractiveness of the usually atrophying rural sector than the dynamic pull of a flourishing job market and service provision in the cities. There is no tightness in labour markets, the mobilisation and organisation of labour remain weak, and many advances of the early decades have been beaten down by in the neo-liberal era. Trade unions do not constitute a credible countervailing power almost anywhere, and social movements are too diffuse, diverse and disparate to coalesce into a coherent social transformative force that can occupy the vacuum left by the collapse of the power of the working classes. Inequalities are all too often applauded and legitimised rather than decried, so that little reliance can be placed on emerging egalitarian social norms as drivers of transformative change. The new rules of the game do not allow the state to act as a prime mover itself, or to be overactive in the matter of fiscal mobilisation to underwrite any serious expansion of the welfare regime. And the provision of public goods has been privatised to such an extent that the elite protect themselves in walled and wired colonies that form special habitation zones for the rich wherein the quality of water, air, climate, sanitation, electricity, connectivity, security, are all assured internally. Public health and education facilities, originally catering to the 'community'—a short-lived construct in the early optimistic days of post-colonial independence—have been thoroughly commoditised. Indeed, the welfare regime in this group of countries has been reduced to a tawdry exercise in the narrowly targeted reduction of extreme absolute poverty.

As far as contemporary late starters are concerned, the Kuznets U-curve has mutated more into an L curve.[17]

"But Inequality Gives the Poor Hope and Incentives!"

In the context of his analysis of American society, Tocqueville argued that inequality provides the incentive for the poor to become rich. More recently and systematically, Hirschman developed the notion of the tunnel effect which would make

[17]For an early assessment making this argument, see Saith (1983); for a comprehensive empirical treatment, see Palma (2011).

the poor tolerate and acquiesce to rising inequality if they could imagine upward mobility for themselves. While it lasts, the tunnel effect involves "patterns of deferred social mobility, even though somewhat mythical, are nonetheless effective."[18]

Hirschman's "basic idea [is] that changes in the income of B lead to changes in A's welfare not only because A's relative position in the income scale has changed, but because changes in B's fortunes will affect A's prediction of his own future income. The principal case that has been considered so far is the tunnel effect: B advances, and this leads A to predict an improvement in his own position as well." [Hirschman (1981:55)].

Developing this hypothetical situation, Hirschman argues "as long as the tunnel effect lasts, everybody feels better off, both those who have become richer and those who have not. It is therefore conceivable that some uneven distribution of the new incomes generated by growth will be preferred to an egalitarian distribution by all members of the society. In this eventuality the increase in income inequality would not only be politically tolerable; it would also be outright desirable from the point of view of social welfare." (1981:43)

There are strong operational policy implications, identifying which was perhaps the prime motivation underlying Hirschman's thesis. If the tunnel effect is strong, the distributional inequalities emerging a process of growth can be tackled sequentially post facto; on the other hand, if there is no tunnel effect, growth and distribution have to be tackled simultaneously through appropriate policy.

Recently, a selectively excised positive interpretation of the Hirschman hypothesis has been used, along with other justifications, by a prominent Indian neoliberal reformer to argue that rising inequalities in the process of rapid Indian economic growth are not iniquitous. Suresh Tendulkar's defence of inequality, written in congratulatory mode as part of a *festschrift* for Montek Singh Ahluwalia—whose first significant piece of research, ironically, was to argue the case for redistribution through growth – is significant for its timing: it appears at a time when rising inequalities, inflation, corruption, and insurgencies, have monopolised the front pages for an extended period. He chides Indian intellectuals of leftist persuasion quoting Hirschman who mentions that the tunnel effect "was often stumbled upon by researchers who were looking for the opposite phenomenon, such as seething discontent and revolutionary fervour among the urban poor, and were surprised and sometimes not a little disappointed at what they actually found" (p.43).

There are several problems with Tendulkar's interpretation of Hirschman; further issues about its empirical applicability in the Indian scenario; and yet further difficulties inherent to Hirschman's approach itself, insightful as it might be.

Tendulkar's take on the tunnel effect seems to suffer from severe tunnel vision. Casually noting some of Hirschman's own qualifications on the existence of the effect, he ignores several others, cherry picks the evidence, and arrives at what looks like a predetermined optimistic conclusion about the existence of the tunnel effect.

First, Hirschman is careful to warn that "it may be impossible to tell in advance whether a given country is or is not adequately supplied with the tunnel effect: it is conceivable that only development itself will tell" [Hirschman (1981), pp. 57-8]. Ride the tiger, and find out, if you survive to tell the tale.

[18][Fernando Henrique Cardoso and Jorge Luis Reyna, writing in 1968, cited in Hirschman (1973), p. 45.].

Second, Hirschman repeatedly emphasises that the tunnel effect is ephemeral and of indeterminate duration: "this tolerance is a loan which eventually expires. It is granted in the expectation that, with time, the disparities will grow smaller. But if this does not happen there will undoubtedly be problems and maybe even disaster" [Hirschman and Rothschild (1973)]; "development disaster occurs in countries … ruling groups and policy-makers fail to realise that the safety valve, which the effect implies, will cease to operate after some time; this situation has been increasingly typical of a number of Latin American countries", and Hirschman (1981:57-58) singles out Brazil and Mexico as significant examples. These are the examples that Tendulkar uses, conveniently glossing over the fact that Hirschman goes on later to cite these very cases as examples where the tunnel effect ran out and inequalities and exclusionary growth induced harsh authoritarian military rule.

Third, Hirschman himself notes the possibility of a reverse tunnel effect, where the improvement in the situation of A is likely to affect B's welfare negatively. Hirschman says "this sort of prediction is not too far-fetched: it is likely to be made in a society whose members are convinced that they are involved in a zero-sum game because resources are available in strictly limited amounts" (p.55). This could be a product of perceptions that follow George Foster's notion of the Image of the Limited Good, deemed to apply to "traditional" peasant societies. However, ultra modern industrial societies could also labour under this burden given the neo-conservative economic requirement of running a balanced budget which clearly gives the fiscal game a similar perceived quality, as is manifest in the bickering and struggles over government expenditures and taxes, especially around election time. In addition, basing himself on Oskar Morgenstern's critique of Pareto optimality, Hirschman argues that "one reason for this prediction could be that A's feeling that B, as a result of his increased wealth, will also acquire more power, a good that is generally acquired at the expense of others, and that this redistribution of power, besides being in itself objectionable to A, will have in time an adverse effect on his economic position. Such a feeling is likely to arise particularly if B comes to be *substantially* better off than A." (emphasis in original). Hirschman regards this as likely in a variety of realistic situations.

One imagines that the conflictual outcome of the reverse tunnel effect would be similar to the negative social and political consequences induced by the premature petering out of a tunnel effect midstream in a disequalising process of economic growth. Perceptively, Hirschman notes: "As long as the effect is strong, the developing country will be relatively easy to govern. It may even exhibit a surprising aptitude for democratic forms, which, alas, is likely to ephemeral; for, after a while the tunnel effect will decay and social injustice will no longer to unperceived and unresisted. As a first reaction, the coercive powers of the state will then be used to restrict participation and to quell protest and subversion. More constructive programmes of responding to crisis are easy to conceive, but seem to be extraordinarily difficult to bring in to the world" (1981:57-58).

Fourth, Hirschman rightly asks: "In what kind of societies does the tunnel effect arise and gather strength? What are the conditions under which it will last for a substantial time period, or, on the contrary, decay rapidly and turn into the opposite, namely disappointment, alienation, and outrage at social injustice? Answering this question is crucial for bringing our hypothesis down to earth and for ascertaining its empirical and heuristic usefulness" (1981:49).

He proceeds carefully to provide a lengthy carefully considered list of pre-conditions under which the tunnel effect might work for a while; there are many more situations where it was unlikely to work, and only a few where it might. Is Tendulkar's invocation of the tunnel effect justified for Indian realities? Given Tendulkar's tendentious treatment of it, it is necessary to revisit Hirschman's perceptive essay.

Hirschman initial reluctance to attach much significance to social stratification as a negative factor is overtaken by a stronger emphasis on the need for empathy across groups and classes. "The tunnel effect will always come into being as, within each social class, those who are not advancing empathise initially with those who are"; but then: "for the tunnel effect to be strong (or even to exist), the group that does not advance must be able to empathise, at least for a while, with the group that does. In other words, the two groups must not be divided by barriers that are, or are felt as, impassable. Thus, the fluidity or rigidity of class lines will have an obvious bearing on the intensity of the tunnel effect" (1981:49).

More relevant for him is "the contrast between fairly unitary and highly segmented societies: "If, in segmented societies, economic advance becomes identified with one particular ethnic or language group or with the members of one particular religion or region, then those who are left out and behind are unlikely to experience the tunnel effect: they will be convinced almost from the start of the process that the advancing group is achieving an unfair exploitative advantage over them. The non-mobile group may thus make the prediction opposite to that implied in the tunnel effect: As a result of another group's advance, it will expect to be worse off. … In any event, it appears that highly segmented societies will or should eschew strategies of development that are politically feasible elsewhere because of the availability of the tunnel effect." (p. 49; emphasis in the original). Further, he warns that "the capitalist road to development appears to be particularly ill-suited for highly segmented societies; if it is followed there, it will require a far greater degree of coercion than it did in the fairly unitary countries in which capitalist development scored it historic successes" (ibid.:50). But there seems to be no better alternative for him since he posits that socialist systems would not work in segmented societies either.

"The more or less unitary character of a country is probably the most important single criterion for appraising the likely strength and duration of the tunnel effect" The degree of national homogeneity is strengthened, or substituted for a while, by "an intensive historical experience that has been shared by all members of a group. Wars and revolutions typically can be such experiences, and the tunnel effect is therefore frequently at its most potent in post-war and post-revolutionary societies." But he warns: "the result can be an irony-laden historical cycle: revolutions are often made to eradicate a certain kind of inequality, but after such a revolution and because of it, society will have acquired a specially high tolerance for new inequalities if and when they arise". Hirschman includes here the anti-colonial experience of the United States: "the egalitarian or, rather, "born equal" heritage of the United States … may have set the stage for the prolonged acceptance by American society of huge economic disparities." Post reform China provides another strong example, where an exceptionally high degree of national homogeneity, cemented further by the collective experience of the Revolution, creates the extended tunnel effect that allows the system to accommodate dramatically wide and rapidly widening inequalities. Clearly, the sustained and rapid growth of the economy has made the tunnel effect more credible and extended its life further. Nevertheless, China clearly rides a tiger into dangerous territory: his caution, that “the more homogenous the country, the more prone will it be to violent social conflict in the course of development unless its leadership is uncommonly perceptive and able”, seems to be relevant to China today with its rising tide of protests and dissension arising from the exclusionary tendencies of its rapid economic growth.

The case of transition economies is perhaps encapsulated in the findings of a recent survey on the attitudes to inequality in Russia. Ravallion and Lokshin (1999), using a 1996 survey of 7000 adults surveyed in the setting of Russia in the 1990s, found that 72 percent favour government action to reduce incomes of the rich. The remaining 28 percent were either the well-off who expected to do even better, with the greatest opposition to redistribution coming from those on “a rising consumption path who expect it to continue”; this last category could be roughly taken to correspond to the constituency defined by the tunnel effect, say, about one in 5 or 6 of the population. The 3 in 4 of the population that favoured redistribution included more women, more communists, and the vulnerable: “the old, poorly educated adults, people who live in rural areas, people who expect to lose their jobs, and people who do not think the government cares about them”. The sturdy conclusion is that the tunnel effect seems to apply to a small minority, whereas the vast majority is immune to its lure. The evidence rejects any notion then that inequalities and vulnerabilities emerging from the transition process became acceptable to the people through the soma of some Russian version of the American dream. This situation could well stand as a proxy for a large group of transition economies.

The tunnel effect works best, perhaps, within traditional non-segmented societies that share a common heritage and defining collective episodes, where family and social networks are active and strong. But even here, society does come out of the tunnel at some point, and all depends on what it then discovers on the other side.

Hirschman refers to the knife-edge between “the expectation of advance and anticipation of decline” which explains “why the forecasting of social conflict is such a hazardous business”(1981:56).

The blaze of upheavals in the Middle East and North Africa provide a pertinent pointer. Indeed, a strict application of the Hirschmanian checklist of criteria could well generate a null set—virtually no developing or transition country inspires confidence, ex ante, about the existence of any significant tunnel effect.

Overall, Tendulkar’s selectivity distorts the rich analysis of Hirschman which, far from providing any endorsement or justification for rising inequalities, repeatedly sounds nuanced warnings of its limited applicability, frequent unsustainability and implicitly, its potential incompatibility with democratic political processes. A careful reading of Hirschman’s classic paper would set off alarm bells for contemporary India (and China), not any ringing endorsement.

And none of the key systemic features that hypothetically predispose a country towards the expedient benefits of the tunnel effect could safely be held to characterise Indian realities. India is far from constituting a unitary society; it is sharply polarised in terms of class and social groups; there is an overwhelming lack of empathy across these class or group lines; there is a high visibility to the widening gaps; there is a massive perception of unfair play on the part of the elite in pulling ahead through corrupt practices; there is a rising tide of new vulnerabilities unleashed by globalisation; there is widely held perception of India being not one country but two; and there is much evidence of outright conflict, in various forms both non-violent and violent, between the two. For many Indians, their American dream takes the form of a "green card", or a successful trip as a migrant worker to the human-rights deserts of the Middle East. Possibly, the would-be proto-elites that form a layer aspiring to promotion might form a, and probably the only, Hirschmanian constituency. But for the rest, their equivalent of the American dream translates more into an Indian fantasy, quite likely to mutate for most into a nightmare. When considered against India today, Tendulkar's analysis does seem to suggest a tunnel vision – not of the Hirschmanian type, but of the genre of the proverbial ostrich ensconced in a comfort zone of denial. One way of "tolerating" inequality is an obstinate refusal to see it.

Additionally, we can raise two fundamental, perhaps terminal, problems inherent to Hirschman's own analysis which undermine the heuristic and practical value that he was seeking. First, it has a somewhat tautological flavour: how does one verify the acceptance or toleration of inequality? How much protest is protest? What is acceptance? Perhaps there is seething resentment, but it diffuses and dissipates and is suppressed or rendered invisible by a variety of means. There can be a great deal of turmoil under a surface that appears to be placid. Perhaps there is continued protest with media and elite fatigue—the coexistence of protest and coercive suppression become a part of daily realities. The inability of protest to permeate and aggregate across society cannot be equated with toleration.

And second, toleration of inequality, even if this could be meaningfully validated, cannot substitute for its justification. Having to tolerate a bad odour does not convert it into a fragrance. The fact that wide and widening inequalities might be tolerated in certain social and time frames does not legitimise them, even less make them intrinsically desirable.

Did Anyone Complain or Protest? It Ain't Broke, Don't Fix It!

A common implicit premise underlying various strains of the apologist discourse on inequality seems to be the notion that people at the wrong end of it willingly acquiesce to it, do not regard it as an issue, as confirmed by the alleged absence of any challenge. "If inequality was so wide, widespread, and widening, why does it not induce political reaction, protests, and thereby induce corrective interventions?" The deduction elicited from this interpretation is that if the poorer sections of society do not regard it as a problem, nor should anyone else, and hence no policy or political action is indicated. However, this self-serving interpretation developed by protagonists of the status quo, is generally spurious.

There can be two categories of responses to the paradox of the missing protest.

First, there is overwhelming credible evidence that effectively undermines the empirical of such claims, from the rash of protests in China, to the yellow shirts in Thailand, to the Maoists in Nepal and India, to the Middle east and large parts of Latin America. There is widespread opposition, though often is fragmented an unable to effectively coalesce into mass protest, sometimes due to weaknesses in mobilisation and organisation, and at other times on account of coercion and suppression of struggles by trade unions, and social or political movements.

Second, it is incorrect to interpret silence, in the face of inequality, as assent on the part of those that carry its burden. An absence of overt opposition could also arise from the Bourdieu *doxa-habitus* syndrome of disempowerment and the evanescing of the exercise of imagination or agency in favour of an alternative way of being - where the existence of inequality is both individually and socially so subjectivised and behaviourally ingrained that it becomes as "natural" as the air you breathe, breeding a passive, unthinking acceptance. Oppressive practices against women and socially excluded communities have persisted relatively unchanged and unchallenged for centuries through such stabilising effects. Such unreflective silence and passivity cannot be read as agreement or support for the status quo of inequality, even less for a further intensification of it.

Third, people can be ignorant or misinformed, and kept that way with a little help for the elite. Take the case of exploding inequalities in the USA. Why don't the bottom 120 million, constituting the poorer 40 per cent of US society, react or object or protest?

Consider the findings of a recent survey conducted by behavioural psychologists in the US. The returns from 5522 respondents revealed that Americans had no clue about the extent of wealth inequality in their country; and also that their preferred "ideal" distributions were far more equal, resembling Sweden's, than the extreme American reality around them that they knew little about [Norton and Ariely (2010)]. For the top quintile, its ideal share was pegged by them at 30-40 percent, a long distance from the actual share of 85 percent of the wealth the riches quintile actually owned. For the bottom 40 percent, the respondents wished them to own 25-30 percent of the wealth, in comparison with 8-10 percent that the respondents felt this group owned, and dramatically distant from the 0.3 percent of the wealth that the bottom 40 percent possessed in reality. Clearly, the respondents thought the wealth distribution was far better than it actually was and, further, they wished it to be even more egalitarian than what they had optimistically felt it to be. Their ideal distribution was far more egalitarian than their guesstimate of reality, which in turn was still far more equal than the actual distribution. "That means Americans think ideally the poorest 120 million Americans should own somewhere between every fourth and fifth dollar of net worth, when in fact they own every 333rd dollar" [Johnston (2010), p. 252].

In fact, Saez's estimate that the top 1 percent took 50 percent of all incremental income in the … period throws up far worse distributional outcomes for the bottom 99 percent.

Ignorance if further compounded and confounded by being misled and manipulated politically. Witness the widespread support, with only limited islands of opposition, for tax breaks in the US, cutting across all social class and economic strata including blue and while collar workers all the way to business tycoons. "Americans have this general belief now that government is bad, taxes are bad". "These ideas are easier to market than dandruff shampoo. Taxes, bad. Government, bad. Tax cuts, good. Less government, better" [Johnston (2010), p. 254]. Yet, the workers and poorer sections had little idea of how these regressive fiscal transfers had actual effects opposite to what they might have fervently believed. The agents, consultants and lobbyists of the political elite are “superbly talented at exploiting this politically toxic amalgam of helplessness and lack of knowledge about taxes” [Johnston (2010), p. 253].

Such lack of knowledge and cynical political manipulation by the elite are clearly powerful reasons, but so is what Ariely calls “learned helplessness”. “When you cannot make a connection between cause and effect, you become depressed and just take it.” More generally, they have little idea of the reality and even less knowledge of the real reasons behind economic outcomes; they are easily swayed by a mass media which is itself manipulated. They become discouraged citizens, sullen, inert, easily mistaken for stoic.

‘‘The people I live with and work with and talk to work at McDonald’s or as security guards or on a road crew—they are high school graduates thinking only about paying their bills and have no idea about politics in this country,’’ Eric[19] told Donald. ‘‘If you try to engage these people about the state of the economy, just in passing, they have no idea, and they don’t care,’’ Eric wrote. ‘‘They know bad things have happened to them, they know they can barely pay their bills. They are scared, but they don’t know why things have gotten so bad, and they don’t know how to find out anything. That’s what scares me—they don’t want to find out, because they say knowing won’t change anything. They say what they know doesn’t matter because they can’t do anything about it.’’

Eric detects a seething anger beneath the surface that the right charismatic figure could ignite. Silence is then far from tolerance; possibly more akin to the tinder-dry fields where a prairie fire might well be about to happen. Tolerance and acceptance? famous last words, more likely. Ask Hosni Mubarak.

Springs of Hope, Winters of Discontent

Official statistics have a powerful potential to misinform, obfuscate and subvert citizens’ struggles. Acknowledging Disraeli’s aphorism—“lies, damn lies, and statistics”—perhaps the most pertinent and prescient observation comes from the astute social imagination of H.G. Wells. Writing over a century ago, he anticipated that “the time may not be very remote when it will be understood that for complete initiation as an efficient citizen of one of the new great complex worldwide States that are now developing, it is as necessary to be able to compute, to think in averages and maxima and minima, as it now to be able to read and write.” Elsewhere, he observes: “Facts and figures illustrating progress fly across frontiers like guided missiles directed at people’s minds. And, of course, those who lag behind in such progress are the most exposed to this propaganda” [Wells (1903)].

Indeed, the mountain of still mounting evidence of rising inequalities in modern times is virtually incontrovertible—despite the empirics being systematically muddied and muddled by tendentious and diversionary interventions purporting to convey a more ambiguous bottom line, through the selective (ab)use of data sets and methods.

Yet, most citizens neither follow nor comprehend these convoluted debates, and have widely inaccurate perceptions of the relevant numerics of inequality. They derive their perceptions from their personal analysis of immediate experience, where this

[19]“Eric” is Donald Cay Johnston’s unemployed brother in rural Oregon. [Johnston (2010), p. 253].

understanding is mediated through social interactions and public debate, especially involving the media, where again they become vulnerable to the capacity of the ruling classes to dissemble, divert and deny the realities of systemic inequalities. Potentially, official and dominant discourses become a powerfully biased and disempowering filter. Academic debate has increasingly become an active and influential agent in this public space, the gate keeping of which is itself controlled by the holders of power. And where this capacity to preempt and diffuse opposition loses its potency—if only because, as the adage goes, not all the people can be fooled all the time—other more direct and coercive means of control tend to be resorted to, giving increased meaning to the exhortation of a despairing Maurice Dobb, “when interest obstructs reason, to preach reason is vain, unless it be to dethrone interest”. The cycle of seasons repeats itself, from hope to disenchantment to sullenness to violence—from the Arab Spring to the winter of discontent.

Perhaps Eric has found voice and is camping on Wall Street, just as his counterparts in the Arab Spring maintain a vigil, if not a siege, on Tahrir Square; just as the Occupy Movement expresses its collective anger, even if symbolically, in waves across countries in every continent against the lurid excesses of plutocratic capitalism; just as the global economy teeters yet again on the brink of another predictable collapse.

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Economic Growth and Regional Convergence: The Case of Pakistan

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1. INTRODUCTION

Growth and development are the closely related terms that convey more or less the same message to the general reader. However, where growth theory concentrates on the factors responsible for determination of income, the theory of development focuses on the overall socioeconomic structure and institutional set-up that move ahead with the passage of time. The growth of income is central to the process of economic development; the relationship between the two resembles that of an engine and the carriage. Following the impetus of growth in income/output, the entire social and institutional structure begins to improve and expand in all directions. If the growth process sustains overtime, the social structure moves gradually towards modernisation, democratic attitudes, broadness in outlook, equity in distribution, reduction in poverty and improvement in the standard of living. The borders of growth and development coincide when a researcher intends to investigate the question of equity in distribution across different households and that of convergence across different regions.

The term 'convergence' has been used in growth literature to imply a narrowing down of the gaps in incomes across regions and thereby a tendency towards a common equilibrium over time. Although the concept is quite old,[1] the issue came to the surface since the late eighties when the new emerging economies exhibited rapid and sustained growth but the old industrial countries experienced relatively a slowing down. As noted by Abramovitz (1986), it was believed (with a sort of fear) that 'East Asians Countries', which embarked on growth path at a later stage, will catch up with their 'Western' counterparts in the near future. It was argued that innovation is often difficult whereas imitation is easier. Naturally, a few may be the innovators and leaders in growth, while majority of others may be the imitators and followers. The contrasting arguments were also floated in that the leaders have, after all, an edge over the followers. The evidence,

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[1]The origin of convergence goes back to mid-18th century and important insights can be found in the scholarly writings of Hume (1742) and Tucker (1776), [see Elmslie (1995) for details].

both in favour and against, could now be traced through the vast literature on growth and convergence.[2]

The hypothesis implies equalisation of per capita income and productivity overtime across the world economies. In this connection, one has to distinguish between absolute and conditional convergence. The former is interpreted as convergence of different economies to a common steady state level, given identical preferences and technologies. This implies that relatively poor regions (should) grow faster than their richer counterparts despite differences in the start-up points. In contrast, if they exhibit significant differences in structural characteristics, then every region will follow an independent path and converge to specific steady state level rather than to a common equilibrium. This latter behaviour is termed as conditional convergence, since the growth rate of an economy is also affected by other features like population growth, nature of technology, political and social characteristics etc. in addition to income. Another important concept often used in the analysis is the dispersion from the steady state (denoted by sigma: σ). If the dispersion or variability of real per capita income across regions decreases with the passage of time, in other words, if they get closer to one another, they are said to exhibit sigma convergence.

The convergence hypothesis has been tested by researchers using different data sources, methodologies and statistical techniques. For large sample of countries (with different socio-economic structures), most of the empirical studies fail to support absolute convergence. Put differently, this kind of behaviour is supported only for 'smaller homogeneous groups' within specific geographic regions. For instance, Barro and Sala-i-Martin (1992), and Mankiw, Romer, and Weil (1992) reject absolute convergence for a diverse group of countries in the global context but do not reject its occurrence for regions like OECD countries, where technologies, preferences and other social structures are more or less similar. In general, most of the studies report in favour of conditional convergence.

2. RATIONALE AND OBJECTIVES OF THE STUDY

The questions concerning the prevalence of poverty, the deepening gulf between rich and poor and the rising trend in other economic disparities across regions, sectors and classes, have always been the burning issues all over the world. These issues, irrespective of their causation (structural or policy discrimination), bear far reaching economic and political consequences. In order to devise appropriate policies for relatively even distribution of the benefits of growth, it is essential to investigate into regional disparities and to understand their causes and impacts. In fact, regional growth is as important for a country as national growth on the grounds of both equity and political harmony. In this connection, the convergence analysis provides an appropriate framework for identification of the nature and causes of disparities. Examples of such attempts are numerous, both for the developed and developing countries.[3]

[2]Baumol (1986) was among the pioneer economists who provided statistical evidence of convergence among some countries and also for its absence among others.

[3]For instance, Juan-Ramon and Rivera-Batiz (1996) analysed the issue for the states of Mexico, Cashin and Sahay (1996) and Bajpai and Sachs (1996) for Indian states, Jian, Sachs, and Warner (1996) and Gundlach (1997) for Chinese provinces, and Hossain (2000) for various regions of Bangladesh.

The Federation of Pakistan displays complex regional diversities, i.e. the geographic regions differ not only in linguistic, cultural, and demographic terms but also reflect evident diversities in the level of social and economic development. During the past half a century, investment in physical and social sectors has largely concentrated in selected parts of the country, particularly big cities like Karachi. This practice has led to large scale migration to cities in search of employment, created economic disparities and aggravated the problems of poverty and inequalities. These disparities have in turn led to development of a sense of deprivations among rural population, weakening of the federation, regional tensions, political instability, terrorism and difficulty in building consensus on issues of national interest.

It may be interesting and useful to investigate the existence of convergence in Pakistan, to identify its nature and to pinpoint the various impediments in its way. A number of indicators like literacy rate, population density, life expectancy, degree of urbanisation, the rule of law etc. speak of much disparity across the socio-political regions. Further, these disparities are increasing over time. This provides sufficient rationale to focus attention on the issue of growth and convergence using the formal models and standard procedures. For this end, we discuss the methodology and analytical framework in the next section. This is followed by a brief discussion of the available data and then an analysis of the main findings. The final section is reserved for conclusions and policy recommendations as usual.

3. ANALYTICAL FRAMEWORK

It seems appropriate to present a brief historical sketch of the models used for the purpose before we concentrate on empirical analysis.

3.1. Historical Background

The neoclassical growth model, pioneered by Solow (1956), which was originally meant to resolve the razor-edge problem of the Harrod model (1939), could also successfully explain as to why certain countries on the globe are so rich and others so poor. At equilibrium, the growth rates of per capita income and capital intensity are closely inter-related. The production function often employed in growth models is Cobb-Douglas, with CRS specification and labour-augmenting technical progress plus the usual neoclassical assumptions. It may be expressed in the reduced form; with all variables in per capita terms:

$$Y_{(t)} = K^{\alpha}_{(t)} [A_{(t)} L^{(1-\alpha)}_{(t)}] \quad \Rightarrow \quad y_{(t)} = A_{(t)} k^{\alpha}_{(t)} \qquad \ldots \qquad \ldots \qquad (1)$$

The symbols carry their usual meaning; ‘Y’ stands for gross output, ‘K’ for capital stock, ‘L’ for the labour force, ‘$k=K/L$’ for capital intensity and ‘A’ denoting the technology growing exogenously at a rate ‘g’. Next utilising the aggregate saving function ($S_{(t)}=sY_{(t)}$) and the incremental capital-output ratio ($v=dK/dY$), the fundamental equation of motion is readily obtained:

$$dk / dt = A_{(t)} s k^{\alpha}_{(t)} - n k_{(t)} \qquad \ldots \qquad \ldots \qquad \ldots \qquad \ldots \qquad \ldots \qquad (2)$$

At the steady state equilibrium, the capital intensity stops changing. The time path of this variable depends directly on saving rate ‘*s*’ and inversely on the growth rate of labour force/population ‘*n*’. This in turn leads to the relationship of per capita income with the same variables/parameters:

$$k^*_{(t)} = \{A_{(t)} s/n\}^{1/(1-\alpha)} \Rightarrow \quad y^*_{(t)} = B_{(t)}.\{s/n\}^{\alpha/(1-\alpha)} = B_{(t)}.\{1/v\}^{\alpha/(1-\alpha)} \quad \ldots \quad (3)$$

The symbols with asterisks denote the steady state values of the variables concerned, and the term $B_{(t)} = A_{(t)}^{\alpha/(1-\alpha)}$. It is now straight forward to show the growth rate of per capita income by the relation:

$$\ln\ y_{(t)} \ = \ \ln\ B_{(t)} \ + \ \{\alpha/(1-\alpha)\}\ln s - \{\alpha/(1-\alpha)\}\ln n \quad \ldots \quad \ldots \quad (4)$$

This relationship conveys an important message: other things remaining the same, countries with high investment and saving rates will grow faster while those with high population density will lag behind in the race. This is the crux of the model.

However, the basic neoclassical model came under criticism from two main angles:

First, the model failed to explain the (large) residual component in growth accounting. Solow attributed this factor to the ‘measure of our ignorance’. However, it was believed to arise primarily due to the way technical progress was considered. The controversy during 1960’s revolved around the question whether technical progress is exogenous or endogenous and whether it could be considered as embodied or disembodied. Further research led to the introduction of endogenous growth models *ala* Romer (1989) and Barro (1990) that emphasised on the role of human capital in development and growth. This also rejected the hypothesis of secular stagnation.

Second, the original model predicted that economies are likely to converge to the steady state equilibrium overtime. However, this very notion of convergence has been interpreted in different ways. Traditionally, it was believed that every economy may follow an independent growth path and converge to some steady state level peculiar to it. On the other hand, it was argued by some researchers that different economies are likely to converge to some common steady-state equilibrium in the long-run and that the growth rate tends to be inversely related to the starting level of income per capita. Thus, relatively poor economies could grow quickly as compared to their rich counterparts over time. However, the cross-country empirical evidence failed to support this prediction of catching-up. As emphasised by the endogenous growth models, rich economies have to grow faster and indefinitely due to higher rate of capital formation and technological advancement. In other words, the very existence of steady state equilibrium was refuted, given that investment in human capital leads to increasing returns and that human capital is a public good.

3.2. The Framework for Convergence Analysis

The primary source of convergence is believed to arise from the very assumption of diminishing returns to reproducible capital. Other sources of convergence include labour migration from poor to richer economies and the diffusion of technology. The catching-up phenomenon is rationalised on the grounds that imitation and adoption of discoveries is comparatively cheaper than innovation and discoveries itself. In other words, technical progress may be relatively slower in leaders and rapid in follower economies.[4]

3.2.1. Absolute Convergence

The contemporary studies on convergence generally follow the specification suggested by Barro and Sala-i-Martin (1991, 1992), which provides the following relationships.[5]

$$\ln y_t^{\circ} = e^{-\beta t} \ln y_0^{\circ} + (1 - e^{-\beta t}) \ln y_{ss}^{\circ} \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (5)$$

In the above equation, y_0° is the initial value of income per effective worker, y_t° is the income at time (t) so that it converges to equilibrium value (y°_{ss}) in the limit as $t \to \infty$. The parameter 'β' captures the speed of convergence, which is determined by technology and preferences. If the technical progress is labour augmenting, we may rewrite the variables in per capita units as under, since the terms expressed in efficiency units are not directly observable.[6] An error term may be added as usual.

$$\ln y_t = gt + (1 - e^{-\beta t}) \ln y_{ss}^{\circ} + (1 - e^{-\beta t}) \ln A_0 + e^{-\beta t} \ln y_0 + \varepsilon_t \quad \ldots \quad \ldots \quad (6)$$

Equation (6) provides the framework generally used for testing absolute β-convergence. It can be easily seen that the initial value of output per worker has no implications for its long run value since as $t \to \infty$, the term $(y_t - y_\infty A_0 e^{gt}) \to 0$ in the limit. It may be possible to divide the time span into smaller sub-periods (of length: 'd') so that the average growth rate of income per worker (between time 't' and 't–d') for the economy concerned, given by $y^\wedge = (1/d)(\ln y_t - \ln y_{t-d})$, may be regressed on the level of income in the past period. As such, the modified format will be as under:

$$y_i^{\wedge} = C_i - (1/d)(1 - e^{\beta d}) \ln y_{i,t-d} + \varepsilon_{i,t} \quad \ldots \quad \ldots \quad \ldots \quad (7)$$

The slope parameter captures the speed of convergence (coefficient 'β') at which the economies are approaching to the common steady state, whereas the intercept term, given by: $C_i = g_i + (1/d)\ (1 - e^{-\beta})\ [\ln y_i{}^{\circ}{}_{ss} - g_{i,(t-d)}]$, captures the effects of technical progress and other unobservable determinants of steady state.

The above specification, however, suits the economies that are closer to one another in structural characteristics (e.g., OECD); and therefore may exhibit absolute convergence. The common intercept in such models constrains all the economies to have the same steady state level, which is a highly restrictive assumption. Obviously, this kind of model may not be suitable for convergence analysis in real world economies, exhibiting vast differences in socio-economic structures.

[4]See Barro and Sala-i-Martin (2004).

[5]For details, see Durlauf, Johnson, and Temple (2004) and Gandolfo (1996), pp. 175–89.

[6]The output per capita (physical labour unit) is given by $y_{it}=Y_{it}/L_{it}$ and that per efficiency worker unit by $y_{it}=Y_{it}/A_{it}L_{it}$, where $A_{it}=A_{i0}e^{gt}$ and 'g' is rate of (labour augmenting) technical progress (exogenously given).

3.2.2. *Conditional Convergence*

The occurrence of absolute convergence is a rare phenomenon as compared to conditional convergence, which is most likely to hold. In this case, the economies are expected to converge towards their peculiar steady states rather than to a common equilibrium [Mankiw, Romer, and Weil (1992)]. As such, a single variable (initial level of per capita income) might not be sufficient to explain the differences in growth rates across heterogeneous economies.

Many empirical studies on conditional convergence have used specifications similar to the general format given below. The growth rate of income per capita in an economy ($g_{i,t}$) and for a given period is regressed on the income per capita with one period lag ($y_{i,t-1}$) and the set of conditioning variables ($x_{i.t}$) meant to control for the differences in the steady state of economy.[7]

$$g_{i,t} = \delta\, x_{i,t} - \beta\, y_{i,t-1} + \varepsilon_{i,t} \qquad \ldots \qquad \ldots \qquad \ldots \qquad \ldots \qquad (8)$$

However, this general (informal) specification provides no information regarding the values of structural parameters since it is based on reduced form equation. In order to avoid this limitation, it is necessary to introduce explicitly a number of conditioning variables like investment rates, population growth rates, differences in the industrial structures, net migration rate of labour, some proxies for accumulation of human capital and certain dummies to control for other differences across the economies. The researchers have therefore tried to estimate the 'structural' convergence equations derived explicitly from the formal models.[8] Mankiw, *et al*. (1992) resort to the assumptions of diminishing returns to capital and that technical progress is a public good (diffuses evenly through all economies); both factors being responsible for convergence as discussed above. In what follows, we discuss the fundamentals of the augmented growth model[9] used for conditional convergence.

The production function may be rewritten in the modified form so as to capture the impact of human capital accumulation. Again, the specification may be Cobb-Douglas and the model may also be written in reduced form:

$$Y_t = K_t^{\alpha}\, H_t^{\omega} [A_t\, L_t]^{(1-\alpha-\omega)} \quad \Rightarrow \quad \overset{\circ}{y}_t = \overset{\circ}{k}{}_t^{\alpha}\, \overset{\circ}{h}{}_t^{\omega} \qquad \ldots \qquad \ldots \qquad (9)$$

The symbol '*H*' denotes the stock of human capital, assumed to be a public good, and the coefficients α and ω measure the partial output elasticities with respect to factor inputs. The labour force (measured in efficiency units) should grow at the composite exponential rate (n+g). The assumption of diminishing marginal returns applies to individual factors, which implies that economy will reach the steady state level overtime. The fraction of income invested in physical and human capital may be denoted by the proportions s_k and s_h respectively such that these sum up to the aggregate saving rate: $s_k + s_h = s = S/Y$. With these manipulations, along with incorporation of the depreciation rate

[7]The researchers have used up to 50 different conditioning variables, following Barro (1991).

[8]Barro and Sala-i-Martin (1992) use the Cass-Koopman's optimal savings version of the neoclassical growth model while Mankiw, Romer, and Weil (1992) derive the specification from Solow-Swan model.

[9]For details please refer to Barro and Sala-i-Martin (2004), and Mankiw (1995).

(denoted by δ), the equations of motion for physical and human capital may be expressed as under:

$$\frac{dk}{dt} = s_k\, k_t^{\alpha} h_t^{\omega} - (n+g+\delta)k_t \;\; and \;\; \frac{dh}{dt} = s_h\, k_t^{\alpha} h_t^{\omega} - (n+g+\delta)h_t \qquad \ldots \qquad (10\ a,b,)$$

The steady state equilibrium is said to occur in the long run where the levels of physical and human capital per effective worker stop changing further. Utilising this information and solving for the resultant equations, one gets the steady state values for physical and human capital per effective worker.[10] Substituting these values back into production function, and by taking logs, the determinants of steady state are readily obtained. The steady state income depends on the parameters: A, s_k, s_h, n, g, δ, α and ω.

$$\ln y_{ss} = \ln A + gt + [\frac{\alpha}{1-\alpha-\omega}]\ln s_k + [\frac{\omega}{1-\alpha-\omega}]\ln s_h - [\frac{\alpha+\omega}{1-\alpha-\omega}]\ln(n+g+\delta) \qquad (11)$$

The conditional convergence explicitly takes into account the possible differences in the determinants of steady state and hence demands incorporation of appropriate variables. The important considerations as to, which variables ought to be included, which elements should be allowed to vary and how, and which should be assumed to remain constant across economies; have been debated in growth literature. Conditional convergence then implies that the growth rate of an economy is positively related to the distance between its steady state level and current level of income. To examine the dynamics of regional economies along transition to their steady states, the speed of convergence can be expressed as[11]

$$d/dt\,(\ln \overset{\circ}{y}_t) = \lambda\,[\ln \overset{\circ}{y}_{ss} - \ln \overset{\circ}{y}_t] \qquad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (12)$$

The parameter 'λ' {= (1–α–ω) (n+g+δ)} implies that an economy with higher level of per worker income at the start exhibits a lower growth rate and vice versa. On solving the above differential equation, we get an expression for convergence as under:

$$\ln y_t^{\circ} = e^{-\lambda t}\ln y_{t-\tau}^{\circ} + (1-e^{-\lambda t})\ln y_{ss}^{\circ} \qquad \ldots \quad \ldots \quad \ldots \quad (13)$$

In this relation, $y_{t-\tau}^{\circ}$ is the initial value of income per effective worker and τ is the starting point. Substituting for ln y_{ss}° from Equation (11), and then transforming the per effective worker terms into per capita terms, we get the following relation:

$$\begin{aligned}\ln y_t - \ln y_{t-\tau} = &-(1-e^{-\lambda\tau})\ln y_{t-\tau} + (1-e^{-\lambda\tau})[(\tfrac{\alpha}{1-\alpha-\omega})\ln s_k + (\tfrac{\omega}{1-\alpha-\omega})\ln s_h \\ &-(\tfrac{\alpha+\omega}{1-\alpha-\omega})\ln(n+g+\delta)] + [(1-e^{-\lambda\tau})gt + e^{-\lambda\tau}g\tau] + (1-e^{-\lambda\tau})\ln A_0\end{aligned} \qquad (14)$$

If the speed of convergence 'λ' is positive, α >0, ω>0 and (α+ ω) < 1 as assumed by the model, the signs of the coefficients can be easily predicted.

Mankiew, *et al.* (1992) have also employed the basic neoclassical model to investigate the hypothesis of conditional convergence. The determinants of growth then

[10]For details, please see Gandolfo (1996), pp. 286-87.

[11]See Mankiw, Romer, and Weil (1992).

simply include the technology level and the observable variables like saving rates, initial level of income per worker and population growth rates. The model assumes the following shape and predicts not only the sign of each coefficient but also its magnitude:

$$\ln y_t - \ln y_{t-\tau} = (1-e^{-\lambda\tau})\ln A_0 + [(1-e^{-\lambda\tau})gt + e^{-\lambda\tau} g\tau] - (1-e^{-\lambda\tau}) \ln y_{t-\tau} + (1-e^{-\lambda\tau})(\tfrac{\alpha}{1-\alpha})\ln s - (1-e^{-\lambda\tau})(\tfrac{\alpha}{1-\alpha})\ln(n+g+\delta) \quad \ldots \quad (15)$$

3.2.3. The Dynamic Panel Framework

As discussed above, the panel data approach can correct the omitted variable bias by allowing for differences in technologies across regions. Islam (1995) restructures the neoclassical model and interprets the term: $(1-e^{-\lambda\tau}) \ln A_{(0)}$ as the time-invariant region-specific effect while using the panel framework. Using the notation of panel data approach, we may rewrite Equation (14) for a given region '*i*' as:

$$y_{i,t} = \gamma\, y_{i,t-1} + \textstyle\sum_{j=1}^{3} \theta_j\, x_{i,t}^{j} + V_t + \mu_i + \varepsilon_{i,t} \quad \ldots \quad \ldots \quad \ldots \quad (16)$$

$$where\ \ \gamma = e^{-\lambda\tau},\ y_{i,t} = \ln y_t, y_{i,t-1} = \ln y_{t-\tau}, \theta_1 = (1-e^{-\lambda\tau})(\tfrac{\alpha}{1-\alpha-\omega}),$$
$$\theta_2 = (1-e^{-\lambda\tau})(\tfrac{\omega}{1-\alpha-\omega}),\ \theta_3 = -(1-e^{-\lambda\tau})(\tfrac{\alpha+\omega}{1-\alpha-\omega}),\ x_{i,t}^{1} = \ln s_k,\ x_{i,t}^{2} = \ln s_h,$$
$$x_{i,t}^{3} = \ln(n+g+\delta), V_t = [(1-e^{-\lambda\tau})gt + e^{-\lambda\tau} g\tau], \mu_i = (1-e^{-\lambda\tau})\ln A_0.$$

The set of conditioning variables (denoted by x_i) capture the differences in the steady states across regions. The 'V_t' term signifies the time specific effects, which include the rate of technological change. The next term 'μ_i' is region-specific factor that represents the combined effect of institutions, resource endowment, climate, customs and traditions etc. This component varies across regions and picks up the effect of any omitted variable that does not vary over time in a panel. Finally, 'τ' is the time interval of four/five year period and 'ε_{it}' represents the usual error term that varies across regions and time.

4. DATA AND METHODOLOGY

In order to test the hypothesis of income convergence across different regions of Pakistan over time, the appropriate economic unit might be the district or even the union council. However, the requisite data is available only at the provincial level, fortunately with rural-urban disaggregation. The tribal areas (FATA), the northern areas (Gilgit-Baltistan) and Azad Kashmir are excluded due to data constraints. The available information covers the period from 1979 to 2005. The important data sets used in the analysis comprise the household income (instead of GDP per capita, the data for which is not available at provincial level), savings rates, literacy rates, combined enrolment ratios, dependency ratios, population growth rates, crude birth rates and infant mortality rates. The data is derived from official sources for the years concerned like the Economic Survey, the HIES (PSLM), Demographic Survey, the Labour Force Survey, the Education and Development Statistics of the provinces etc.[12]

[12]The data sets used in the analysis can be provided on request.

Human capital is an important determinant of economic growth and convergence besides physical capital and labour force. It is indicated by education, training and experience as well as good health and physique; but it is difficult to measure. Mankiw, Romer, and Weil (1992) have used the secondary school enrolment rate as proxy for human capital, whereas Sala-i-Martin (1997) has used life expectancy at birth as proxy for non-educational human capital and school enrolment rate for educational human capital. We have preferred to construct a composite index of human capital following the construction of Human Development Index (HDI) by the UNDP (1997). The proposed index includes proxies for both education and health.[13]

Panel data estimation is made possible by dividing the available period-wise information for each region into several shorter time spans. We consider a span of four/five years to be appropriate, which is also the standard practice followed in empirical research work. Dividing the total time period (1979–2005) into shorter spans, we obtain a total of six panels for each of the province. The constructed intervals are 1979–1984, 1984–1988, 1988–1993, 1993–1997, 1997–2001, 2001–2005. The dependent variable is the logarithm of per capita (per worker) income by the end point of each time span where the most important explanatory variable is the lagged value of income per capita (in log form). Other variables such as saving rates, labour force growth rates and human capital are averaged over four/five year period for each region.

An important issue that arises while using the panel data is whether the individual region-specific effects should be considered fixed or random. The disturbance term (OLS specification) does not take into account the unobserved differences among the regions, which may be important. The fixed effect specification may then be appropriate choice. The dynamic panel growth model with fixed effect allows us to control for the unobserved differences among the steady states of regions in addition to the observed differences, the later captured by the set of conditioning variables. The empirical work based on single cross-section regressions may suffer from two inconsistencies, i.e. omitted variables and endogeneity bias. The first bias arises when the region-specific effects are assumed to be uncorrelated with other explanatory variables and the second arises when certain explanatory variables happen to be endogenous.[14] The reliability and consistency of the estimates is then a serious issue. Islam (1995) has used a fixed effect specification (least square dummy variable technique) to estimate the panel data model so as to address these limitations. Caselli, *et al.* (1996) suggested that the first difference GMM approach deals successfully with both the issues.[15]

[13]First we estimate the education index by giving 2/3 weight to literacy and 1/3 to secondary school enrolment, where the maximum is 100 and minimum is zero. Next we estimate the health index by giving 60 percent weight to infant survival and 40 percent to crude birth rate, where the maximum expectancy is 85 years and minimum is 25 years. The compound human capital index is then the simple average of the two indices.

[14]For details, see Caselli, Esquivel and Lefort (1996) and Durlauf and Quah (1999).

[15]Durlauf and Temple, *et al.* (2004) point out that omitted unobserved region-specific effects in dynamic panel model cause the least square estimators to be biased and inconsistent. The fixed effect or within groups estimator, which takes into account the unobserved region-specific effects, also provides biased and inconsistent estimates. This is due the fact that the lagged dependent variable is correlated with the mean of individual errors. Bond, Hoeffler, and Temple (2001) and Durlauf and Temple, *et al*. (2004), suggest that the 'least square estimate' may provide the (approximate) upper bound on the coefficient of lagged variable and the 'within group estimate' can be regarded as the (approximate) lower bound. Thus an estimate lying between the two may be consistent.

5. ANALYSIS AND RESULTS

We applied different estimation techniques, discussed above, to the panel data so as to compare the results and find consistent estimates. We confronted the data set to test for absolute as well conditional convergence. The results are discussed below.

5.1. The Absolute Convergence

To see the existence of unconditional (absolute) convergence, the model given by Equation (7) is used. As noted above, the slope parameter captures the speed of convergence. The coefficient on initial level of per worker income, with a negative sign and statistically significant value would imply absolute convergence to the steady state common for all regions and vice versa. By implication, a zero value of the parameter (or non-zero but insignificant) indicates no convergence or divergence, which shows that each region follows an independent growth path. Next we focus on the analysis.

5.1.1. *Aggregate Analysis*

Table 1 reports the cross-sectional regression results, which cover a period of twenty six years (1979–2005) and correspond to income per worker. We have divided this time span into three sub-periods, (1979–1988), (1988–1998) and (1998–2005) in order to find the evidence of convergence, if any, separately. Another reason for this division into sub-periods is to test whether the political and economic stability (instability) bear any implications for absolute β-convergence.[16]

Table 1

Cross-Sectional Tests for Absolute Convergence (Aggregate)
Dependent Variable ln (y_t /y_{t-1})

Periods	(1979-2005)	(1979-1988)	(1988-1998)	(1998-2005)
Constant	4.349	4.318**	0.123	–2.288
Standard Error	3.488	0.668	9.764	5.351
T- value	1.247	6.461	0.013	–0.428
P- value	0.339	0.023	0.991	0.711
Ln (yt-1)	–0.522	–0.533**	–0.018	0.317
Standard Error	0.454	0.087	1.235	0.684
T- value	–1.149	–6.121	–0.014	0.464
P- value	0.370	0.026	0.990	0.688
ß=Implied Speed	0.028	0.074	0.002	N/A
R^2	0.397	0.924	0.060	0.503

Notes: All regressions are for the four provinces of Pakistan.
** Significant at 5 percent level.

[16]The first and third sub-periods represent the military-guided, semi-democratic regimes of General Zia-ul-Haq and General Pervez Musharaf respectively. The second sub-period shows the so called fake-democratic regime. Although the country was ruled by publicly elected governments during this period but these were politically unstable. Four elections were held during 10/11 years but no elected government could complete its tenure.

So far as the entire period is concerned, the coefficient for the explanatory variable is negative but statistically insignificant. Thus, the data do not provide any evidence in favour of β-convergence in Pakistan. For the sub-period (1979–1988), the coefficient is negative but statistically significant. This is a strong evidence of convergence during the period concerned where the R^2 is quite high and the implied speed of convergence is 7.4 percent per annum, which is respectable. The result can be rationalised on the basis of certain ground realities. For instance, the overall economic performance was better relative to other developing countries around the globe; the growth rate was high and inflation rate was mild, which may be seen from the World Bank reports.[17] There was a sharp increase in workers remittances during the era, which boosted up the living standard of masses during 1980's as noted by Haque (1999).

However, this trend could not be sustained during the next decade (1988–1998), where the sign is correct but the value is closer to zero (insignificant). During the third sub-period (1998–2005), the results are just in the opposite direction. The coefficient bears a positive sign, although it is insignificant, which implies a weak signal of divergence. The results support the popular claims that poverty and inequalities have increased across Pakistan during the past decade.

5.1.2. *The Urban-Rural Split*

The rural and urban areas can be considered as separate entities due to certain obvious differences in their socio-economic and political characteristics. The concept of convergence in rural and urban areas is more difficult to imagine within the existing administrative set up, however the available information allows us to see the dynamics and gain some useful insights. Table 2 is concerned with rural areas. It can be seen that the coefficient for the explanatory variable concerning the entire period (1979–2005) is negative, but significant only at 10 percent level. However, when the time span is divided into three sub-periods, the slope coefficient turns out insignificant but alternates in sign.

Table 2

Cross-Sectional Tests for Absolute Convergence (Rural Areas)
Dependent Variable $ln(y_t /y_{t-1})$

Periods	(1979-2005)	(1979-1988)	(1988-1998)	(1998-2005)
Constant	3.385*	2.497	–0.530	2.013
Standard Error	1.071	2.327	4.751	3.236
T- value	3.161	1.073	–0.112	0.622
P-value	0.087	0.396	0.921	0.597
Ln (yt-1)	–0.399*	–0.284	0.061	–0.241
Standard Error	0.135	0.316	0.612	0.424
T-value	–2.947	–0.900	0.100	–0.567
P-value	0.098	0.463	0.930	0.628
ß=Implied Speed	0.020	0.033	N/A	0.039
R^2	0.685	0.288	0.005	0.577

Notes: All regressions are for the four provinces of Pakistan.
*Significant at 10 percent level of significance.

[17]The average real GDP growth rate per annum was 6.15 percent and inflation rate of Pakistan was 6.74 percent during 1980s as compared to the average rates of developing countries: annual real GDP growth rate of 4.49 percent and inflation rate of 34.72 percent during the decade.

Table 3

Cross-Sectional Tests for Absolute Convergence (Urban Areas)
Dependent Variable $ln(y_t / y_{t-1})$

Periods	(1979-2005)	(1979-1988)	(1988-1998)	(1998-2005)
Constant	4.351***	8.427	9.673**	0.360
Standard Error	0.107	5.986	2.456	2.253
T- value	40.555	1.408	3.938	0.160
P- value	0.001	0.294	0.059	0.888
Ln (yt-1)	–0.489***	–1.035	–1.173*	–0.022
Standard Error	0.013	0.748	0.301	0.273
T- value	–36.457	–1.384	–3.892	–0.080
P- value	0.001	0.301	0.060	0.944
ß=Implied Speed	0.026	N/A	N/A	0.003
R^2	0.998	0.489	0.825	0.003

Notes: All regressions are for the four provinces of Pakistan.
***Significant at 1 percent level.
**Significant at 5 percent level.
*Significant at 10 percent level of significance.

Again the results can be rationalised easily. The very base and the vital component of our rural economy is the agricultural sector, which primarily depends on the forces of nature. Therefore, the natural shocks in the form of prolonged droughts and floods obviously affect the agricultural produce and hence the living conditions of masses in rural areas. Similar results can be seen in Table 3 that concerns with the urban regions. The regression coefficient for the explanatory variable has the correct sign and it is statistically significant even at 1 percent level for the entire period from 1979 to 2005. The regression has a good fit. However, when the time span is divided into sub-periods, the coefficients turn out to be insignificant, although the signs are correct. In this case, the regression is good fit for the period (1988–98) only.

The implied speed of convergence for the rural and urban economies works out to be 2 percent and 2.6 percent per year respectively, when we consider the entire period. These results indicate that rural and urban economies are not likely to converge to the common steady state; rather they are following their independent growth paths. However, more tests are needed to explain the nature and causes of growth in rural and urban economies separately since the lonely variable (initial per worker income) is not sufficient to explain the complex process of growth and convergence.

5.2. The Conditional Convergence

In the absence of satisfactory evidence on absolute convergence, it is necessary to verify the hypothesis under specific regional conditions. The existence of significant natural, social and historical differences among different geographical regions of Pakistan renders them less likely to converge towards the same equilibrium. This diversity can be seen via a number of indicators like the literacy rate, rate of saving, population density, life expectancy, infrastructure facilities, degree of urbanisation, the rule of law, social and family structure etc. Furthermore, these disparities have been increasing over time across different regions.

We have tried three estimation techniques, namely the OLS estimators, the Fixed or within groups estimators and the GMM estimators meant for the panel data framework. To explore the evidence of conditional convergence, we employ two different specifications of the neoclassical growth model. First is the original neoclassical model due to Solow (1956) and second is the modified version due to Mankiw, Romer and Weil (1992) that augments the former with human capital. Next we focus on the results.

5.2.1. *Estimation via the Basic Neoclassical Model*

We begin our analysis with the basic neoclassical model without any provision for human capital. The specification for the panel data estimation is provided by Equation (15), in which the intercept captures the region-specific effects. The evidence of convergence rests on the sign and size of the coefficient for lagged real per worker income. A statistically significant value of the coefficient bearing a negative sign implies conditional convergence. Other variables on the right hand side measure differences in the steady state levels.

The results are presented in Table 4. The first column reports the OLS estimation obtained by simply pooling the time series and cross section data. The second column reports estimation through the fixed effects model or Within Groups (WG) estimators. The third column reports the results of first differenced Generalised Method of Moments (GMM) *ala* Arellano and Bond (1991).[18]

Table 4

Panel Data Tests for Conditional Convergence
(Estimation via the Basic Neoclassical Mode)
Dependent Variable $\ln Y_{i,t} - \ln Y_{i,t-\tau}$

Variables	Least Squares	Fixed Effect (WG)	DIF-GMM
$\ln(y_{i,t-\tau})$	–0.238	–1.262**	–0.331***
	(0.148)	(0.177)	(0.074)
$\ln(s_{i,t})$	0.012	0.024*	0.020*
	(0.019)	(0.013)	(0.012)
$\ln(n_{i,t}+g+\delta)$	–0.733	–0.260	–0.319*
	(0.457)	(0.294)	(0.191)
Implied λ	**0.054**	**N/A**	**0.080**
J-statistic			14.402
Instrument Rank			16.000
Sargan Test (p-value)			**0.346**

Notes: Data used over four/five years intervals between 1979 and 2005.
The symbol (λ) denotes the convergence speed. Standard errors given in parentheses.
* Significance at 10 percent level, ** Significance at 5 percent level, *** Significance at 1 percent level.
The figures reported for the Sargan test are the p-values of the null hypothesis for valid specification. J-statistic is simply the Sargan test of over-identifying restrictions.

A comparison of the results in the first row reveals that the OLS provides higher estimates than WG method. The signs in both cases are correct. The OLS estimates a value of (–0.238) and WG provides a value of (–1.262) for the coefficient (the initial

[18]We report only important parts of GMM results and ignore details about the instruments due to space constraints.

level of per worker income). Fortunately, the value given by the GMM estimator (–0.331) falling within the upper and lower bound and therefore it is more likely to be unbiased and reliable. The validity of the instrumental variables used in the GMM estimation can be checked by Sargan test. The p-value (0.346) strongly suggests that the instrumental variables used in the analysis are valid.

In view of the above, the results obtained from the first differenced GMM technique seem to be appropriate. All the coefficients are statistically significant and bear the expected signs. In particular, the coefficient of lagged per worker income supports conditional convergence across regions. The coefficient of saving indicates that one percent increase in saving rate will lead to a small increase of 0.02 percent in growth of real income. Likewise, an increase of one percent in the growth rate of population will be followed by 0.32 percent decline in growth rate of real income. The speed of convergence 'λ' can be estimated from the coefficient of lagged income. The implied speed of convergence is 8 percent per year.[19] The results show that most of the regions are nearer to their respective steady states level. The differences across the regions can be explained by the differences in the factors that determine the respective steady states. These factors (or conditioning variables) might not only be different across the regions but also might be changing within a region over time. Thus change in these factors causes a shift in steady state level.

5.2.2. *Estimation via the Augmented Model*

Human capital is another important variable that is considered in empirical literature on growth besides savings and population growth rates. We estimate an augmented version in which the production function also includes the stock of human capital, as shown in Equation (16) above. The panel data results are reported in Table 5.

Table 5

Panel Data Tests for Conditional Convergence
(Estimation via the Augmented Neoclassical Model)
Dependent Variable $\ln Y_{i,t} - \ln Y_{i,t-\tau}$

Variables	Least Squares	Fixed Effect(WG)	DIF-GMM
$\ln(y_{i,t-\tau})$	–0.238	–1.315***	–0.359***
	(0.152)	(0.176)	(0.028)
$\ln(s_{i,t})$	0.011	0.031**	0.027*
	(0.020)	(0.014)	(0.014)
$\ln(n_{i,t}+g+\delta)$	–0.731	–0.256	–0.302
	(0.472)	(0.287)	(0.245)
$\ln(h_{i,t})$	–0.009	0.732	0.665**
	(0.492)	(0.539)	(0.337)
Implied λ	**0.054**	**N/A**	**0.089**
J-statistic			14.106
Instrument Rank			17.000
Sargan Test(p-value)			**0.366**

Notes: Standard errors are given in parentheses, (λ) denote the annual convergence rate.
* Significance at 10 percent level, ** Significance at 5 percent level, *** Significance at 1 percent level.

[19]The half-life of convergence process is given by the formula: $T = \ln(2)/\lambda$, and if $\lambda = 0.08$, $T = 8.67$ years. The estimated half-life of convergence (the time it takes to eliminate half of the gap between steady state and actual real per capita income).

For the first differenced GMM estimator, the coefficient of lagged income is highly significant. It falls between the upper and lower bounds given by the OLS and WG estimates and it is also consistent with the results of Table 4. The p-value (0.366) given by the Sargan test does not reject the validity of the instruments used in the analysis. Likewise, the coefficients of saving and population growth have the expected signs. The coefficient of human capital is positive and statistically significant, which indicates its importance for growth. The speed of convergence 'λ' is slightly higher than the estimate given by the basic neoclassical model (as shown in Table 4 above).

5.2.3. *Estimation via the Restricted Models*

In this section, we address the question whether the estimates obtained are consistent with the predictions of growth models or otherwise. The data is considered to support predictions if the estimated coefficients carry the predicted signs and have the expected magnitudes. The signs and magnitudes of the coefficients as predicted by the formal models and shown in Tables 4 and 5 make it convenient to test the models under restrictions. The restricted least squares technique can help in this regard.

First, with reference to the basic neoclassical model, we apply the restriction that the coefficients of saving and population growth rates [$\ln(s)$ and $\ln(n+g+\delta)$] are equal in magnitude but opposite in sign. Although, the concerned estimates reported in Table 4 are a little bit different, however we re-estimate the model by imposing this restriction. This also enables us to find the implied share of physical capital (α). Equation (15) may be rewritten in modified form as under.

$$\ln(y_{i,t} / y_{i,t-\tau}) = \gamma_1 \ln y_{i,t-\tau} + \gamma_2 [\ln s_{i,t} - \ln(n_{i,t} + g + \delta)] + \nu_t + \mu_i + \varepsilon_{i,t} \qquad (15\text{ a})$$

where $\gamma_1 = -(1-e^{-\lambda t})$, $\gamma_2 = \gamma_3 (1-e^{-\lambda t})(\alpha/(1-\alpha)$, $\nu_t = [(1-e^{-\lambda t})\, gt + e^{-\lambda t}\, g\tau]$, $\mu_i = (1-e^{-\lambda t}) \ln A_0$

The regression results, after incorporating the restriction, are reported in Table 6. The p-value (0.0861) for GMM technique given by the Wald test clearly rejects the hypothesis ($\gamma_{2} + \gamma_3 = 0$), which implies that our data do not support the predictions of the neoclassical model. The implied value of the share of physical capital estimated in GMM case is 0.064, which is very low.

Table 6

Panel Data Tests for Conditional Convergence
(Restricted Neoclassical Model-Basic)
Dependent Variable $\ln Y_{i,t} - \ln Y_{i,t-\tau}$

Variables	Least Squares	Fixed Effect(WG)	DIF-GMM
$\ln (y_{i,t-\tau})$	–0.0068	–1.2306***	–0.2866***
	(0.0178)	(0.1707)	(0.0693)
$\ln (s_{i,t}) - \ln (n_{i,t}+g+\delta)$	0.0154	0.0236*	0.0197
	(0.0192)	(0.0133)	(0.0155)
Implied λ	0.001	N/A	0.07
Implied α	0.6931	0.019	0.064
Wald test: p-value	0.199	0.131	0.0861

Notes: Standard errors in parentheses.
* Significance at 10 percent level, ** Significance at 5 percent level, *** Significance at 1 percent level.

Second, with reference to the augmented neoclassical model, we may examine the restrictions that the coefficients of physical capital (saving rate) and population growth rate as well as the coefficients of human capital and population growth rate sum to zero. In this regards, Equation (14) may be rewritten as under:

$$\ln(y_{i,t}/y_{i,t-\tau}) = \gamma_1 \ln y_{i,t-\tau} + \gamma_2[\ln s_{i,t} - \ln(n_{i,t}+g+\delta)] + \gamma_3[\ln h_{i,t} - \ln(n_{i,t}+g+\delta)] + \nu_t + \mu_i + \varepsilon_{i,t} \quad \dots \quad \dots (14\ a)$$

The coefficients are: $\gamma_1 = -(1-e^{-\lambda t})$, $\gamma_2 = (1-e^{-\lambda t})[\alpha/(1-\alpha-\omega)]$, $\gamma_3 = (1-e^{-\lambda t})[\omega/(1-\alpha-\omega)]$, where 'α' is the share of physical capital and 'ω' is the share of human capital in per capita income. The estimated results from the restricted regression are reported in Table 7.

Table 7

Panel Data Tests for Conditional Convergence
(Restricted Neoclassical Model-Augmented)
Dependent Variable $\ln(Y_{i,t}) - \ln(Y_{i,t-\tau})$

Variables	Least Squares	Fixed Effect(WG)	DIF-GMM
$\ln(y_{i,t-\tau})$	–0.100	–1.302***	–0.353***
	(0.093)	(0.174)	(0.045)
$\ln(s_{i,t}) - \ln(n_{i,t}+g+\delta)$	0.019	0.028*	0.025**
	(0.020)	(0.013)	(0.013)
$\ln(h_{i,t}) - \ln(n_{i,t}+g+\delta)$	0.371	0.340	0.367*
	(0.363)	(0.248)	(0.242)
Implied λ	**0.021**	**N/A**	**0.087**
Implied α	**0.039**	**0.017**	**0.033**
Implied ω	**0.758**	**0.204**	**0.493**
Wald test: p-value	**0.27**	**0.41**	**0.2545**

Notes: Standard errors in parentheses.
* Significance at 10 percent level, ** Significance at 5 percent level, *** Significance at 1 percent level.

The restriction implied by the augmented neoclassical model cannot be rejected at the conventional levels of significance (i.e. with p-value 0.2545**).** The results from first differenced GMM show the share of physical capital to be 0.033, which is very low and unrealistic, and the share of human capital is 0.49, which is quite reasonable. So it can be concluded that the data support the predictions of augmented model to some extent but not in case of basic neoclassical model.

Moreover, we can observe that estimates of convergence coefficient are not affected by restricting both the models and remain almost same as those obtained from unrestricted models and reported in Tables 4 and 5. This behaviour indicates that the coefficients are consistent with the specifications shown above, and the results for the speed of convergence are robust.

5.3. The Sigma Convergence

The sigma (σ) convergence does not relate directly to the growth rates of economies but it focuses attention on the dispersion of per capita income over a cross section of economies at each point in time. If the cross-regional dispersion of income (measured as standard deviation of the logarithm of real income) tends to decrease over time, the regions are said to converge and vice-versa. We have also tested the available data for sigma-convergence. By comparing the findings, the regional disparities in terms of per capita incomes appear to be more severe than that of per worker incomes. The finding implies that the number of dependent or inactive members of the population is responsible for higher dispersion of per capita income. This is in line with the conventional wisdom, since a higher dependency ratio means higher consumption or lower saving rates and thereby lower growth rates.

Fig. 1. Dispersion of Real Per Capita/Worker Income (All Regions) (Sigma Convergence) 1979–2005

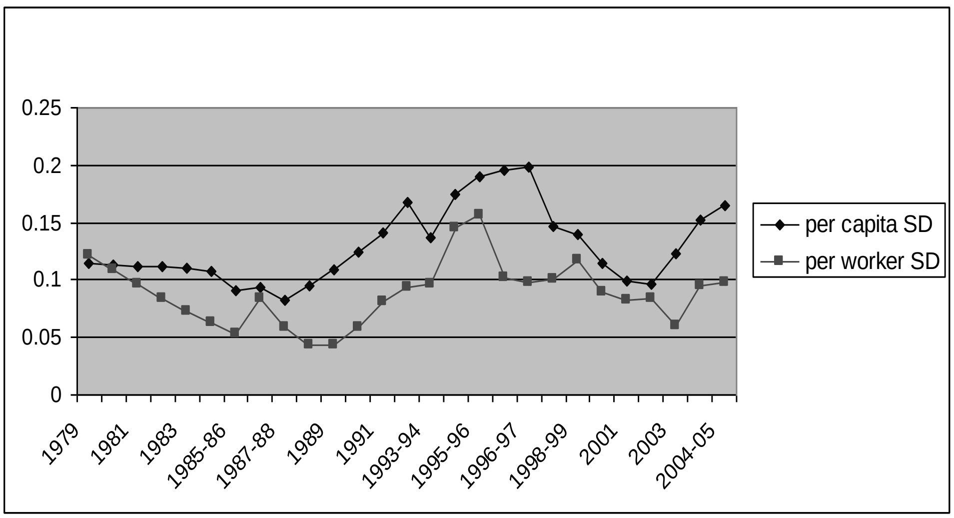

Figure (1) shows the dispersion of both per capita and per worker incomes across all regions of Pakistan over the period from 1979 to 2005. The trend in dispersion in the per capita income during the whole period (1979-2005) shows that there is no evidence of σ-convergence, rather the disparities in regional incomes seem to rise. The standard deviation rose from (0.114) in 1979 to (0.165) in 2005, with a significant increase of 44 percent, keeping aside the slight decrease for the years 1988 and 2001-02. However, much of the sharp increase in dispersion has taken place during the 1990s, where the highest value can be observed for 1996-97. So far as the case of per worker income is concerned, the figure shows a slight decrease in dispersion from 0.12 in 1979 to 0.10 in 2005. However, there is a sign of σ-convergence in 1980s as evident from declining tendency in dispersion, however with some temporary increase in year 1986-87. During 1990s, the standard deviation rose sharply indicating an increase in regional disparities. Thereafter no uniform trend prevails; rather there are fluctuations.

An application of the model separately to rural and urban areas revealed that the intra-regional differences in the socio-economic conditions are as serious as the inter-regional differences. To sum up, the findings indicate that incomes per capita across the provinces are moving farther away from one another overtime and there is little tendency for reducing of disparities.[20]

Some important results can be derived from σ-convergence analysis across regions of Pakistan. The comparison between per capita and per worker income turns out to be quite useful and important. When we observe the data in per capita terms, regional income disparities appear to be more stringent as compared to the small decline of dispersion in per worker terms. The result might be rational keeping in view the fact that a large fraction of Pakistani population is not economically active. In general, the families depend on active members (workers) as shown by high dependency ratios.[21] It can also be noted that all values of standard deviation in per worker income are lying below the estimates for per capita income, showing lesser dispersion in terms of per worker data. It seems that the number of dependent and inactive members of the society is responsible for increase in income disparities. Put differently, the income of earning hands seems to be eaten up by the dependent and inactive members. These results are also consistent with the findings arrived at under absolute convergence of per worker income during period 1979-2005.

6. CONCLUSIONS AND POLICY IMPLICATIONS

The evidence on conditional convergence indicates that each regional economy converges to its specific steady state, rather than to a common equilibrium. However, it does not tell about prevalence of regional disparities; as to how they appeared or gravitated overtime and how they could be addressed. Hence, conditional convergence neither implies necessarily a reduction in regional disparities nor does it contradict with trends of increasing disparities.

The present study has examined the phenomenon of convergence of per capita income to steady states across the four provinces of Pakistan with rural-urban splits over the period from 1979 to 2005. We could not find any evidence of absolute convergence for the entire time span of 26 years from 1979 to 2005 except for the period 1979-88, when the signs of regional convergence could be observed. However the trend could not continue thereafter, rather the symptoms of divergence were observable for the period 1998-2005. Put differently, the absence of absolute convergence predicts an increase in disparities over time across regions. On the other hand, a strong evidence of conditional convergence could be observed. The findings imply that differences in the socio-economic conditions prevailing across the political entities are crucial and responsible for economic disparities to persist. Pakistan has been undergoing substantial structural changes in recent years, so the steady state determinants also changing constantly.[22]

[20] We do not report the detailed results for space constraints, which may be provided on request.

[21]According to Population Census Report (1998), Economically Active Population is 29.4 millions out of total population 132.4 millions. The report also indicates that only one third of the population 10 years and above in Pakistan is economically active which is very low.

[22]These changes might be in response to the aftermaths of 9/11 event that have drastically upset the geo-political environment in Afghanistan and Pakistan. The US intervention has resulted into massive

The differences in social, cultural and political behaviours across the four provinces of the federation are natural and can be easily understood. However, the prevalence of abject poverty and gross inequalities over the long run, both across the regions and within the regions in rural-urban bifurcation, is posing problems. This situation needs serious attention and calls for immediate remedial measures, failing which the dangerous sense of deprivation will continue to develop and lead to political instability. Economic theory predicting convergences across regions subject to fulfilment of certain assumption can help in this regard. The growth rate of a region is affected by both the distance from the steady state and the shift in the steady state itself. There are sufficient evidences that the important part of growth process is not convergence to steady state level per se, rather the factors responsible for determination of steady state equilibrium are more important. If any public policy can shift the steady state level of income per capita, then the growth rate of that region should also accelerate. Alternatively, all the regions can converge to some common steady state equilibrium (and thereby economic disparities removed) if and only if the differences in the factors responsible for the steady state level of income across the respective regions could be minimised somehow via appropriate public policies.

Special efforts are therefore needed to enhance investment, not only in physical infrastructure but also in the social sector and human capital, to improve the conditions of living in targeted parts of the country, which were either ignored in the past or remained lagging on the path to prosperity for one reason or the other. In particular, special attention is needed to improve the efficiency of labour and to generate more employment opportunities in the relatively poorer rural regions. "Regional prosperity implies strengthening of the federation" can be considered as a simple rule of thumb. High GDP growth is meaningless if does not reduce the sufferings of masses. Further research is needed to identify the peculiar determinants of growth, keeping in view the socio-political circumstances prevailing in different regions of the country.

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Infrastructure and Growth

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1. INTRODUCTION

Physical infrastructure stock development has many important direct and indirect effects to an economy. These effects operate through various channels. For example, through labor productivity gains resulting from improved information and communication technologies, reductions in time wasted commuting to work and stress, improvements in health and education, and through improvements in economies of scale and scope throughout the economy. On the supply side, there is both a direct channel (infrastructure capital stock serves as a production factor), and an indirect one (improved infrastructure affects technological progress). From a demand side point of view, infrastructure provides people with services they need and want—water and sanitation; power for heat, cooking, and light; telephone and computer access; and transport.

In Pakistan, low infrastructure development in the past two decades has become binding constraints to production sector in the economy. It has also impacted to the direct consumption of the household sector and thereby reducing the overall welfare of the general public. Continuous underinvestment since the last few years has further aggravated the situation in Pakistan. Frequent cutbacks in the PSDP and the low levels of allocations imply that there is a need for strategic selection of the projects/programmes, specifically in the energy sector, to maximise the effectiveness of the development plans. Inadequate and poor quality infrastructure in Pakistan has held back not only economic activity but has also drastically reduced the quality of life of the masses. Thus, the government of Pakistan should place infrastructure development very high on its action agenda.

Table 1 gives decade-wise growth rates of different infrastructure indicators and per capita GDP growth in Pakistan. All of the infrastructure indicators have decreasing trend over the period and are very low in the last two decades. The fastest growth in electricity generation is observed in the 80s, largely because of the commissioning of the Tarbela Dam. Per capita water availability for agriculture appears to have consistently declined over the last four decades. The 80s also saw relatively rapid expansion in the road network but has visibly slowed down during the last decade.

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Table 1

Decade-wise Growth Rate of Different Types of Infrastructure and Per Capita GDP of Pakistan, 1976 to2011

(Percentage)

	1970s*	1980s	1990s	2000s	2010-11
Per Capita GDP growth	2.7	2.9	1.8	2.8	0.8
Per Capita Electricity Generation (Gwh)**	6.1	7.4	2.3	1.9	-2.6
Per Capita Water Availability (MAF)	–1.5	–1.0	–1.2	–2.3	0.5
Length of Roads (Kilometers)	4.0	6.3	3.9	0.5	–1.6
Telecommunications					
– Number of Telephone Lines (per 1000 people)	7.8	11.1	11.3	0.2	-7.8
– Mobile Phones availability (per 1000 people)	–	–	45.7***	72.3	2.2

Source: World Development Indicators, World Bank.
Pakistan Economic Survey, Government of Pakistan.
* From 1975-76 to 1979-1980
**Adjusted for transmission losses.
*** From 1995-196 to 1999-2000.

There has been a virtual explosion in the telephone network during the 70s, 80s and 90s, however, this has decreased very sharply in the last decade because of massive usage in the mobile phones, whose usage has increase by 72 percent during the same period. Also from the Table 1, we can see that infrastructure appears to relate significantly to per capita GDP growth. This is particularly true in the decades of 70s and 80s mainly through accumulating huge infrastructure stock. In 2010-11, most of the infrastructure variables have a negative growth rate only the mobile phones and water availability indicators have shown positive growth, although, the growth rate is very minor compare to early periods. Note that electricity generation has negative growth in this year. This is the main reason of almost very low growth in the per capita GDP.

Against this background, the objective of this paper is, first, to find out the determinants of the total factor productivity (TFP). In this exercise our focus will mainly be on the public infrastructure stock as an important determinant of TFP. Second, to determine how infrastructure stock impacts economic growth, specifically, to determine which types of infrastructure, that is, electricity generation, roads highways, power, telecommunications, irrigation, etc., are more effective from the viewpoint of raising the growth rate of the economy as a whole. Implications of the research on the allocation priorities within the PSDP will be derived.

The paper is organised as follows: Section 1 gives a brief introduction of the paper by describing and discussing the main objective of the paper. Section 2 reviews the literature relevant to the topic of the paper. Section 3 gives the framework of analysis of determinants of the TFP and the relationship between infrastructure and growth. This section also discusses the results of the two analyses. Final section concludes the paper and gives some policy recommendations.

2. LITERATURE REVIEW

Economists have been trying to measure the link between economic growth and infrastructure stock since long. Mostly, their effort has been to measure the impact of the private and public capital stock on the economic growth in terms of monetary values

[Denison (1980); Barro (1998, 1989) and Barro and Sala-i-Martin (1995)]. These approaches have been criticised vastly and their findings have mostly been found to be unreliable [Romp and Haan (2005); Straub (2008) and Straub and Terada-Hagiwara (2011)]. Because these studies have focused their analyses using the infrastructure variable at the aggregated level and it is hard to see impact on economic growth for the individual infrastructure stock. Aschauer (1989) initiated the empirical literature relating individual infrastructure stock to economic growth (productivity). He estimated that the productivity elasticity in relation to the public capital in the United States was 0.24 for the "core" infrastructure (i.e., roads and highways, airports, gas and electrical and gas facilities, mass transportation, sewers and water).

Recently, Straub and Terada-Hagiwara (2011) presents the state of infrastructure in developing Asian countries. They apply two distinct approaches (growth regressions and growth accounting) to analyse the link between infrastructure, growth, and productivity. Their paper concludes that the infrastructure stocks in developing Asia have been growing at a significant pace. However the findings show that their levels remain well below the corresponding world averages both in terms of quality and quantity. There seems to be a positive impact on the economic growth due to the accumulation of infrastructure stock (in electricity, telecommunications, transport, and water supply) as a massive build up of these stocks was needed but may be beyond the financial reach of many governments. Their analysis also give cross country estimations which shows that for most of infrastructure indicators, the growth rate of stocks has a positive and significant impact on per capita GDP average growth rate. Further, they have found on the basis of growth accounting exercise, a positive and significant effects of infrastructure variables on total factor productivity (TFP) growth.

In another paper, Straub (2008) did a survey of studies on the infrastructure stock and economic growth on developing countries in which energy, transport, telecommunication, water and sanitation are considered. There are two main set of issues that the survey covers. The first one is the linkages between infrastructure and economic growth at the economy-wide, regional and sectoral level. The second deals with the composition, sequencing and efficiency of alternative infrastructure investments which include arbitrage between new investments and maintenance expenditures, and public versus private investment. The survey sustains a number of conclusions which lead to potential research areas and need for associated data development; which can be organised in three related parts, relating to macroeconomic, microeconomic and economic geography aspects. Further he conclude that in terms of data development, the main effort should be concentrated in the microeconomic part, through a strategy to gather data from both household and firm-level survey on aspects including access, quality and costs of services. Indicators, aggregated at different levels, could then be used both in macro-level and economic geography types of estimations.

In most of the literature on infrastructure and economic growth, development of energy has always been considered critical for economic growth and social development [Isaksson (2010)]. Because as economies develop, energy consumption grows more or less in parallel, and adequate and affordable energy supply is needed to meet the demands of industry, commerce and domestic users and to enable the movement of people and goods [United Nations (2005)]. These studies find that energy is closely linked to poverty reduction because it is central to practically all aspects of the core conditions of poverty—such as poor health, lack of access to water, sanitation, and education. Enhancing access to energy services also reduces poverty and enables economic growth in a sustainable manner. This is a major challenge that countries must address in order to achieve the MDGs [United Nations (2005); Fan (2004)].

The Paris Declaration and the Programme of Action of the Second United Nations Conference on the least developed countries noted that the deterioration in physical infrastructure in the 1980s in these countries impaired their ability to resume growth and development. It also recognised that urban infrastructure had not kept pace with urbanisation, while rural infrastructure development suffered from a lack of institutional capacity and absence of decentralisation. In another study, Agénor and Blanca (2006) provide an overview of the various channels through which public infrastructure development may affect growth. In addition to the conventional productivity, complementarity and crowding out affects which is emphasised in the literature; the impact of developing infrastructure on the investment adjustment cost like durability of private capital, and production of health and education services are also highlighted.

Teles and Mussolini (2010) analyses the relationship between infrastructure and total factor productivity (TFP) in the four major Latin American economies: Argentina, Brazil, Chile and Mexico. They hypothesise that an increase in infrastructure has an indirect effect on long-term economic growth by raising productivity. To assess this theory, they use the traditional Johansen methodology for testing the cointegration between TFP and physical measures of infrastructure stock, such as energy, roads, and telephones. They then apply the Lütkepohl, Saikkonen, and Trenkler Test, which considers a possible level shift in the series and has better small sample properties, to the same data set and compare the two tests. Their results do not support a robust long-term relationship between the series and find strong evidence that cuts in infrastructure investment in some Latin American countries were the main reason for the fall in TFP during the 1970s and 1980s.

Canning and Pedroni (2004) investigated the long run consequences of infrastructure provision on per capita in a panel data of countries from 1950 to 1992. Their paper develop a simple panel based tests which enable them to isolate the sign and direction of long run effect of infrastructure on income in a manner that is robust to the presence of unknown heterogeneous short run causal relationships. The results show clear evidence that in majority of the cases the development of infrastructure induces long run growth effects. But a great deal of variation has also been seen in the results across individual countries. When the countries are taken as a whole, the results demonstrate that telephones, electricity generating capacity and paved roads are provided at close to the growth maximising level on average. But they are under-supplied in some countries and over-supplied in others. These results also help to explain why cross section and time series studies have in the past found contradictory results regarding a causal link between infrastructure provision and long run growth.

3. THEORETICAL FRAMEWORK AND EMPIRICAL RESULTS

As seen in the last section, most of the literature on economic growth measures the impact of the infrastructure through the standard production function where factors are gross complements, an increase in the stock of infrastructure capital would have a direct, increasing effect on the productivity of the other factors. These approaches measure the impact of infrastructure capital in terms of some estimates of output elasticity. However, recent studies point out a number of weaknesses in the methodology and estimation of these approaches on measuring the impact of infrastructure capital on economic growth. See for example Straub (2011); Romp and Haan (2005); and Bom and Ligthart (2008). The authors point out a number of weaknesses in the econometric analysis by the earlier studies. These weaknesses include the presence of likely potential reverse causality between output and infrastructure investment, which can generate an upward bias in the estimated coefficients. Taking these concerns into account, these authors find out that the output elasticities of public capital are between 0.1 and 0.2. Similarly, Calderón, *et al.* (2009) estimate the output elasticity of public infrastructure to be between 0.07 and 0.10.

This paper uses a different methodology to measure the impact of the physical infrastructure development on economic growth in Pakistan, as developed by the Straub and Terada-Hagiwara (2011). In this approach, the relationship between the infrastructure and growth is quantified by indicators of physical availability of infrastructure rather than the total public capital stock (in constant prices) in infrastructure. This approach also has the merit that it enables identification of the differential impact of various types of infrastructure on growth.

The analysis of the paper is divided into two parts. In the first part, we present the determinants of TFP using the growth accounting framework. In the second part, we present the growth regression analysis to measure the impact of individual infrastructure variables on economic growth.

(a) Determinants of Total Factor Productivity

In this section, we used growth accounting analysis to find out the determinants of TFP. Specifically, in this part, we try to find out the impact of public capital stock on TFP along with other exogenous variable. For this, we ran a regression of the form

$$GTFP_t = \alpha_{0t} + \alpha_{1t}GPKS_t + \alpha_{it}Z_{it} + e_t; \qquad i = 2,3,\dots,n$$

where *GTFP* is the growth rate of total factor productivity, *GPKS* is the growth rate of the public capital stock and Z_{it} is the vector of other exogenous variables. Three most important determinants of the total factor productivity, other than public capital stock, that can be identified from the literature are the human capital stock, foreign direct investment and the trade openness of a country. The growth rate of the TFP is calculated by taking the elasticities of the labour, capital stock and the land from the paper of Ahmed and Bukhari (2007).[1] The analysis period of this paper is almost same as the analysis period of this paper. Data for the GPKS construction requires long term series data and is a time-consuming task. Fortunately, the data base of the Social Policy and

[1]*Y* is the gross domestic product, *A* is a measure of total factor productivity, *K* is the capital stock, *N* is the total labour force and *L* is the land. From this production function, we calculated TFP by the Solow's residual equation, as

$$\frac{\Delta A}{A} = \frac{\Delta Y}{Y} - \alpha\frac{\Delta K}{K} - \beta\frac{\Delta N}{N} - (1-\alpha-\beta)\frac{\Delta L}{L}$$

For more details on the methodology, see the paper of Ahmed and Bukhari (2007).

Development Centre (SPDC) Integrated Social Policy and Macroeconomic Planning Model for Pakistan contains such an index, which has been constructed from 1972-73 to 2007-08 at constant prices of 1999-2000. This index has been made available to us by SPDC. From 2007-08 onwards, the series has been extended using the methodology of the SPDC's model. For other variables data is collected from the Annual Reports of the State Bank of Pakistan and Annuals Reports of the SPDC.

The results of the regression on determinants of TFP are given below:

$$GTFP = -1.0525 + 0.785GMYS + 0.317GPKS + 0.012GFDI + 0.048GOPENNESS$$
$$(-2.391)^{**} \quad (4.328)^{*} \quad (3.665)^{*} \quad (2.783)^{*} \quad (1.689)^{***}$$

Adjusted-R^2 = 0.636, DW-Stat = 2.539
F-statistic = 11.490 (0.000)

In this regression, *GMYS* is the growth rate of the mean years of schooling taken as a proxy for human capital stock, *GFDI* is the growth rate of foreign direct investment and *GOPENNESS* is the growth rate of the trade openness. The results of the regression are very much according to the expectations. As can be seen from the results, the human capital development has the largest impact on the *TFP* growth. After it growth in the public capital stock has the largest impact on growth of *TFP*. Other two variables, *GFDI* and *GOPENNESS*, also impact growth in *TFP* positively and significantly but their magnitude is relatively small compare to *GMYS* and *GPKS*. Overall, the regression is a good fit and gives reasonable results.

(b) Growth Regression Analysis

As we saw in the last section that public capital stock has a significant positive impact on TFP. In this section, we will see how the individual physical infrastructure stock has an impact on economic growth. For this we used the following growth regression technique:

$$g_t = \beta_{0t} + \beta_{it} Z_{it} + \beta_{jt} K_{jt} + e_t$$
$$\text{while } i = 1,2,\dots,m \;\&\; j = 1,2,\dots,n$$

where g_t is the growth rate of real per capita GDP, Z_t is a vector of control variables and K_t is a vector of physical infrastructure variables. To control the structure of the economy we used the following variables: agriculture growth rate, nominal interest rate, and the mean years of schooling. On the other hand, the following indicators of physical availability of infrastructure have been used in the analysis:

- per capita electricity generation, adjusted for transmission losses (in Gwh),
- per capita availability of water for agriculture (in MAF), including water from tubewells,
- length of roads (in Kms), and
- telephone lines (including mobile phones) per 100 people.

Data on the above indicators has been obtained for the period, 1975-76 to 2010-11, from the *Pakistan Economic Survey* and the *World Bank Development Indicators* data base.

Results of the econometric analysis of the impact of growth of different types of infrastructure on the growth rate of real per capita GDP are given in Table 2. Initially, we ran regression only on the exogenous variables, which are agricultural growth, nominal interest rate and mean years of schooling. Then along with these exogenous variables each infrastructure indicator is introduced separately, in Equations (2) to (5) respectively. Thereafter, different infrastructure indicators are added sequentially in Equations (6) to (8).

The results of the regressions with separate indicators indicate the high level of significance of the electricity generation indicator. The telecommunications and water availability indicators are also significant at the 5 and 10 percent level of significance. The surprising result is the complete lack of significance of the indicator of access to roads and highways. This is the first indication that the country has perhaps been over-investing in the development of the road network, especially highways.[2] As expected, the exogenous variables, especially agricultural growth, are significant in most regressions. The other two exogenous variables are also highly significant.

The results do not alter when all infrastructure indicators are introduced simultaneously into the regression analysis. The significance of the electricity generation indicator remains unchanged, highlighting the robustness of the relationship between availability of power and growth. The elasticity of per capita income growth with respect to growth in electricity is about 0.16. This is close to the elasticity of 0.20 estimated by Straub and Hagiwara (2010) for a cross-section of Asian countries. From the analysis, it is clear that part of the reason for the decline in GDP growth rate in the last few years is clearly due to the failure in expanding power generation capacity.

The water availability and telecommunications variables also remain significant at a high level of significance. The access to roads variable remains insignificant when all infrastructure variables are introduced simultaneously in the growth regressions. Overall, the results clearly demonstrate a clear positive and highly significant differential impact of various types of infrastructure on growth. The table also presents the results of the Wu-Hausman test of endogeneity. Its p-value indicates that there is no problem of endogeneity in the regression models.

From the model, we have estimated the capital cost of electricity generation per 100 MW from a sample of the recent vintages of plants. The cost is approximately $950 million per 100 MW. Given the coefficient of electricity generation capacity in the growth regressions the implied incremental capital-output ratio is only 0.57. This indicates the high returns today to investment in the power sector.

4. CONCLUSION AND POLICY RECOMMENDATIONS

Physical Infrastructure stocks in Pakistan since the last two decades have been growing at a low pace and this is the main reason of low economic growth since the last four years. The paper reviewed the state of infrastructure development in Pakistan and performed two types of analyses. In the first analysis, it tried to find out the impact of different indicators on TFP, specifically that of the public infrastructure stock and, in

[2]According to the *Global Competitiveness Report, 2010-11,* Pakistan has a higher ranking in Quality of Roads than countries like Iran, Egypt, Indonesia, India and Bangladesh, although Pakistan still has not reached desirable levels of road density.

Table 2

Results of Regressions Analysis on Infrastructure and Growth[a]
(Dependent Variable is Growth Rate of Real Per Capita GDP)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	**(8)**
Constant	4.024*	2.603***	4.214*	1.871	3.938*	2.946**	**1.543**	1.403
	(2.720)	(1.879)	(2.971)	(1.328)	(2.602)	(2.447)	**(1.274)**	(1.124)
Agriculture Growth Rate	0.294*	0.284*	0.303*	0.235*	0.294*	0.320*	**0.287***	0.286*
	(4.630)	(4.933)	(4.971)	(4.227)	(4.554)	(6.357)	**(6.088)**	(5.993)
Nominal Interest Rate (%)	–0.325*	–0.240***	–0.326*	–0.192***	–0.327*	–0.252*	**–0.163*****	–0.164***
	(–2.876)	(–2.275)	(–3.018)	(–1.856)	(–2.854)	(–2.746)	**(–1.816)**	(–1.811)
Growth Rate of Mean Years of Schooling	0.437*	0.413*	0.431*	0.554*	0.440*	0.304**	**0.352***	0.358*
	(2.607)	(2.796)	(2.685)	(3.887)	(2.588)	(2.530)	**(3.183)**	(3.185)
Growth Rate of Electricity Generation Per Capita	–	0.120*	–	–	–	0.161*	**0.160***	0.157*
		(3.283)				(5.193)	**(5.716)**	(5.456)
Growth Rate of Per Capita Water Availability	–	–	0.174***	–	–	0.325*	**0.327***	0.327*
			(1.954)			(4.592)	**(5.099)**	(5.030)
Growth Rate of Per Capita Availability of Telephones and Mobiles	–	–	–	0.020**	–	–	**0.019***	0.020*
				(2.314)			**(2.684)**	(2.686)
Growth Rate of Length of Roads	–	–	–	–	0.032	–	**–**	0.035
					(0.427)			(0.589)
Adjusted-R^2	0.514	0.624	0.556	0.664	0.501	0.726	**0.774**	0.769
F-statistics	12.650*	11.971*	11.333*	14.099*	9.275*	16.426*	**18.122***	15.530*
DW-Stat	2.297	2.372	2.449	2.032	2.292	2.067	**2.646**	2.552
SC-Value	3.709	3.591	3.689	3.476	3.807	3.367	**3.238**	3.325
Wu-Hausman test, p-value						0.185	**0.587**	0.529

[a] *Note*: *, **, *** indicate that the coefficients are significant at the 1 percent, 5 percent and 10 percent level of significance. Values in parentheses are the t-ratios. SC-value is the Schwarz criterion value. SC-Value is the Schwartz Criterion value. We perform the Wu-Hausman test of endogeneity and each equation passed the test. The analysis period is from 1975-76 to 2010-11.

Table 2

second analysis, it tried to find out the impact of the physical infrastructure stock (electricity generation, telecommunications, water availability and access to roads and highways) on real per capita GDP. Both these analyses clearly demonstrate that infrastructure matters from the viewpoint of growth and TFP. Individual and combined results, from the growth regression, show that investments in power generation, telecommunications and in enhancing the availability of water for agriculture have significant effects on growth. However, in the Pakistani setting, development outlays on expanding/upgrading the road network do not seem to confer significant visible benefits. Within the PSDP, the sector actually receiving the largest allocation currently in the area of infrastructure development is communications (mostly highways). There is a case for changing this priority and diverting resources away from communications to water and power to achieve a bigger impact on GDP growth within the given size of PSDP. Also, results of the analysis do not have implications on priorities within the communications sector. For example, it may be that investment in railways sector and expansion of the road network may have higher returns than development outlays on Motorways and Expressways.

Further, as can be seen from results of both analyses, infrastructure stock accumulation has a positive impact on economic growth and a massive buildup of infrastructure stock in electricity, telecommunication, transport, and water supply is needed for it to have a positive impact on economic growth. Moreover, demand for infrastructure services is expected to soar in cities due to rapid urbanisation. In order to keep cities competitive, investments in infrastructure need to be designed to take account of congestion, environmental degradation, and other impediments to productivity that are associated with urban agglomeration. Another key question refers to sequencing. Which type of infrastructure is more effective in supporting growth and should be prioritised? Clearly, the results show that investment in electricity generation capacity should be the most important priority of the Public Sector Development Programme (PSDP). Currently, the total outlay through the budgetary PSDP and self-financing of power investments adds up to 0.65 percent of the GDP. This will have to be increased to above 1.5 percent of the GDP if the problem of shortage of electricity is to be addressed on a priority basis so as to raise the growth rate of the economy.

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What Determines Innovation in the Manufacturing Sector? Evidence from Pakistan

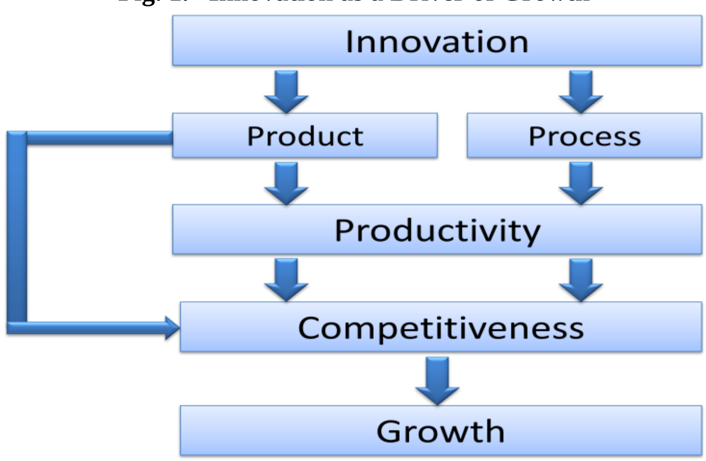
HAMNA AHMED and MAHREEN MAHMUD

1. INTRODUCTION

Innovation plays a critical role in determining a country's overall competiveness, productivity and hence economic growth. Amongst others, it is considered to be one of the key ingredients in a developing country's growth strategy in order to catch up to the more developed economies. This in turn is also important for shaping and sustaining an economy's global competitiveness. Therefore, the World Economic Forum considers innovation as one of the twelve pillars of its widely disseminated Global Competitiveness Index.

There is a rich body of literature which establishes the innovation and growth link. Figure 1 illustrates the possible linkages between two types of innovative activity (product and process innovation), competitiveness and growth. For product innovation, the link might be directly from the offering of a new product to making the firm more competitive and not necessarily through increasing competitiveness because of enhanced productivity.

Fig. 1. Innovation as a Driver of Growth



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For instance, Crespi and Zuniga (2011) finds for a set of six Latin American countries that firms which innovated had higher labour productivity compared to non-innovating firms. Hall (2011) finds that there is significant effect on revenue productivity and thereby on growth of firms of product innovation. Furthermore, there is a general consensus in literature on the presence of a significant and positive relationship between innovative activity and productivity. A review of various industrialised countries such as Netherlands, Germany, France, Norway, Sweden etc., shows the elasticity of innovation with respect to productivity ranges between 0.035 and 0.29 [see amongst others Van Leeuwen and Klomp (2006); Polder, *et al.* (2009); Mairesse and Robin (2010); Janz, *et al*. (2003)].

This innovation-productivity link can then potentially translate into increases in aggregate productivity for the country. This can work through two channels: firms that innovate tend to produce more efficiently (cost effectively) and also better quality products which is likely to increase demand for products of the sector. Secondly, at the aggregate level firms that innovate will exhibit faster growth than firms which don't. This may drive out inefficient players from the market creating room for more competitive firms and thus contributing to overall productivity gains. Hall (2011) empirically establishes this positive link for a set of 23 OECD countries by comparing aggregate innovation rates (both product and process) with aggregate productivity as measured by GDP per hours worked. His findings are robust to sophisticated econometric estimations.[1] An interesting dimension of his finding is the positive link between size of firm particularly large firms, innovation and productivity.

Defining Innovation

Innovation is considered to be a complex process which is difficult to quantify. Historically, it was measured by the spending on research and development (R&D) activities and/or the number of patents obtained by a firm. The use of R&D data has been criticised on account of being an input variable which may or may not result in the actual development of a new product or process or an up gradation of an existing one [Flor and Oltra (2004); Kleinknecht, *et al.* (2002)]. Thus, it would be an overestimation of the actual level of innovation in the firm. On the other hand, the use of patent data would tend to be an underestimation of actual innovation whenever it is not a new invention by the firm. It would also pose a problem in settings where property rights are not clearly defined as is the case with most developing countries including Pakistan. Also, firms where innovation is largely undertaken by adopting processes and products of other firms in the industry would not be considered.

According to Becheikh, *et al.* (2006) a review of empirical studies on innovation from 1993 to 2003 reveals that 81 percent of the authors investigated process, product or both types of innovative activity. This definition stems from the Oslo Manual[2] where innovation refers to the introduction of a new product or process over the past three years.

[1]Such as Leasty Absolute Deviations and Least Median of Squares.

[2]The Oslo Manual was first published by the OECD in 1992 with the objective of developing a framework within which research on innovation can be compared across countries. To that end, the manual defined innovation as "introduction of technologically new products and processes and significant technological improvements in products and processes" as well as laid down a set of survey procedures for conducting research in this domain.

This is also one of the most widely used operational definitions in the literature on innovation and one which we will also be using for this study.

Motivation and Objectives

Pakistan continues to exhibit poor performance in this domain. According to the Global Competitiveness Report 2011-2012, Pakistan ranks at 118th out of a total of 142 countries and it fares worse than the neighbouring countries of Bangladesh (ranked at 108), India (ranked at 56), and Sri Lanka (ranked at 52). Moreover, in the context of Pakistan this becomes especially important in the industrial sector since the composition of industrial production has been largely unchanged since the 1970s.[3] The country seems to be stuck at the low end of the technology ladder while we do know that other Asian countries (such as Malaysia, Thailand, People's Republic of China, Vietnam etc.) have exhibited tremendous growth at the back of transition from low to high technology production [Felipe (2007)]. What made this transition possible is innovation. Given the crucial importance of innovation for competitiveness on the one hand, and Pakistan's poor performance on the other, the objective of this study is to examine the determinants of innovative behaviour for manufacturing firms in Pakistan.

The main overarching question that the study attempts to answer is that, what are the characteristics of firms which innovate versus those that do not? Literature classifies these into two categories namely i.e., those which are (a) internal and those which are (b) external to the firm.

Internal characteristics include those which pertain to size [Greve (2003)], age [Jung, *et al.* (2003); Sorensen and Stuart (2000)], ownership structure [Bishop and Wiseman (1999); Love, *et al.* (1996)] and past performance of the firm [Tsai (2001)]. It also includes trade status of the firm which has been found to be an important determinant of innovative activity in the literature [Landry, *et al.* (2002); Romijn and Albaladejo (2002)]. In addition, characteristics representing the quality of the management of the firm like training, educational background and experience of the managers and entrepreneurs have also been studied [Koellinger (2008); Baldwin and Johnson (1996)].

External determinants of innovation which have been explored in the literature include geographical location of the firm, demand growth in the industry, industry concentration, government policies as well as the general institutional structure prevalent in the area in which the firm operates [Smolny (2003); Sternberg and Arndt (2001); Coombs and Teomlinson (1998); Baptista and Swann (1998)].

The remainder of the paper is organised as follows: Section 2 describes the data and presents basic summary statistics; Section 3 the methodology and the estimation strategy; results are discussed in Section 4 and Section 5 concludes the paper.

2. DATA

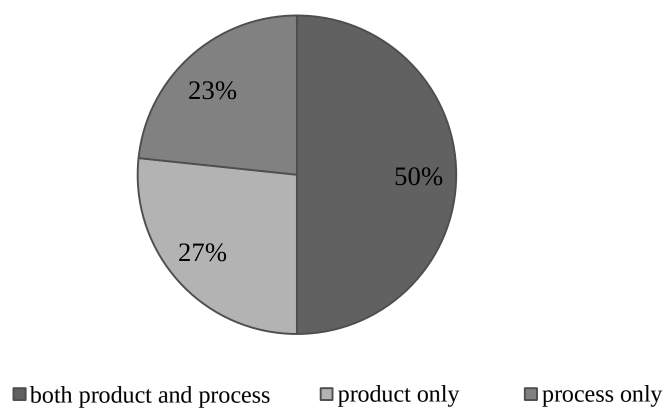
The study uses a panel data provided by the two rounds of the Pakistan Investment Climate Assessment Survey conducted by the World Bank in 2002 and 2006-07 respectively. This panel survey provides detailed information on firm characteristics and

[3]See Table 3 on page 15 [Felipe (2007)].

on various aspects of business environment in the country. The former includes information on an establishment's sales, employment and productivity. Key dimensions of business environment include infrastructure and services, courts, crime, government-business relations, degree of competition and factor markets (land, labour and finance). The surveyed firms are located in thirteen cities across the country with a large share coming from big cities such as Karachi. Firms belong to seven different industries with a sixty percent share coming from the Textiles, Food and Garments industries.

The panel consists of 402 manufacturing firms of which 107 firms (26.7 percent) innovated either by introducing new products, new processes or both. Combining data from several innovation surveys across the world, Hall (2011) estimates that on average 30-50 percent of firms introduced a new product and/or process over the last three years. The innovation rate of 26.7 percent in the manufacturing industry for the sample under study shows that Pakistan still has a long way to go in terms of catching up to innovation rates in the developed world. However, in line with evidence from these countries, within the firms which are innovating, there is an equally likelihood of undertaking product or process innovation in Pakistan (Figure 2).

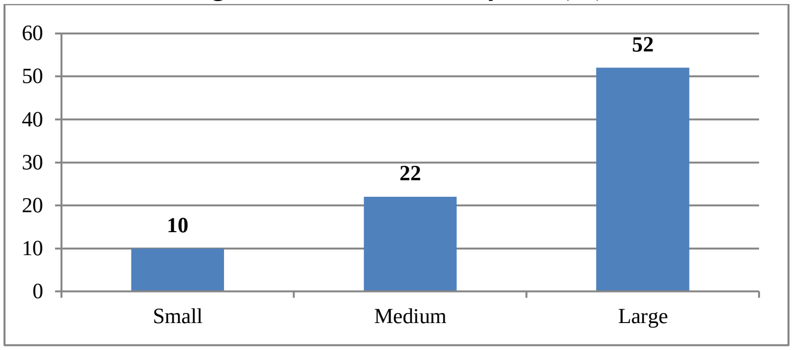
Fig. 2. Innovators by Type



Raw data suggests that there are significant differences in innovations rates across both internal and external characteristics. Internally, both product and process innovations rates differ significantly by a firms size. Large firms are 5 times more likely to innovate in the 2004 to 2007 period than a small firm[4] (Figure 3). When innovation by product and process was separately studied, percentage of innovators was fairly consistent across firm size. Innovators appear to have more access to external finance compared to non-innovators since twice as many firms in the sample of innovators report positive external financing compared to the sample of non-innovating firms.

[4]Where size is defined as: Small: 0 to 20 workers, Medium: 20 to 100 workers and Large: More than 100 workers.

Fig. 3. Innovation Rates by Size (%)



Source: Author's Own calculation, Investment Climate Assessment Survey, 2002 and 2007.

Externally, innovation rates differ across industry and region (Tables 1 and 2). Industry wise differences might arise due to the potential for greater innovation in certain industries than others. Further, a possible factor that explains the differences across regions could be the presence of the firm in a cluster. Of the innovating firms, 50 percent of the firms are part of a cluster.[5]

Table 1

Innovation Rates by Industry (%)

Industry	Product	Process
Food	18.8	20.3
Garments	14.7	17.6
Textiles	27	25
Machinery and Equipment	0	0
Chemicals	27.3	27.3
Electronics	16.7	16.7
Leather and Products	13	13
Other Manufacturing	27.4	23.2

Source: Author's Own calculation, Investment Climate Assessment Survey, 2007.

Table 2

Innovation Rates by Location (%)

Region/City	Product	Process
Karachi	50.6	50.6
Lahore	24.2	29
Sheikhupura	0	0
Sialkot	18.6	11.4
Faisalabad	11.9	13.4
Gujranwala	2	2
Wazirabad	9.1	9.1
Islamabad/Rawalpindi	0	0

Source: Author's Own calculation, Investment Climate Assessment Survey, 2007.

[5]Cluster is defined as an area where at least 30 percent of the firms in a particular industry in the sample are located.

3. METHODOLOGY

3.1. Empirical Framework

A major issue with studying the determinants of innovation is that most of the characteristics of innovating firms identified in literature could pose endogeneity issues. This is because observing firms after they have innovated makes it difficult to determine whether these characteristics are a result of innovation or they in fact let to the innovating activity of the firm. For instance when exploring the relation between a firm's trade status and innovation, is it that entry into international markets allowed easier diffusion of foreign technology and hence led to innovation or is it that innovating firms as a result of it are able to become more competitive thereby allowing them to break into the export market. This problem of reverse causality is present in most of the variables of interest in determining innovation. To circumvent this problem, we will be making use of the unique panel which will allow us to look at the impact of pre-innovation characteristics of the firm in 2002 on incidence of innovation in 2006-07. To that end the following model is specified:

$$I_{jt} = \alpha_0 + \sum \beta_i X_{jt-1} + \sum \gamma_i Y_{jt-1} + \varepsilon_0 \qquad \dots \qquad \dots \qquad \dots \qquad \dots \qquad (1)$$

Where I_{jt} is a dummy variable taking on a value of 1 if firm *j* is an innovator in year 2006-07 and 0 otherwise. In line with the discussion above, a firm is characterised as an innovator if it has introduced a new product (process) in the 2003-06 period. *t* refers to the second round of the panel (2006-07) while *t*–1 refers to the first round conducted in 2002. $X_{jt-1}(Y_{jt-1})$ is a vector of internal (external) characteristics that the firm *j* had in 2002. Finally, α_0, β, γ are parameters while ε_0 is the error term.

The internal characteristics include the trade status, size of the firm, growth of the firm, quality of the top manager and the organisational type. Trade status is a dummy variable which equals 1 if the firm is an exporter, 0 otherwise. A priori it is expected that an exporting firm is more likely to innovate since in order to sustain in the global markets, the firm needs to be competitive which in turn requires a continuous process of improving existing processes. Furthermore, it is easier for these firms to acquire the latest technology.

Size has been defined in terms of the number of people working in the organisation. A firm is small if the number of employees is less than 20, medium if between 20 and 100 and large if more than 100. The base category for our analysis is a small firm while dummies for large and medium sized firms are included. Larger firms are expected to have an advantage over smaller firms due to their capacity for investing in R&D and the acquisition of new technology.

Growth has been defined in terms of the growth in labour force in the 1999–2002 period. An alternate possibility of the sales growth rate but due to concerns about the validity of the data reported this was not used. Fast growing firms on average are more likely than slow growing or stagnant firms to have the resources to innovate.

We also include measures for quality of management for which we proxy by the education attainment and experience of the top manager in that particular firm. Organisational form of the firm has been captured by including a dummy variable which equals 1 if a firm is a private organisation and 0 otherwise.

In order to innovate, firms need to invest in costly research and development. Literature shows that ease of access to external finance has a significant positive impact on the probability of innovation as it can potentially serve to relax the resource constraints that firms face. In order to capture this dimension we measure external finance by the percentage of working capital financed through institutional sources which include private commercial banks, state owned banks and non-bank financial institutions.

On the external side, a particularly interesting question is whether being in a cluster increases the likelihood of a firm innovating through possible benefits from knowledge spillovers and greater competition. This is captured by a dummy variable that takes on a value of 1 if the firm is located in a cluster where cluster is defined as an area where at least 30 percent of the firms in a particular industry in the sample are located.[6] Using firm concentration levels in each location we find the conventionally established clusters such as the textiles cluster at Karachi and Faisalabad, the leather and sports goods cluster at Sialkot (Appendix-A details the location-industry clusters identified).

Another interesting aspect is how the environment in which the firm operates affects the probability of innovation. To answer this question this analysis is based on perceptions based information regarding business climate.[7] These can be broadly categorised as those pertaining to availability of infrastructure, the policy environment and the overall macroeconomic condition of the country. To construct each of these three indices, we employ principal component analysis on the top manager's response to the relevant questions. These responses are on a scale of 1 to 5 where 5 refers to if the manager considers that particular factor to be a major or severe constraint to the firm's operation.

3.2. Estimation Strategy

In line with the nature of the dummy dependant variable, we will be estimating a Probit model using maximum likelihood estimation technique:

$$Prob(I_{jt} = 1|X, Y) = \alpha_0 + \sum \beta_i X_{jt-1} + \sum \gamma_i Y_{jt-1} + \varepsilon_0 \qquad \ldots \qquad \ldots \qquad (2)$$

Existing studies show that product innovations tend to have a different set of determinants compared to process innovations despite their close link.[8] This is because product innovation tends to be a much radical change while process is in most cases is an up gradation of the existing operating/manufacturing procedures. Therefore, the level of investment both in time and capital usually required for product innovation is much greater as compared to process innovation. For instance it could be that being small imposes a greater constraint as far as product innovation is concerned in comparison to process innovation. Against this backdrop product and process innovative activity is separately studied using the specification in (1) with a modified dependant variable:

[6]Conventionally clustering is defined using the Ellison-Glaeser index (1997) based on employment of an industry in a particular location. However, lack of nationally representative industry data in the sample under study does not allow such calculations.

[7]While it would be most accurate to have factual information on the business climate but due to data constraints perceptions based data is being used to capture this dimension.

[8]See amongst others Freer (2003), Gopalakrishnan, *et al.* (1999), Lager and Horte (2002), Michie and Sheehan (2003), Papadakis and Bourantas (1998), Sternberg and Arndt (2001).

$$Prob(Prod_{jt} = 1|X,Y) = \alpha_0 + \sum \beta_i X_{jt-1} + \sum \gamma_i Y_{jt-1} + \varepsilon_0 \quad \dots \quad \dots \quad (3)$$

$$Prob(Proc_{jt} = 1|X,Y) = \alpha_0 + \sum \beta_i X_{jt-1} + \sum \gamma_i Y_{jt-1} + \varepsilon_0 \quad \dots \quad \dots \quad (4)$$

Where prod (proc) refers to product (process) innovation in the 2003-06 period, respectively. Hence, estimates on the determinants of innovation are calculated separately for product and process innovators.

4. RESULTS

We begin by estimation of Equation (2) where the dependant variable captures firms which innovate either by introducing a new product or process or both. Results from the Probit estimation show (Table 3) that of the internal characteristics firm size and quality of human capital are significant in explaining innovation. The probability of innovation is 17 percent (51 percent) higher for medium (large) firms compared to small firms. Further, the quality of human capital in the organisation appears to have a significant but a smaller impact than firm size. This is evident from the positive and statistically significant coefficients on top manager's experience (1 percent) and education (3 percent).

Table 3

Maximum Likelihood Probit Estimates

	Coefficient	Marginal Effects	t-stat	Coefficient	Marginal Effects	t-stat
Internal						
Trade Status	–0.24	–0.07	–1.19	–0.27	–0.08	–1.32
Medium Size	0.54***	0.17	2.77	–0.12	–0.03	–0.37
Large Size	1.41***	0.51	5.05	0.86**	0.31	2.16
Growth Rate	–0.00	0.00	–0.29	–0.00	0.00	–0.18
Private Limited	0.04	0.01	0.22	0.04	0.01	0.08
Manager Experience	0.03**	0.01	2.16	0.03**	0.01	0.26
Manager Education	0.09**	0.03	2.05	0.09*	0.03	2.00
External						
Cluster	0.63***	0.18	3.46	–0.06	–0.02	1.87
Access to External Finance	–0.00	0.00	–0.07	0.00	0.00	–0.35
Infrastructure Index	0.03	0.01	0.46	0.00	0.00	0.02
Policy Index	–0.02	0.00	–0.24	–0.01	0.00	–0.15
Macro Environment Index	–0.01	0.00	–0.18	–0.01	0.00	–0.15
Medium * Cluster	–	–		0.96**	0.32	2.38
Large * Cluster	–	–		0.88*	0.32	1.74
Constant	–2.15***	–	–7.34	–1.64***	–	–4.79

*** p<0.01, ** p<0.05, *p<0.1.

Trade status of the firm turns out to be insignificant in increasing firm’s likelihood of innovating. Literature identifies two possible channels through which trade status is linked with innovation. One is it that entry into international markets allowed easier diffusion of foreign technology and hence led to innovation. Alternatively it could be the case that innovating firms as a result of it are able to become more competitive thereby allowing them to break into the export markets. Given the insignificance of trade status clearly for the sample under study the first channel does not hold. However, a look at raw data suggests that the latter channel might be working in Pakistan since the number of exporters within the innovating firms doubled between 2002 and 2007 while for non-innovating firms there was no change. But to establish this casual link one obviously needs to investigate more rigorously

Further Growth is insignificant which is not surprising given the fact that the period for which we are taking the growth rate is 1999-2002 which we all know was one of the worst time periods for the country’s manufacturing sector. Also, literature finds that private firms may be more likely to innovate compared to public sector firms but we get an insignificant relation.

On the external side, presence of the firm in a cluster increases the probability of innovation by 18 percent. However, all variables capturing the business climate in which the firm operates come out to be insignificant. This might be attributable to the perceptions based nature of the data used in the construction of these indices as these perceptions may not be accurately representative of the true environment in which the firm operates.

While presence in a cluster is significant in determining innovative activity but this impact may vary according to a firm’s size. Therefore we augment Equation (2) by introducing size-cluster interactions. We find that mere presence in a cluster is not enough in determining innovative activity. This is evident from the fact that cluster is no longer significant once the size-cluster interactions are incorporated in the model. Results (Table 3) suggest that for the sample of firms under study, medium (large) firms in a cluster are 17 percent (47 percent) more likely to innovate compared to firms of the same size not located in a cluster. Medium firms per se do not have an advantage over small firms in innovating. It is only when medium firms are located in a cluster that their probability of innovating significantly increases relative to other small and medium firms outside of cluster as illustrated by the insignificant coefficient on the medium dummy. However, large firms still have an advantage over small firms outside of a cluster as evident by the significance of the dummy indicating a large firm and this advantage further increase with presence in a cluster.

Further, Equations (3) and (4) were estimated and results are in Table 4. A comparison of results by product and process innovators shows that both types of innovative activity is more or less determined by the same set of explanatory variables. This is also in line with literature that establishes the linkage and closely connected nature of both product and process innovations [for e.g. Martinez-Ros (1999)]. The one noteworthy difference is the significance of presence in a cluster. While this variable is insignificant for process innovators it is significant and positive for product innovators. This is in line with the inherent difference between these two types of innovative activities as discussed above. Product innovation being a more visible change in the organisation compared to the introduction of a new or improvised process is likely to benefit more from the knowledge spillovers that is a characteristic of being in a cluster.

Table 4

Maximum Likelihood Probit Estimates by Product and Process Innovators

	Product Only			Process Only		
	Coefficient	Marginal Effects	t-stat	Coefficient	Marginal Effects	t-stat
Internal						
Trade Status	–0.14	–0.04	–0.71	–0.13	–0.03	–0.64
Medium Size	0.47*	0.13	2.30	0.49**	0.12	2.26
Large Size	1.23***	0.43	4.43	1.18***	0.40	4.13
Growth Rate	0.00	0.00	–0.02	0.00	0.00	0.66
Private Limited	–0.01	0.00	–0.06	0.07	0.02	0.39
Manager Experience	0.01	0.00	1.13	0.04***	0.01	2.73
Manager Education	0.10*	0.03	2.05	0.11**	0.03	2.26
External						
Cluster	0.39*	0.10	2.15	0.06	0.01	0.33
Access to External Finance	0.00	0.00	–1.10	0.00	0.00	0.55
Infrastructure Index	0.00	0.00	0.00	0.00	0.00	0.00
Policy Index	–0.05	–0.01	–0.74	0.02	0.00	0.24
Macro Environment Index	0.00	0.00	0.08	–0.05	–0.01	–0.77
Constant	–2.00***	–	–6.65	–2.15***	–	–6.88

*** p<0.01, ** p<0.05, *p<0.1.

5. POLICY IMPLICATION AND CONCLUSION

The objective of this study was to explore the determinants of innovative activity for a sample of manufacturing firms in Pakistan. Operational definition of innovation used in this study refers to the introduction of a new product and/or process in the past three years by the firm. To account for simultaneity bias between innovation and various explanatory variables such as growth of the firm, trade status etc., the study uses characteristics of the firm prior to undertaking innovation.

Key findings are that size of the firm, presence in a cluster and management quality are important determinants for the sample of manufacturing firms under study. This points to the need for firm level investment in good quality management and broadly for investment in human resources in the country. Further, there is a need to encourage natural clusters the same as industrial estates since there exists strong policy as far as industrial estates are concerned but not much focus towards natural clusters at present.

Finally, there is casual/anecdotal evidence which suggests that there is a lack of organic growth of firms over time in the country. Our findings suggest that medium and large firms have a clear advantage over small firms and so there is a need to facilitate growth of small firms. Interestingly, the advantage of a medium firm over a small firm is subject to the presence of that firm in a cluster while a large firm is not subject to such constraints but the likelihood of innovating increases further when part of a cluster.

Data constraints did not allow the market structure dimension to be studied and future studies can explore this aspect which can provide further insights into the drivers of innovative activity in the industrial sector.

APPENDIX-A

Industry—Location Clusters

	Textiles	Garments	Leather	Food	Electronics	Chemicals	Sports Goods
Karachi							
Lahore							
Sheikhupura							
Sialkot							
Faisalabad							
Gujranwala							
Wazirabad							
Islamabad/Rawalpindi							
Sukkur							
Hyderabad							
Quetta							
Peshawar							

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Testing the Harrod Balassa Sameulson Hypothesis: The Case of Pakistan

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1. INTRODUCTION

In this modern era of globalisation, the stabilisation of exchange rate is very important phenomenon for the financial institutions and for the international trade, especially for a small open economy like, Pakistan. A stable exchange rate may help financial institutions to reduce their operational risk. While a fluctuating exchange rate can affect macroeconomic fundamentals like, prices, wages, interest rate, output etc. That eventually leads to the devaluation of the real exchange rate for the correction of external balance [Parikh and Williams (2008)].

After pioneer study of Cassel (1916) Purchasing Power Parity (PPP) theory has become very famous tool to determine the long run real exchange rate and to asses, whether shocks to real exchange rate are permanent or transitory. It asserts that under the assumptions of perfect markets and free trade, the nominal exchange rate between two countries will be equalised to the ratio of the general price level of the both countries. Due to which, real exchange rate will be constant over time and any shock to the real exchange rate will be transient and mean reverting. In the free trade world with no transaction cost, it is also called “law of one price”. Nevertheless, in the real world, the existence of transportation costs, capital flows, speculative expectations and the existence of non-traded goods make the theory more controversial.

In 1933, Harrod criticised this theory and afterward Balassa and Sameulson (1964) did the same by saying that, PPP theory is not the appropriate theory of the exchange rate determination. As real exchange rate can diverge from its long run equilibrium path due to the productivity differences through the channel of non-traded goods’ prices that are part of the general price level of a country and which resist the price levels between the two countries to be equalised. These productivity differences can take two forms; productivity differences between tradable and non-tradable goods within the country and the same across the countries. Productivity in the tradable sector is generally higher than the non-traded sector that leads to the increase in prices of non-traded goods and then the general price levels, which leads to the real appreciation of real exchange rate. This theory is commonly known as Harrod-Balassa-Samuelson (HBS) hypothesis.

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Due to the controversies in literature regarding HBS and PPP, both of the theories have been re-evaluated at the empirical ground by using annual time series data for the period of 1972-2008. In addition to the relative productivity fundamental variables, the terms of trade, government consumption, money supply and world oil prices are added as the secondary explanatory variables, which can also be seen as a test of the extended (unrestricted) HBS model.

This paper is distinct from the similar studies at several grounds. Firstly, the paper is different due to two-step method because most of the studies evaluated HBS through one-step method in Pakistan. That is more important for the analysis of the exact reason behind the failure of the hypothesis in Pakistan as most studies have concluded. Secondly, the most important distinction of the study is that it is based on the sectoral data and relative prices of the traded and non-traded sectors are used which, to my best knowledge, have never been used before for the analysis of HBS in Pakistan.

A review of previous studies that have examined the relationship between real exchange rate and productivity, among developed and developing countries provided in Section 2. In Section 3, an economic model of Purchasing Power Parity and Harrod Balassa Sameulson hypothesis is derived using a production function approach. Data description and methodology presented in Section 4 while Section 5 describes the results developed after estimation and Section 6 concludes the paper and discusses some policy implications based on econometric results of the study.

2. REVIEW OF LITERATURE

After dozens of published papers, in 1994, De Gregorio and Wolf integrated the "terms of trade" formally into the BS model. In their influential study, they develop a simple model of a small open economy producing exportable and non-tradable goods and consuming importable and non-tradable goods, and present empirical evidence for a sample of fourteen Organisation for Economic Co-Operation and Development (OECD) countries. Clearly, they conclude, "The evidence from OECD countries broadly supports the predictions of the model, namely that faster productivity growth in the tradable relative to the non-tradable sector and an improvement in the terms of trade induces a real appreciation" [De Gregorio and Wolf (1994), p.1]. After this stream of work, many studies came with the models of additional independent variables. Such as, Broeck and Slok (2001) linked this phenomenon to the transition countries by using additional independent variables like, ratio of broad money to GDP, government balance, openness, fuel and non-fuel prices and terms of trade. Sonora and Tica (2007) also contribute to the verification of the HBS for 11 transition countries by including Government consumption to GDP ratio as an explanatory variable.

Jongwanich (2010) incorporated terms of trade, government spending, productivity differential and capital flows as explanatory variables. Capital flows further separated into three categories, foreign direct investment, portfolio investment, and other investment flows. While Chinn (1998) examined the productivity based explanation for real exchange rate for East Asian countries by using three additional variables; oil prices, government spending and terms of trade. In which only oil prices show the significant contribution in explaining the productivity effect on real exchange rate (RER).

With the passage of time as there have been made different modifications in the model, different econometric techniques were introduced. The first econometric test was a cross-sectional OLS analysis used by Balassa in 1964. In the early 1980s, Instrumental Variables, and Engle-Granger co-integration techniques were used but the mainstream technique was still OLS. In the early nineties, seemingly unrelated regression technique was used widely but in the late nineties Johanson and Juselius co-integration technique became one of the most popular technique in testing the HBS hypothesis. Recently, the auto regressive distributed lag (ARDL) has become very popular also [Tica and Druzic (2007)].

Solanes and Flores (2008) used panel data unit root tests and Pedroni-co-integration technique both for OECD and Latin America as well. They distinct their study by employing two-stage approach and found that the first stage of the hypothesis holds in both of the groups but the second stage which relates relative prices to real exchange rate holds only in LA countries. The same kind of results were found by Egert (2002) which used VAR based co-integration technique to see the effect of HBS in five transition economies. The relationship between productivity growth and relative prices is much stronger than the relationship between relative prices and real exchange rate movements.

To stabilise prices and trade flows many developing countries are trying to manage their real exchange rates by official interventions.

On the other hand, Qayum, *et al*. (2004) tested the validity of Purchasing Power Parity hypothesis for Pakistan by the VAR based Johenson co-integration approach. The results are in favour of PPP in the traded sector by saying that in the absence of shocks, exchange rate and whole sale prices will be adjusted to its equilibrium but the speed of adjustment is very slow. In this regard, Khan and Ahmad (2005) also concluded by using three different types of price indices of the four Asian countries.[1] The long run cointegrating relationship suggests that the long run relationship between nominal exchange rate and prices exists only for the wholesale price index. In this regard Bianco (2008) tested the PPP theory of exchange rate for Argentina as this country has experienced a downfall from developed to developing. The downfall of this once developed country has affected its RER and raised the question about the validity of PPP. The results are less favourable for PPP, as its RER appears as a non-stationary variable, but more favourable for HBS effect.

With the increasing importance of HBS, Chowdhary (2007) used Auto Regressive Distributive Lag (ARDL) approach to estimate HBS for SAARC countries because ARDL approach is free from the problem of the same order of integration. The findings of the ARDL approach show that the BS effect is only working in Bangladesh. The reason might be the exclusion of the other relevant explanatory variables like, interest rate differentials, terms of trade and foreign direct investment etc., which affect real exchange rate besides the productivity differential. So, Choudhri and Khan (2005) examines the BS hypothesis, in which terms of trade together with non-traded and traded goods productivity differentials are used as the explanatory variables, to explain the real exchange rate movements of 16 countries in 1976- 1994 period by employing Dynamic Ordinary Least Squares (DOLS) method. According to the authors, the results of the study provide strong verification of the BS effects for developing countries.

[1]Indonesia, Malaysia, Pakistan and Singapore.

3. ECONOMIC MODELS

3.1. Purchasing Power Parity Model

"The theory states that barring frictional or complicating factors such as tariffs, taxes and transportation costs, the price of an internationally traded good in one country should achieve the identical price in another country, once the price is adjusted to a common currency" [Nguyen (2001), p. 1]. Mathematically, it can be expressed as;

$$P = e.\, P^{*}$$

In the expression above, P is the domestic price, e is the nominal exchange rate defined as the domestic currency units per unit of foreign currency and $P*$ is the price in the foreign country expressed in foreign currency. If PPP holds, then above equation can be written as,

$$P/ P^{*} = e \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (1)$$

Or $P/ P^{*}\ x\ 1/e = 1$

Where, expression (1) describes the **'Absolute PPP'** between two countries and the second expression shows the real exchange rate or the exchange rate that is adjusted for the price levels between two countries that must be equal to one for the PPP to hold.

The empirical or estimated form of the Absolute PPP can be written as;

$$e_t = \beta_0 + \beta_1\ (p - p^*)_t + u_t \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (2)$$

Where, e_t is the natural log of the nominal exchange rate expressed in the domestic currency per unit of the foreign currency. (p – p*) is the price differential between domestic and foreign currency in logarithmic form. For the PPP to hold β_0 must be zero and β_1 will be equal to one.

However, to test the absolute PPP for the countries, the deficiency of the proper price level data available for internationally standardised baskets of goods and its inability to capture the inflation differentials between countries, researchers often move to the testing of relative PPP [Rogoff (1996)]. Moreover, restriction on β_1 equal to one will be relaxed in the Equation (2).

The testable form of the relative PPP is as;

$$\Delta e_t = \alpha_0 + \alpha_1\ (\Delta p - \Delta p^*) + \varepsilon_t \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (3)$$

Where, Δ represents the first difference operator indicating that rate of change in log exchange rate is equal to the inflation differential between two countries.

Conversely, in the real world distinction between relative and absolute PPP is not possible because price levels in both the countries are measured assuming unit price in some base year [Bhatti 1996].

3.2. The Basic HBS Model

The HBS hypothesis states that the productivity differences in tradable and non-tradable sectors across countries lead to differentiation of wages, price levels and, hence the real exchange rates. In the other words, this theory offers the supply side explanation of higher inflation and the real exchange rate appreciation in the countries those have higher productivity growth.

In its domestic version, relative inflation is explained by relative productivity growth between tradable and non-tradable sectors. It is observed that usually productivity growth in tradable sector is much higher than the non-tradable sector. Therefore, if wages are equal in both the sectors then higher productivity-driven wages will push the wages in the non-tradable sector as well. As wages have been increased more than its productivity gains in the non-tradable sector, prices will increase. This, in turn, raises the ratio of non-tradable to tradable prices. In literature, it is also known as the 'Penn-effect'.

In the international version, this causal link between productivity growth and relative prices further explains the appreciation of the real exchange rate. As there is assumed to be the PPP in the tradable sector, the productivity-driven inflation differential will cause the appreciation of the real exchange rate (as $R=e.P^*/P$).

3.2.1. *Approaches to Estimate HBS*

In the literature, there are two main approaches to test the HBS hypothesis; one-step approach and the two-steps approach.

One Step Approach

The empirical equation that was estimated by Balassa (1964) in cross-sectional analysis refers to the one-step approach. In which productivity difference is directly related to the real exchange rate.

Two Step Approach

The two-step approach firstly examines the relationship of productivity differences between tradable and non-tradable sectors to their relative prices.

Then in the second step, the existence of PPP in the tradable sector is to be checked. Together, if the two steps show positive results, the real exchange rate is expected to move together with differences in the relative productivity of tradable over non-tradable sectors between countries.

3.2.2. *Formal Exposition of the HBS Model*

It is assumed that an open economy produces two goods: traded and non-traded. Labour is used as an input and outputs are generated with constant-return production functions (CRS):

$$Y^T = A^T F(L^T) \quad \text{and} \quad Y^{NT} = A^{NT} F(L^{NT}) \qquad \ldots \quad \ldots \quad \ldots \quad (7)$$

Where, subscripts T and NT denote tradable and non-tradable sectors, respectively. If, there is used '*' with the same function then it will represent the foreign country. Assuming that both goods are produced by the total domestic labour supply which is constant and equal to

$L = L^{T} + L^{NT}$.

It is further assumed that the labour market is competitive and labour is mobile across sectors but not across countries. Labour mobility ensures that workers earn the same wage W in either sector. The profit maximisation first order conditions of the Equation (7) says that, Marginal Product of Labour "MPL = w" in both the countries or in logarithmic form;

$$wT - pT = \alpha T \quad \text{and} \quad wNT - pNT = \alpha NT \qquad \ldots \quad \ldots \quad \ldots \quad (8)$$

Thus, the assumption of wage equalisation implies

$$pNT - pT = \alpha T - \alpha NT \qquad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (9)$$

By subtracting the foreign country

$$(pNT - pT) - (pNT^* - pT^*) = (\alpha T - \alpha NT) - (\alpha T^* - \alpha NT^*) \qquad \ldots \quad \ldots \quad (10)$$

To show the internal mechanism that how productivity differences affects non-tradable prices and then to overall inflation, we can rearrange Equations (9) as;

$$pNT = pT + \alpha T - \alpha NT \qquad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (11)$$

The overall price inflation in the country is defined as a weighted average of the tradable and non-tradable sectors with 'θ' and '1- θ' used as weights measured as traded and non-traded goods' share in GDP (Gross Domestic Product), respectively.

$$p = \theta\, pT + (1 - \theta)\, pNT \qquad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (12)$$

Now by substituting the value of pNT in Equation (14) , it will become;

$$p = pT + (1 - \theta)\, (\alpha T - \alpha NT) \qquad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (13)$$

OR

$$p = pT + (1 - \theta)\, (pNT - pT) \qquad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (14)$$

$$p^* = pT^* + (1 - \theta)\, (pNT^* - pT^*) \qquad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (15)$$

Therefore, according to this mechanism Equation (10) implies that increase in the productivity of traded goods in home than in the foreign will put the upward pressure on the prices of non-traded goods in home country [Egert (2002)].

For the international comparison of the countries' prices,

$$q = e + p^* - p \qquad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (16)$$

Where 'q' is log real exchange rate 'e' is the nominal exchange rate, 'p' and 'p^*' are the logarithmic forms of the domestic and foreign consumer price indices, respectively. These price indices are the geometric averages of the traded and non-traded goods as is the form of Equation (12).

Now by putting Equations (14) and (15) into (16) and assuming θ = β we get;

$$q = e + \{pT^* + (1 - \theta)\, (pNT^* - pT^*)\} - \{pT + (1 - \theta)\, (pNT - pT)\} \qquad \ldots \quad (17)$$

If $pT = pT^*$ then 'e' will be equal to one. To see the equalisation in traded goods' prices, Franses and Dijk (2002) decomposed the 'q' into stationary and a non-stationary component.

$$q = x + y$$

$$\text{Where, } x = e + \beta pT^* - \theta pT \qquad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (18)$$

And

$$y = (1 - \beta)\,(pNT^* - pT^*) - (1 - \theta)\,(pNT - pT) \qquad \ldots \quad \ldots \quad \ldots \quad (19)$$

If 'x' is equal to '1' or is stationary process then,

$$q = (1 - \theta)\,(pNT^* - pT^*) - (1 - \theta)\,(pNT - pT)$$

Alternatively,

$$q = -(1 - \theta)\,[(pNT - pT) - (pNT^* - pT^*)] \qquad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (20)$$

It means that whenever prices of non-tradable sector in home relative to foreign will increase, exchange rate will be appreciated in the home country.

$$\text{OR} \quad q = -(1 - \theta)\,[(\alpha T - \alpha NT) - (\alpha T^* - \alpha NT^*)] \qquad \ldots \quad \ldots \quad \ldots \quad (21)$$

3.3. Empirical Formulation of the Models

In order to use these deterministic models in the estimation, firstly they are converted into the empirical one.

Restricted Model

$$\ln(RPRCS)_t = a_0 + a_1 \ln(RPROD)_t + \eta_t \qquad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (22)$$

$$\ln(RER)_t = b_0 + b_1 \ln(RPRCS)_t + \eta_t \qquad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (23)$$

$$\ln(RER)_t = \gamma_0 + \gamma_1 \ln(RPROD)_t + \eta_t \qquad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (24)$$

Where, Equations (22) and (23) are indicating the one-step method while (24) is for two-step approach.

Unrestricted Model

However, after 1994, a strand of literature has been developed for the increasing trend of the inclusion of other explanatory variables in "Restricted Model" that can be name by **"**Unrestricted Model" which is defined as follows;

$$\ln(RPRCS)_t = a_0 + a_1\ln(RPROD)_t + a_2\ln(GEX)_t + a_3\ln(TOT)_t + a_4\ln(WP)_t + a_5\ln(M2)_t + \eta_t \qquad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (25)$$

$$\ln(RER)_t = b_0 + b_1\ln(RPRCS)_t + b_2\ln(GEX)_t + b_3\ln(TOT)_t + b_4\ln(WP)_t + b_5\ln(M2)_t + \eta_t \qquad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (26)$$

$$\ln(RER)_t = \gamma_0 + \gamma_1\ln(RPROD)_t + \gamma_2\ln(GEX)_t + \gamma_3\ln(TOT)_t + \gamma_4\ln(WP)_t + \gamma_5\ln(M2)_t + \eta_t \qquad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (27)$$

The model has been developed by taking into account the importance or significance of the underlying explanatory variables in the modern literature.

3.4. Definition of Real Exchange Rate

The various definitions of the RER can mainly be divided into two groups; the first one is categorised in the PPP and second one is the distinction between tradable and non-tradable prices.

$$RER_{ppp} = e.\ P^*/P$$

Where, increase in the RER_{ppp} means the real depreciation and decrease represents the real appreciation. But the problem with this type of *RER* is the choice of the appropriate price index.

The second definition of the *RER* defined by the relative tradable and non-tradable prices, takes the relative prices as an indicator of the country's competitiveness.

$$RER_r = P_t/P_n$$

Under the assumption that tradable prices are the same in all over the world, the RER_r can be defined as;

$$P_t = e.\ P^*_t$$
$$RER_r = e.\ P^*_t/P_n$$

Where, increase in the RER_r indicates the real depreciation and decrease means the real appreciation.

Therefore, to calculate the PPP for Pakistan, first definition has been used. While, for the analysis of HBS, the second definition of RER has been utilised.

3.5. Variables Description

- lnNER = Nominal Exchange rate is the national currency per U.S. dollar taken as period averages (Equation 1 of PPP).
- lnPD = Price Differential is the GDP Deflator of Pakistan divided by the GDP Deflator of U.S. (Equation 1 of PPP).
- prcntNER = Percentage change in nominal exchange rate
- prcntINF = Percentage change in the prices of both countries that is in other words, the inflation differential between two countries.
- lnRER = Real Exchange rate which is calculated as; the nominal exchange rate of Pakistan in terms of US dollar multiplied by the tradable prices of U.S. divided by the non-traded prices of Pakistan ($e.P^*t/Pn$).
- $\ln RER^T$ = Real exchange rate based on the tradable sector prices ($e.P^*_t/P_t$).
- lnRPROD = Relative productivity is calculated as the labour productivity of Pakistan in industrial sector divided by the productivity of Pakistan in services sector then divide this whole term with the labour productivity of U.S. in industrial sector divided by labour productivity in services sector. Where 'Industry' is the proxy for traded goods sector while 'Services is the proxy for

non-traded goods sector and labour productivity is measured as the sectoral output divided by the sectoral employment in each sector of the related country.

- lnRPRCS = Relative prices are the services share of Pakistan in GDP Deflator divided by the industrial share of Pakistan in GDP Deflator then divide this whole term by the services share of U.S. in GDP Deflator divided by the industrial share of U.S. in GDP Deflator. Where, GDP Deflator is calculated by dividing the nominal to real GDP.
- lnWP = World prices are the world average crude oil prices index.
- lnTOT = Terms of Trade is the unit value of exports divided by the unit value of imports.
- lnGEX = Government consumption expenditures as a percent of GDP
- lnM2 = M2 is the proxy for money supply.

3.6. Theoretical Relationships

Terms of trade is reflecting the external price shock. Terms of trade exhibits an income effect and a substitution effect. Therefore, the terms of trade effect is ambiguous. The effect of government consumption depends upon the utilisation of the consumption on traded or non-traded goods. Like the government consumption expenditures, the effect of the money supply on the real exchange rate depends upon whether the people are utilising this money in the purchase of tradables (like, import of machinery and raw materials) or non-tradables. So, the effect of money supply on RER is blurred. For the world prices, it is considered that for the oil exporting countries, an increase in the oil price will result in the appreciation of the RER of the country. While, for the oil importing countries, an increase in the oil price will result in the depreciation of the RER of the country. However, empirically this relationship can be altered [Chinn (1998)].

4. DATA AND METHODOLOGY

4.1. Data Sources and Description

For the empirical estimation of the HBS hypothesis in Pakistan, time series data have been used for the period 1972-2008. Where, United States has been selected as a numeraire country to compare the relative productivities and relative prices data of Pakistan. Although, both the countries are not similar in terms of the per capita income, the comparison has been made at the ground of the highest share of trade in Pakistan with U.S. For traded goods, industrial data is used for both Pakistan and U.S. where industry includes, manufacturing, mining and construction. The composition of the industrial sector is same for both the countries. While, services are the proxy for non-traded goods where, services includes, trade, communication, transportation and all other services.

All the data series are taken from IFS CD-ROM and Online (2010) except for the RPROD, RPRCS, and M2. M2 for Pakistan is taken from the Handbook of statistics issued by State Bank of Pakistan. Relative prices are taken from WDI CD-ROM and Online (2010). For relative productivity of Pakistan, sectoral output is taken from different issues of Economic Survey of Pakistan while sectoral employment is taken from Labour Force Survey. For US, output by sectors is taken from WDI CD-ROM and online, (2010) while sectoral employment data is taken from International Labour Organisation (2010).

To make consistency, all the series are in natural logs, converted into million rupees and based on 2000 (= 100).

Analysis of Data

Table 1

Growth Rates of Sectoral Productivity, Sectoral Prices and Real Exchange Rate

		Average Annual Growth Rates (%)							
		Pakistan				United States			
		Productivity		Prices		Productivity		Prices	
Periods	RER	Industry	Services	Industry	Services	Industry	Services	Industry	Services
1973-77	12.23	1.62	2.78	9.24	7.99	4.61	3.07	8.72	7.69
1978-82	6.83	8.91	2.09	4.57	7.87	5.19	3.86	10.76	7.36
1983-87	13.97	-1.52	8.94	-3.69	-3.75	8.60	11.14	1.12	5.90
1988-92	8.99	7.46	3.91	1.82	1.73	8.59	9.61	2.70	4.35
1993-97	9.92	1.56	-0.38	1.10	1.91	12.52	12.32	0.94	2.52
1998-02	7.70	-1.59	3.79	0.03	1.03	9.84	9.99	0.30	2.29
2003-08	-1.90	4.07	1.61	9.31	8.38	4.04	3.76	3.27	2.64
Total avg.	7.97	2.93	3.25	3.20	3.59	7.63	7.68	3.97	4.68

Source: Based on author's own calculations.

As shown in above Table 1, the productivities in Pakistan are not acting according to the HBS hypothesis , as, average productivity in industrial sector is 0.32 percent lesser than the services productivity for the period of 1973-2008. However, as for as services prices are concerned, it is acting according to the theory and the services prices are 0.39 percent higher than the industrial prices. If relative productivities are lower then services prices must be lower. Thus, the reason for this opposite relation or the upward pressure of the services prices can be demand side of the economy or some external shocks. But, the relationship between relative productivities and RER is showing somehow favourable condition for the HBS, as, relative industrial productivity in Pakistan is less than the relative industrial productivity of U.S. leading towards the depreciation of RER of Pakistan. Therefore, this entire situation leads to the prophecy that countries with high productivity growth will have an overvaluation of their currencies. Moreover, the poorer countries will have the depreciated RER due to the slow GDP growth leading towards the low productivity growth. Because of the real GDP per capita of the developing countries, fall relative to the developed countries [Bianco (2008)].

On the other hand, in United States, productivities and prices are behaving somehow different. Labour productivity in industrial and services sector are almost the same but services prices are 71 percent higher than the industrial prices. However, prices are moving according to the theory. As, relative non-tradable sector prices are lower in the Pakistan than the U.S. leading to RER depreciation of 7.97 percent.

4.2. Methodology

To start the estimation, firstly, the time series properties of RER and relevant fundamentals have been evaluated. If series are proved to stationary, then Ordinary Least Squares (OLS) yields accurate results and standard't' and 'F' statistics can be used as inference. But in case of non-stationary series, ‘t’ and ‘F’ statistics do not give meaningful results. Thus, the analysis of the time series properties of the variables in question helps to determine an appropriate estimation technique.

Augmented Dickey Fuller (ADF, 1979) Unit Root Test

To see the non-stationary of the series ADF has been implied.

Table 2

Augmented Dickey Fuller Unit-Root Test Results

Variables	Level	First diff	Integration Order
$lnNER_t$	5.793	–2.667*	I(1)
$lnPD_t$	6.006	–90.07*	I(1)
lnRERppp	0.1866	–5.1910*	I(1)
$changeNER_t$	–0.564	–3.176*	I(1)
$changePD_t$	**–2.462**	–4.758*	I(1)
$lnRER_t$	2.360	–7.559*	I(1)
$lnRPRCS_t$	–0.351	–4.863*	I(1)
$lnRPROD_t$	-0.164	–6.004*	I(1)
$lnWP_t$	2.325	–4.735*	I(1)
$lnGEX_t$	4.402	–2.265*	I(1)
$lnTOT_t$	–1.310	–5.430*	I(1)
$lnM2_t$	**–1.317**	–4.335*	I(1)

Notes: (1) * is indicating 1 percent level of significance. (2) All tests are conducted without including any trend or intercept except for the series in bold. (3) Bold series’ test is conducted by including ‘intercept’. (4) Automatic lag length selection (Schwarz Information Criterion) has been used with maximum 8 lags.

The ADF test has been applied on individual series (in levels) and resulting test statistics are compared with the ADF critical values where, the test statistic is proving to be less than the critical value for each series. Consequently, the null of the non-stationary can not be rejected. Similarly, the application of the test to the first differences of the individual series yields a test statistics which is greater than the critical values for each series indicating that all the series are I (1) process. Thus, all the series are showing the same order of integration. Therefore, it is concluded that all the series are non-stationary in levels but stationary at first difference.

However, in the presence of non-stationary series the standard tests of OLS in not valid due to its spurious results.Therefore, one way to escape from these spurious regressions is to see the co-integration relationship between these non-stationary series.

Co-integration Theory

According to the Engle and Granger (1987), co-integration relationship says that despite the fact that series are individually non-stationary but a linear combination of two or more non-stationary series will become stationary. Moreover, two variables will be co-integrated if they have a long-run relationship between them. However, Engle-Granger two-step approach is more famous for testing the co-integration relationship between two series. If there are more than two series in the regression, then Vector Autoregressive (VAR) based Johansen co-integration approach, developed in (1991, 1995a), is more relevant and practical.

VAR-based Johansen Co-integration

This approach implements a system by assuming a VAR of order 'P'

$$X_t = A_1X_{t-1} + A_2X_{t-2} + \ldots\ldots + A_pX_{t-p} + By_t + Z_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \text{(X)}$$

Where X_t is a k-vector of non-stationary I (1) variables, y_t is a d-vector of deterministic variables, and Z_t is a vector of shocks or innovations. Therefore, this system of VAR can be rewrite as,

$$\Delta X_t = \varphi X_{t\text{-}1} + \eta_i\, \Delta X_{t\text{-}i} + By_t + Z_t \ldots\ldots\ldots \text{(X.1)} \qquad \text{Where, } \varphi = A_i - I, \text{ and } \quad \eta_i = -A_j$$

Granger, (1987) represents it by saying that if the coefficient matrix φ has reduced rank means, $r < k$ (where r is the number of co-integrating relations), then there exists k x r matrices θ and γ each with rank 'r' such that

$\varphi = \theta\ x\ \gamma$' and $\gamma' X_t$ is I (0)

Where each column of γ is the co-integrating vector and elements of θ are representing the adjustment parameters of Vector Error Correction Model (VECM). Johansen estimates this φ matrix through an unrestricted VAR and tests whether the restrictions implied by the reduced rank of φ can be rejected or not. Furthermore, he estimates the equation (X.1) by Maximum Likelihood method and determines the number of co-integrating vectors or rank of the 'r' by Trace statistics and Maximum Eigen-value (λ-max).

5. ECONOMETRICS RESULTS

5.1. Model Specification and Lag Selection in VAR

As it is mentioned in the previous chapter that, co-integration analysis is sensitive to the specification of the trends and the number of the lags used in the VAR. Therefore, a greater attention has been given to this part to deal with this problem.

Table 3

Results of the Model Specification and Lag Selection

		LR	FPE	SC	AIC	HQ	Preferred Lags	Preferred Model
PPP		1	1	1	1	1	1	2
Restricted Model	Penn-effect	1	2	1	2	1	1	3
	Indirect effect	1	1	1	1	1	1	3
	BS effect	2	2	1	2	2	2	3
Unrestricted Model	Penn-effect	3	3	1	3	3	3	3
	Indirect effect	1	1	1	2	1	1	2
	BS effect	1	1	1	2	1	1	3

Note: Lag selection has been conducted by the k-max = 3. LR: sequential modified LR test statistic (each test at 5 percent level), FPE: Final Prediction Error, AIC: Akaike Information Criterion, SIC: Schwarz Information Criterion, HQ: Hannan-Quinn Information Criterion. Model 3: Linear trends in the level data but not in the VAR.

In Table 3, the selection of the preferred lag(s) has been done according to the decision of maximum criteria.

5.2. PPP Results

To examine whether the nominal exchange rate and the price differential have a long run co-integrating relationship or not, Trace-statistics and Max-Eigenvalue statistics have been used.

Table 4

Results of the Co-integrating Rank for Purchasing Power Parity Model

Null Hypothesis	Absolute PPP r = 0	r ≤ 1	Rank
Trace Statistics	21.39742*	2.333243	1
Max-Eigen Statistics	19.06418*	2.333243	1
	Relative PPP		
Trace Statistics	14.83588	5.078195	0
Max-Eigen Statistics	9.757685	5.078195	0

Note: * is for significance at 5 percent level.

Table 4 is depicting that both nominal exchange rate and price difference are having long run relationship in Pakistan as both of the statistics are in favour of one co-integrating rank for this relationship. However, the results of relative form of PPP are indicating that there is no co-integrating equation in the model.

The below Table 5 is indicating that long run relationship is insignificant in the form of both absolute and relative PPP.

Table 5

Results of the Long run and Short run Coefficients for PPP

	Absolute PPP Long run Co-integrating Coefficients	
lnNER	**lnCPI**	**C**
1.000000	0.630288 (0.94429)	1.053407 (0.37525)
	Short run Adjustment Coefficients	
0.022758 (2.7923)**	0.022728 (4.50059)*	
	Relative PPP Long run Co-integrating Coefficients	
CHANGENER	**CHANGECPI**	**C**
1.000000	0.473355 (1.12770)	4.603331 (2.0684)**
	Short run Adjustment Coefficients	
–0.648720 (3.0595)*	0.015188 (0.12753)	

Note: Values in parentheses are the t values. * and ** are for significant at 1 percent and 5 percent level of significance, respectively.

Table 2 can validate these results, where lnRERppp is a non-stationary variable. Which indicates that for Pakistan, PPP does not hold in the long run. The results are in accordance with the results of the many studies including the developing countries. As, Khan and Ahmad (2005) found no favourable results for PPP in Pakistan using consumer price index and gross domestic product deflator. Testing for thirty developing countries, Holmas (2002) also found no compelling results in favour of PPP. Further, the Sarno and Taylor (2002) conclude that PPP can be of long run phenomena when applied to the bilateral exchange rate of the key industrialised countries.

5.3. Results of Restricted Model

After the rejection of the nominal theory of RER determination in Pakistan, now the analysis has been turned out toward the real theory of RER determination - the HBS hypothesis.

Table 6

Results of the Co-integrating Rank for Restricted Model

Null Hypothesis		r = 0	r ≤ 1	Rank
Penn-effect	Trace	16.73672*	1.836606	1
	Max-Eigen	14.90011*	1.836606	1
Indirect Effect	Trace	27.81613*	1.93708	1
	Max-Eigen	26.62242*	1.93708	1
B-S Effect	Trace	15.62315*	0.195152	1
	Max-Eigen	15.42800*	0.195152	1

Note: '*' indicates rejection of the null hypothesis at 5 percent level of significance.

Table 6 is showing that both Trace and Max-Eigen statistics are favouring the long run relationship for the components of 'restricted model'. As, both the tests are rejecting the null of 'no co-integrating rank' at five percent level of significance and unable to reject the null of 'at least one co-integrating rank'.

However, before further proceeding with the results of the 'restricted model', it is necessary to validate the assumption of the "PPP in tradable sector prices".

Testing the PPP in Traded Sector

To see the stationarity of the RER^T, two types of unit-root tests have been applied. The results of these two tests are given below;

Table 7

Unit-Root Tests Results of $lnRER^T$

	ADF			KPSS	
	Level	1st diff.	Order of Integration	Level	Order of Integration
None	–3.141*	–	I (0)	–	–
Trend and Intercept	–1.393	–7.234*	I (1)	**0.124**	I (0)
Intercept	–1.436	–7.494*	I (1)	**0.688**	I (0)

Note: * is for significant at 1 percent level of significance. Bold values are showing the LM statistics of KPSS which indicating that H_0 cannot be rejected.

Table 7 explains the Unit-Roots of the part of the real exchange rate that includes only tradable sector prices. Unit-Root of the series has been evaluated through two alternative tests ADF and Kwiatkowski-Phillips-Schmidt-Shin (KPSS) (1992). KPSS has been selected to verify the results of ADF because where all other four tests of the unit-root assumes non-stationary in the series as a null hypothesis, KPSS assumes 'series is stationary' in the null hypothesis.

In the Table 8, there are five specifications regarding the stationarity of the '$\ln RER^{T}$' where out of five, three results are in favour of that series is stationary or I (0). While favouring the PPP in Pakistan, Khan and Qayyum (2007) give two reasons for the existence of PPP in the tradable sector. One is that since 1990, Pakistan is pursuing trade liberalisation policies and the second one is that economic development of developing countries like Pakistan is highly dependent on the developed countries. It means that part of the real exchange rate, which represents non-tradable sector prices, can be a factor explaining reasoning of non-stationarity in RER.

Table 8

Results of the Long-run and Short-run Coefficients for Restricted Model

Long Run Co-integrating Coefficients					
Penn-effect		Indirect Effect		BS Effect	
lnRPRCS	lnRPROD	lnRER	lnRPRCS	lnRER	lnRPROD
1.000000	–1.178903	1.000000	–11.03334	1.000000	9.635449
	(4.43413)*		(7.05636)*		(4.42206)*
Short Run Adjustment Coefficients					
-0.092810	–0.443301	0.067103	–0.024687	0.009989	0.54263
(1.85929)***	(4.03778)*	(4.97059)*	(2.98152)**	(0.81609)	(4.03742)*

Note: Values in parentheses are the t-values. *, **, *** are significant at 1 percent, 5 percent and 10 percent level of significance, respectively.

In Table 8 the long run normalised co-integrating coefficient value of '*lnRPROD*' is indicating that relative productivity of tradable sector has a significant effect on the relative prices of non-tradable sector and a 1 percent increase in relative productivity will result in 1.17 percent decrease in relative prices. Which means that rather than increasing in the non-tradable prices, as suggested by the HBS hypothesis, it will decrease due to the increase in the relative productivity. Moreover, the short run adjustment parameters are suggesting that in the short run, adjustment will take place in both the variables. However, the adjustment process is very slow following 0.09 and 0.44 for RPRCS and RPROD, respectively.

On the other hand, by looking at the situation of 'Indirect effect' it can be observed that there exists a significant and negative effect of relative prices on the exchange rate. Broadly speaking, one percent increase in the relative prices of non-traded sector in Pakistan relative to U.S. will result in the appreciation of RER of Pakistan by 11 percent. Where, sign is according to theory, but, the elasticity is much higher which can be reduced in the presence of some other economic fundamentals in the model. In the short run, RPRCS will adjust by 0.02 percent to remove any disequilibrium. Again, the short run adjustment parameter is very low indicating that, economy will recover from its disequilibrium only in the long run.

In Table 8, the third part of the hypothesis, which directly relates relative productivities and real exchange rate, is showing significant but positive effect as one percent increase in the relative productivity of tradable sector will result in the 9.63 percent depreciation of the real exchange rate. Where, the short run adjustment parameters are also verifying the long run relationship of the RPROD and RER.

These results are opposite to the results of Egert (2002) which found the strong relationship between relative productivities and relative prices while there was a weak relationship between relative prices and RER of transition economies. But, the results are in favour of Chowdhury (2007) which estimated the BS effect for SAARC countries. On the failure of HBS model, Lafrance and Schembri (2000) said that

> *"Because both the exchange rate and relative productivity depend on a large set of underlying factors, it is highly unlikely that a simple causal relationship between the two variables exists and can be easily detected from the data".*

According to De Gregorio and Wolf (1994), in the time series regressions, it is highly difficult to find a role for supply side effects on the real exchange rate. Therefore, to incorporate the role for relative productivity level one must include demand shocks like government spending. Due to the underlying reasons, it is worthy to estimate an '***Unrestricted model***', which incorporates not only the productivity shocks but also some demand side factors.

5.4. Results of the Unrestricted Model

The long run relationship of the variables is being analysed, again, through the Trace and Max-Eigen statistics.

Table 9

Results of the Co-integrating Rank for Unrestricted Model

Null hypothesis		r = 0	r ≤ 1	r ≤ 2	r ≤ 3	r ≤ 4	r ≤ 5	Rank
Penn Effect	Trace	166.19*	100.461*	50.078	31.299	14.955	3.653	2
	Max-Eigen	65.730*	50.383*	18.778	16.344	11.302	3.653	2
Indirect Effect	Trace	143.01*	87.134	55.167	33.511	15.468	7.203	1
	Max-Eigen	55.869*	31.967	21.656	18.042	8.265	7.203	1
BS Effect	Trace	112.64*	67.686	38.315	18.388	6.441	1.250	1
	Max-Eigen	44.962*	29.371	19.926	11.947	5.1909	1.250	1

Note: *, ** are significant at 1 percent and 5 percent level of significance, respectively.

Results in Table 9 show that there exists a long run relationship between the components of the 'unrestricted model'. As, there are two co-integrating equations in the 'Penn effect' and one in the vectors of 'Indirect effect' and 'BS effect', as well.

Short-run and Long-run Coefficients of Unrestricted Model

The first part of the Table 10, which belongs to the long run co-integrating coefficients of the 'Penn effect', is representing that all the explanatory variables are having significant and positive relationship with relative prices except for the M2 and

TOT. Which is imposing negative impact on relative prices as one percent increase in the M2 will result in the 0.51 percent decrease in the relative prices of non-tradable sector and one percent increase in the TOT will result in the 0.53 decrease in the non-tradable prices. However, the coefficient of relative productivities is fulfilling the requirement of the HBS hypothesis by representing significant and positive impact of relative productivities on relative prices.

Table 10

Results of the Long-run and Short-run Coefficients for Unrestricted Model

			Penn – Effect			
Variables	lnRPRCS	lnRPROD	lnGEX	lnTOT	lnM2	lnWP
Long run	1.0000	0.242141	0.412320	–0.539869	-0.516061	0.227453
		(2.593)**	(4.19010)*	(3.92882)*	(6.36728)*	(4.20560)*
Short run	–0.01535	0.523398	0.142836	–0.207035	–0.322628	–0.120785
	(0.2935)	(2.065) **	(0.62885)	(0.89074)	(5.61812)*	(0.18969)
			Indirect Effect			
Variables	**lnRER**	**lnRPRCS**	**lnGEX**	**lnTOT**	**lnM2**	**lnWP**
Long run	1.0000	–5.523992	–1.574547	1.331372	1.436149	–0.241788
		(5.57376)*	(2.5874)**	(1.716)***	(3.05306)*	(0.77756)
Short run	0.103398	–0.051485	0.000672	0.017576	0.017135	–0.139697
	(5.1690)*	(4.91848) *	(0.02572)	(0.63525)	(1.42719)	(1.846)***
			BS Effect			
Variables	**lnRER**	**lnRPROD**	**lnGEX**	**lnTOT**	**lnM2**	**lnWP**
Long run	1.0000	–0.695969	–1.833554	–1.584440	2.294959	–1.387244
		(2.4231)**	(6.19980)	(4.4188) *	(10.1129) *	(9.4339) *
Short run	0.119828	0.087714	–0.131382	0.092398	0.005605	–0.720870
	(1.7826)	(0.98304)	(2.00615) *	(1.33365)	(0.17988)	(4.3441) *

Note: Values in the parentheses are the t-values. '*, **, ***' are significant at1 percent, 5 percent and 10 percent level of significance, respectively.

If the above results are compared with the results of the restricted model, then it is evident that due to the inclusion of the relevant explanatory variables the relative productivity now has a positive relationship with relative prices, as one percent increase in the relative productivity will be resulted in the appreciation of relative prices in Pakistan by 0.24 percent. GEX is representing that government is spending more on the services, due to which prices of services is increasing by 0.41 percent. WP is capturing the effect of exogenous shock, which is another cause of the positive reception of the relative services prices in Pakistan.

The short run adjustment parameters are showing that, if there is any disequilibrium in the relative prices then, M2 will help to mitigate this disequilibrium. Where, adjustment will take place by 0.32 percent in one time (or year).

The second part of the Table 5.6 contains the results of the 'Indirect effect'. Where, RPRCS and GEX are the sources for the appreciation of the RER. As one percent increase in the RPRCS, RER will appreciate by 5.52 and due to the GEX, RER will appreciate by 1.57 percent. On the other hand, TOT and M2 are depreciating the RER by 1.33 and 1.43 percent, respectively.

The adjustment coefficients are representing that RPRCS and WP will adjust in the short run to come back the RER on its equilibrium. However, the adjustment coefficients are very low, indicating a long run equilibrium process.

The third and the last part of the Table 5.6 is about the BS effect that is the direct relationship of the RPROD and RER in the presence of the macroeconomic fundamentals. This says that one percent increase in the relative productivity will appreciate the RER by 0.69 percent. This estimated B-S effect is also comparable with the coefficient estimated for developing countries. Choudhri and Khan (2005) estimated the B-S coefficient for developing countries, incorporating terms of trade and productivity difference as explanatory variables, between 0.9 and 1.2. For the GEX and WP, it is evident that both the variables are contributing significantly for the appreciation of the RER in Pakistan and signs and magnitudes are according to the theory. M2 is the variable, which is depicting that due to the increase in the money supply RER will depreciate by 2.29 percent. On the other hand, TOT is appreciating the RER of Pakistan by 1.58 percent.

6. CONCLUSION AND POLICY IMPLICATION

The issues of HBS and PPP are addressed a lot of time for the developed, transition, OECD and developing countries. However, due to the different data ranges, methodologies, explanatory variables and the use of the proxies, the different results have been emerged. Some are in favour of PPP for the real exchange rate determination while others are favouring HBS or its extended form.

Taking into account for the issues in literature related to PPP and HBS, both of the theories are re-examined in this study for Pakistan by employing VAR based Johenson Co-integration method, for the period of 1972-2008. Where, the PPP theory does not hold for Pakistan because there is no long run cointegtaing relation between prices and nominal exchange rate. Furthermore, the non-stationarity of the real exchange rate tested by the Augmented Dickey Fuller test is also verifying the divergence of the exchange rate from its long run equilibrium of PPP.

On the other hand, the stationarity of the exchange rate based on the tradable sector's prices is indicating that there is the greater chance of the existence of the HBS in Pakistan. However, the results of the HBS are also not in the favour of the productivity-biased explanation of the higher prices in Pakistan, as there is significant relationship between relative tradable goods' productivity and relative non-traded goods prices but the sign is not positive. However, the relationship between relative non-traded sector prices and relative exchange rate is much stronger following that real exchange rate is appreciating due to the increase in the non-traded goods prices. That is signaling for the presence of some other explanatory variables, along with the productivity-bias for the exchange rate determination.

Therefore, the extended HBS model is estimated based on various macroeconomic fundamentals suggested in economic literature. Now, the results are in favour of HBS, where, in one-step approach, relative productivity, government consumption expenditures, terms of trade and world oil prices are significantly contributing in the appreciation of real exchange rate in Pakistan, while money supply is a significant source for the depreciation of RER. Furthermore, the elasticity of the relative productivity is also in line with the theory. So, money supply is the best rule to decrease the relative non-traded prices and for the depreciation of real exchange rate. In other words, there must be some role of the central bank to reduce the fluctuations of the RER.

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The Current Account Dynamics in Pakistan: An Intertemporal Optimisation Perspective

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1. INTRODUCTION

Current account is a variable that is both a broad reflection of the stance of macroeconomic policies and a source of information about the behaviour of economic agents. It reflects not only changes in a country's trade flows, but also the difference between a country's saving and investment. Furthermore, the current-account balance can also be described as the addition to a country's claims on the rest of the world. Hence, movements in current account convey information about the actions and expectations of all market participants in an open economy.

The modern macroeconomic models of the open economy have emphasised that the current account is an intertemporal phenomenon. The movements in the current account are deeply intertwined and convey the information about the actions and expectations of all economic agents in an open economy. Therefore, the current account is an important macroeconomic indicator for policy decisions and the measurement of economic performance in any open economy. An array of theories has actually been developed to analyse the behaviour of the current account movements during the second half of twentieth century. However, the failure of each successive theory to adequately explain the dynamic behaviour of the current account in the face of rapidly changing economic conditions has led to the emergence of the intertemporal approach to current account (ICA). This approach has gained popularity since the introduction of the theoretical model into the literature by Sachs (1981, 1982) that builds upon the neoclassical theory. Systematic empirical tests of the intertemporal model used the approach originally pioneered by Campbell (1987) and Campbell and Shiller (1987) to derive the optimal current account of an optimising agent within the VAR testing principle.

Current account deficit (CAD) has been a constant feature of Pakistan's economy as in the last 63 years the country faced current account surplus only in six years. Three of these six years are FY 01 (1.878 billion dollars), FY 02 ($3.854 billion dollars) and FY 03 ($3.573 billion). This structural feature of the economy stems from the fact that Pakistan is one of those developing countries which neither export oil nor any other

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mineral. The structural tendency of current account deficit in our economy has re-asserted with a bang in 2004-05 when we had a current account deficit of $0.817 billion. The CAD of 2005-06 surpassed this figure and stood at $3.606 billion. This has raised alarm bells in Washington and in Pakistan. Both the International Monetary Fund (IMF) and the World Bank (WB) have advised the government to devalue the currency by at least 10 percent. However, the increasing trend in CAD continues and it touched the figure $ 9.26 billion in 2008 and then a decline was observed in it during 2009 when we had a CAD of $ 3.95 billion.[1] The major driver in accelerating the CAD is the widening trade imbalance in both goods and services.

Since the early 1980s there has been substantial growth in the literature using the ICA to analyse the behaviour of the current account movements for different countries and time periods. The theoretical refinements in the intertemporal approach have led most of the empirical studies in the literature today to apply the basic present value model of current account (PVMCA) and its extended versions to examine the fluctuations in the current account balances of both developed and developing countries. To date, the empirical support for the PVMCA to a certain extent is mixed. For example, Sheffrin and Woo (1990), Milbourne and Otto (1992), Otto (1992), Manteu (1997), Makrydakis (1999), Ogus and Niloufer (2006), Goh (2007) and Khundrakpam and Rajiv (2008) find evidence against the basic PVMCA which is not a surprising result for this version of the ICA [Bergin and Sheffrin (2000); and Nason and Roger (2006)]. However, the findings of Ghosh and Ostry (1995)[2] and Agenor, *et. al*. (1999) reveal that the basic PVMCA conforms to the restrictions implied by the intertemporal theory quite well. Though highly stylised, the basic PVMCA has been the test bed for the entire intertemporal approach most consistently used in the literature. Formal tests of this model in most of the cases have routinely failed while the search for sources of failure goes on.

Bergin and Sheffrin (2000) identify stochastic world interest rates and real exchanges rates to be incorporated in the model as they show an improved performance of the model in the presence of these variables. The authors argue that external shocks are most likely to affect the current account balance of small open economies through these variables. Gruber (2004) shows the inclusion of habit formation improves the ability of the simple PVMCA to match current account data. However, Kano (2008) argues that the PVMCA with habit formation in consumption is observationally equivalent to a PVMCA with a transitory consumption component potentially generated by stochastic (consumption-based) world real interest rates. This observation implies that the Gruber's test of the PVMCA with habit formation has no power against the alternative, i.e., the PVMCA with stochastic (consumption-based) world real interest rates. Nason and Rogers (2006) observe that the failure of the basic PVMCA is explained by the absence from time varying world real interest rates at best. For the last few years an extended PVMCA developed by Bergin and Sheffrin (2000) which allows simultaneously for time-varying world real interest rates and exchanges rates has been used by many studies. This version of the ICA performed relatively better as compared to its basic counterpart [see, for example, Adedeji, (2001); Landeau (2002); Saksonovs (2006); Darku (2008); and Campa

[1]*Source: Pakistan Economic Survey* (2005-06 and 2009-10).

[2]For majority of developing countries included in their sample a favourable evidence has been recorded.

and Gavilan (2010), among others]. The aim of this study is to examine and compare the ability of the intertemporal models (basic and extended) to explain fluctuations in Pakistan's current account. In particular, it examines whether the inclusion of the stochastic world interest rate and the exchange rate yield an improvement in the fit of data. The present study appears to be first in the context of Pakistan that applies the extended PVMCA developed by Bergin and Sheffrin (2000) for analysing the behaviour of the current account balance.

The rest of this study is organised as follows: Section 2 presents the analytical framework and the data; Section 3 initially conducts the empirical tests of the basic model and then it proceeds to discuss the results when the model is extended to incorporate changes in the world interest rate and the exchange rate; and final section concludes the study.

2. ANALYTICAL FRAMEWORK

2.1. The Basic PVMCA and Its Testable Implications

The theoretical model adopted here is based on Sachs (1981), Sheffrin and Woo (1990), Otto (1992) and Ghosh (1995). The basic PVMCA considers an infinitely lived representative household in a small open economy. This economy consumes a single good and has access to the world capital markets at an exogenously given world real interest rate. The intertemporal model is similar to the PIH [Friedman (1957); and Hall (1978)] where the representative agent chooses an optimal consumption path to maximise the present-value of lifetime utility subject to a budget constraint. The representative agent is assumed to have rational expectations. The infinitely lived household has the expected lifetime utility function given as:

$$E_tU = E_t\left[u(C_t) + \beta u(C_{t+1}) + \beta^2 u(C_{t+2}) + \cdots\cdots\right] = E_t\left[\sum_{s=t}^{\infty} \beta^{s-t}\{u(C_s)\}\right], \qquad \ldots \qquad (1)$$

where E_tU is the expected utility, E_t is the conditional expectations operator based on the information set of the representative agent at period t, β is the subjective discount factor with $0 < \beta < 1$, and C represents private consumption of the single good. The period utility function $u(C)$ is continuously differentiable and it is also strictly increasing in consumption and strictly concave: $u'(C) > 0$ and $u''(C) < 0$.

In the ICA the current account acts as a mean of smoothing consumption amidst shocks faced by the economy e.g., shocks to national output, investment and government spending. The current account expresses the evolution of the country's net foreign assets with the rest of the world and is given by:

$$CA_s = A_{s+1} - A_s = Y_s + rA_s - C_s - I_s - G_s, \qquad \ldots \qquad \ldots \qquad \ldots \qquad \ldots \qquad (2)$$

where CA_s is the current account balance in period *s*, A_s represents the country's net foreign assets, *r* denotes the world real interest rate (assumed constant), Y_s is the gross domestic product, C_s, I_s and G_s capture aggregate consumption, government expenditures and total investment respectively.

Constraint (2) holds as an equality based on the assumption of non-satiation. By taking the expectation of (2) and by imposing the standard no-Ponzi game condition to rule out the possibility of bubbles, iterating the dynamic budget constraint in (2) gives the intertemporal budget constraint facing the representative agent as:

$$\sum_{s=t}^{\infty}\left(\frac{1}{1+r}\right)^{s-t} Y_s + (1+r)A_t = \sum_{s=t}^{\infty}\left(\frac{1}{1+r}\right)^{s-t}\left(C_s + I_s + G_s\right) \quad \ldots \quad \ldots \quad \ldots \quad (3)$$

Deriving and substituting the optimal consumption level in Equation (2), it can be shown that the present value relationship between the current account balance and future changes in net output (ΔNO) is given by:

$$\widehat{CA}_t = -\sum_{s=t+1}^{\infty}\left(\frac{1}{1+r}\right)^{s-t} E_t\left(\Delta NO_s\right) \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (4)^3$$

We define net output (NO) as gross domestic output less gross investment and government expenditures i.e.,

$$NO \equiv Y - I - G. \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (5)$$

According to Equation (4), the optimal current account balance is equal to minus the present value of the expected changes in net output. For example, the representative agent will increase its current account, accumulating foreign assets, if a future decrease in income is expected and *vice versa*.

But problem is that Equation (4) is not empirically operational because the expression requires the researcher to be knowledgeable of the full information set of consumers' expectations. Campbell and Shiller (1987) explain that information on consumers' expectations is not required since the current account contains consumers' expectations of shocks to national cash flow. We begin therefore by estimating a first-order vector autoregressive (VAR)[4] model in the changes in net output and the current account as:

$$\begin{bmatrix}\Delta NO_s \\ CA_s\end{bmatrix} = \begin{bmatrix}\phi_{11} & \phi_{12} \\ \phi_{21} & \phi_{22}\end{bmatrix}\begin{bmatrix}\Delta NO_{s-1} \\ CA_{s-1}\end{bmatrix} + \begin{bmatrix}\varepsilon_{1s} \\ \varepsilon_{2s}\end{bmatrix} \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (6)$$

where ε_{1s} and ε_{2s} are errors with conditional means of zero, ΔNO_s and CA_s are now expressed as deviations from unconditional means so that only the dynamic restrictions of the present value model of the current account are tested [see Otto (1992); Ghosh (1995); Adler (2002); Goh (2007) and Adedeji and Jagdish (2008)]. The main interest in (6)

[3]See Sheffrin and Woo (1990), Milbourne and Otto (1992), Otto (1992), Ghosh and Ostry (1995) and Makrydakis (1999) for derivation details.

[4]The generalisation to higher order VARs is straightforward. Given that the present study will use annual data and that the sample is relatively small, the first order VAR is sufficient to capture the time series properties.

concerns the regression in which ΔNO_s is a dependent variable. It is the discounted value of all date s forecasts of this variable conditional on the agent's full set of information that will determine the optimal current account at time t. That is, according to (6), future expected changes in net output are reflected in today's current account. Then intuitively, not only will ΔNO_{s-1} be important in determining ΔNO_s but also CA_{s-1} is helpful in predicting ΔNO_s, since it may contain additional information. So, Granger causality should run from the current account to changes in net output.

Taking expectation of Equation (6) we get

$$E_t\begin{bmatrix}\Delta NO_s \\ CA_s\end{bmatrix}=\begin{bmatrix}\phi_{11} & \phi_{12} \\ \phi_{21} & \phi_{22}\end{bmatrix}^{s-t}\begin{bmatrix}\Delta NO_t \\ CA_t\end{bmatrix}. \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (7)$$

In Equation (7) we use the condition that $E_t\left(X_{t+j}\right)=\Omega^j X$ which is derived considering that expectations are formed rationally in the underlying theoretical model [Makrydakis (1999)]. Ω is the 2×2 matrix of coefficients ϕ_{ij}. We can get forecast of ΔNO_s by premultiplying right hand side of Equation (7) by vector $[1 \quad 0]$ as:

$$E_t\Delta NO_s=\begin{bmatrix}1 & 0\end{bmatrix}\begin{bmatrix}\phi_{11} & \phi_{12} \\ \phi_{21} & \phi_{22}\end{bmatrix}^{s-t}\begin{bmatrix}\Delta NO_t \\ CA_t\end{bmatrix} \quad \ldots \quad \ldots \quad \ldots \quad (8)$$

Or

$$E_t\Delta NO_s=\begin{bmatrix}1 & 0\end{bmatrix}\Omega^{s-t}\begin{bmatrix}\Delta NO_t \\ CA_t\end{bmatrix} \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (9)$$

Let I be a 2×2 identity matrix. Substituting Equation (9) into Equation (4) and simplifying gives:

$$\widehat{CA}_t=-\begin{bmatrix}1 & 0\end{bmatrix}\left(\frac{1}{1+r}\Omega\right)\left(I-\frac{1}{1+r}\Omega\right)^{-1}\begin{bmatrix}\Delta NO_t \\ CA_t\end{bmatrix}$$

$$=\begin{bmatrix}\Phi_{\Delta NO} & \Phi_{CA}\end{bmatrix}\begin{bmatrix}\Delta NO_t \\ CA_t\end{bmatrix}=k\begin{bmatrix}\Delta NO_t \\ CA_t\end{bmatrix} \quad \ldots \quad \ldots \quad \ldots \quad (10)$$

Equation (10) has the advantage that the optimal current account series $\widehat{CA}_t$ can be compared to the actual series CA_t. If the model is true, the two series should be identical. So, if the model is true, it follows that

$$\widehat{CA}_t=\begin{bmatrix}0 & 1\end{bmatrix}\begin{bmatrix}\Delta NO_t \\ CA_t\end{bmatrix}=CA_t. \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (11)$$

There are a few testable implications of the present value relationship indicated in Equation (4) noted in Otto (1992), Ghosh and Ostry (1995), Makrydakis (1999), Adedeji (2001) and others which we conduct as well. In brief they are: (i) the optimal current account $\left(C\widehat{A}_t\right)$ variable is stationary in level; (ii) the current account Granger causes changes in net output; (iii) there is equality between the optimal and actual current account balances; (iv) there is equality of variances of the optimal and current account series; and (v) the stationarity of the optimal current account implies the stationarity of the actual current account.

2.2. Consumption Based Interest Rates and Extended Intertemporal Model of Current Account

To develop an extended intertemporal model, we assume a small country which produces both traded and non-traded goods. The country can also borrow and lend in the world capital market at a time-varying real interest rate. In the model, changes in both real interest rate and real exchange rate stimulate consumption substitution between periods and therefore it generates an intertemporal effect on a country's current account. A representative household chooses a consumption path that maximises the lifetime utility function:

$$E_t U = E_t\left[\sum_{s=t}^{\infty}\beta^{s-t}\{u(C_{Ts}, C_{Ns})\}\right],\ u'(C) > 0 \text{ and } u''(C) < 0 \qquad \dots \qquad \dots \quad (12)$$

subject to the dynamic budget constraint:

$$A_{s+1} - A_s = Y_s + r_s A_s - (C_{Ts} + P_s C_{Ns}) - I_s - G_s \quad \dots \quad \dots \quad \dots \quad \dots \quad (13)$$

where C_T and C_N are consumption of traded and non-traded goods respectively. The relative price of non-traded to traded goods i.e., the real exchange rate at time s is P_s. Y_s, I_s and G_s are equivalent to those in (2). Since there is no money in this model, all variables are measured in terms of traded goods. r_s is the world real interest rate in terms of traded goods. Departing from the basic PVMCA, r_s is allowed to change over time and the relative price between tradable and non-tradable is included in the analysis. Based on the assumption that the economy has both traded and non-traded goods, the total consumption expenditure (C_s) in terms of traded goods can be expressed as $C_s = C_{Ts} + C_{Ns}$. $C^* = \lambda(C_T, C_N)$ is a linear homogenous function of C_T and C_N. This function is interpreted as an index of total consumption. We specialise this function to a Cobb-Douglas function: $C^* = C_T^{\alpha} C_N^{1-\alpha}$ and present it as:

$$u(C_{Ts}, C_{Ns}) = \frac{1}{1-\sigma}\left(C_{Ts}^{\alpha} C_{Ns}^{1-\alpha}\right)^{1-\sigma} \qquad \dots \quad \dots \quad \dots \quad \dots \quad \dots \quad (14)$$

$$\sigma > 0, \quad \sigma \neq 1, \quad 0 < \alpha < 1$$

where σ is the coefficient of relative risk aversion which is inverse of the elasticity of intertemporal substitution (γ) and α represents the share of traded goods in total consumption index.

Under certain conditions, the evolution of the optimal consumption profile can be presented as:[5]

$$E_t c_{t+1} = \gamma E_t r_{t+1}^c, \quad \dots \quad \dots \quad \dots \quad \dots \quad \dots \quad \dots \quad (15)$$

where $\Delta c_{t+1} = \log C_{t+1} - \log C$, r^c is a consumption-based interest rate defined by:

$$r_t^c = r_t + \left[\frac{1-\gamma}{\gamma}(1-\alpha)\right]\Delta p_t + Cons\tan t^{6} \quad \dots \quad \dots \quad \dots \quad \dots \quad (16)$$

and $\Delta p_t = \log P_{t+1} - \log P$ .The optimal consumption profile is thus influenced by the time-varying world interest rate, r_t, and the change in the relative price of non-traded goods, Δp_t i.e., the exchange rate. In the basic intertemporal model the expected change in consumption is zero since the representative consumer always tries to smooth consumption over time by borrowing and lending. The exchange rate plays a similar role through the net impact of an intratemporal effect and an intertemporal effect. A change in the exchange rate induces an intratemporal substitution effect on consumption. When the price of traded goods is temporarily low, households substitute traded goods for non-traded goods in consumption. Given that the intratemporal rate of substitution is 1 (Cobb-Douglas), this raises the current consumption expenditure by $(1-\alpha)$.The intertemporal effect is driven by the relative price of future vs. current consumption in terms of the prices of traded goods. When the price of traded goods is temporarily high and expected to decrease, the future payment of a loan in terms of traded goods is high and also expected to decrease. This implies that this future repayment has a lower cost in terms of the full consumption bundle than in terms of traded goods alone. Thus r_t^c raises and lowers the total consumption expenditure by the elasticity $\gamma(1-\alpha)$. As long as, $\gamma > 1$ the intertemporal effect will dominate.

The solution to the maximisation problem (12) requires combining (15) with the intertemporal budget constraint of the problem. After some manipulation, the latter can be written as:[7]

$$-\sum_{t=1}^{\infty}\beta^t\left[\Delta no_t - \Delta c_t\right] = no_0 - c_0 \quad \dots \quad \dots \quad \dots \quad \dots \quad \dots \quad (17)$$

where lower case letters represent the logs of upper case counterparts. Taking expectations in Equation (17) and combining it with Equation (15) one can then get that

$$\widehat{CA}_t = -E_t\left[\sum_{s=t+1}^{\infty}\beta^s\left(\Delta no_s - \gamma r_s^c\right)\right], \qquad CA_t \equiv no_t - c_t \quad \dots \quad \dots \quad \dots \quad (18)$$

[5]See Bergin and Sheffrin (2000), Adedeji (2001) and Darku (2008) for exact derivation.

[6]The constant term will be irrelevant for the estimation when we later demean the consumption-based real interest rate using Equation (16).

[7]This intertemporal budget constraint is log-linearised around the steady state in which net foreign assets are 0, i.e., $\overline{A} = 0$. See Bergin and Sheffrin (2000); Adedeji (2001) and Darku (2008) for more details.

Equation (18) is the more relevant equation of the model, and it clearly illustrates the consumption smoothing character of the current account. Ceteris paribus, the higher the net output expected in the future, the smaller today's current account balance. Also, ceteris paribus, the smaller the consumption based real interest rate expected in the future, the smaller the current account balance, because the representative consumer substitutes away future consumption for current consumption. An important testable implication, coming from Equation (18), is that the current account should Granger cause Δno and r^c but not the other way around. Remaining testable implications of the extended model are the same which have been discussed under the basic model.

Now consider that the behaviour of the three variables of interest, Δno, $\widehat{CA}$ and r^c can be modeled according to an unrestricted VAR model of order 1 as follows:

$$\begin{bmatrix} \Delta no_t \\ CA_t \\ r_t^c \end{bmatrix} = \begin{bmatrix} \phi_{11} & \phi_{12} & \phi_{13} \\ \phi_{21} & \phi_{22} & \phi_{23} \\ \phi_{31} & \phi_{32} & \phi_{33} \end{bmatrix} \begin{bmatrix} \Delta no_{t-1} \\ CA_{t-1} \\ r_{t-1}^c \end{bmatrix} + \begin{bmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \\ \varepsilon_{3t} \end{bmatrix} \quad \ldots \quad \ldots \quad \ldots \quad (19)$$

Using Equation (19) and the conditions that $E_t\left(X_{t+j}\right) = \Omega^j X$, $E\left(\varepsilon_{1t}\right) = E\left(\varepsilon_{2t}\right) = E\left(\varepsilon_{3t}\right) = 0$ and Ω is the 3×3 matrix of coefficients ϕ_{ij}, the restrictions on Equation (18) can be expressed as:

$$hy_t = -\sum_{s=t+1}^{\infty} \beta^{s-t}\left(g_1 - \gamma g_2\right)\Omega^{s-t} y_t \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (20)$$

where $y_t = \left(\Delta no_t \quad CA_t \quad r_t^c\right)'$, $g_1 = \left[1 \quad 0 \quad 0\right]$, $g_2 = \left[0 \quad 0 \quad 1\right]$, and $h = \left[0 \quad 1 \quad 0\right]$ (Again this can also be generalised for a higher order VAR). For a given y_t, the right hand side of Equation (20) can be expressed as:

$$\widehat{CA}_t = ky_t \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (21)$$

where $k = -\left(g_1' - \gamma g_2'\right)\beta\Omega\left(I - \beta\Omega\right)^{-1} = \left[\Phi_{\Delta no} \quad \Phi_{CA} \quad \Phi_{r^c}\right] = \left[0 \quad 1 \quad 0\right]$.

Equation (21) provides the model's prediction for the current account consistent with the VAR and the restrictions of the intertemporal theory. For evaluating the extended PVMCA we have to test the hypothesis that $k = \left[0 \quad 1 \quad 0\right]$ in Equation (21), so that $\widehat{CA}_t = CA_t$, by using the delta method to calculate a χ^2 statistic. In other words, we apply a Wald test of the non-linear restriction on the vector *k* implied by Equation (21) to jointly assess the restrictions of the model.

2.3. Data Sources and Construction of Variables

The present study aims to conduct a time series analysis for Pakistan, which requires a relatively larger data set to obtain relatively more realistic results. While quarterly data would be the right choice for this empirical exercise, however, due to non-availability of quarterly data for some variables we use annual data for the period 1960 to 2009. Data sources for the present study include *International Financial Statistics* (IFS), International Monetary Fund (IMF), *Pakistan Economic Survey* (various issues), *Statistical Hand Book of State Bank of Pakistan* and *World Development Indicators* (WDI), the World Bank (WB).

With regard to the construction of variables, we begin from the variables used in testing the empirical validity of the ICA in Pakistan. In this connection, we have collected the data on private consumption, government consumption, investment (which consists of gross fixed capital formation and change in inventories) and gross domestic product (GDP). All variables are used in real per capita terms by dividing the nominal variables by the GDP deflator (2005=100) and the level of total population. Following Ghosh (1995), Bergin and Sheffrin (2000) and Adler (2002) among others, we construct current account series by subtracting private and government consumption expenditures and investment from the gross national product (GNP). The net output series (*NO*) is computed by subtracting government and investment expenditures from GDP. Similarly, we construct the net output inclusive of interest payment (*NOR*) by subtracting government and investment expenditures from GNP. Both the models of the ICA used in the study express net output and the current account in per capita terms with the aim to accommodate the data of these variables to the assumption of a representative agent.

For constructing the world real interest rate data the study follows Barro and Sala-i-Martin (1990) i.e., we use the weighted averages of the real interest rates of G-7 economies as the world real interest rates. The weight for each economy is time-varying and based on the economy's GDP share in the G-7 total. The real interest rate data for each economy are constructed by deflating the money market rates with inflation rates calculated from the economy's GDP deflator. For real exchange rate data, first, we have computed the bilateral exchange rates between Pakistan's rupee and the currencies of its ten major trading partners.[8] Then, using the calculated nominal exchange rates and the consumer price indices for Pakistan and the relevant trading partner, the weighted average of real exchange rate of rupee *vis-à-vis* the currencies of its ten major trading partners is constructed. The weight assigned to a trading partner is based on the extent of trade flows between Pakistan and the relevant trading partner. The consumption-based interest rate, r^c, is given by the world interest rate adjusted for the expected change in the exchange rate.

There are three other parameter values that need to be set for implementing the PVMCA empirically: the elasticity of intertemporal substitution, γ, the share of traded goods in the total consumption index, α, and the subjective discount factor (or the preference parameter), β. Considering that various views exist in the literature regarding the value of the intertemporal elasticity parameter, it is quite difficult to provide a specific value for it. Given the fact that the present study allows for non-tradable goods, we tend to support the position of Ostry and Reinhart (1992), that the intertemporal elasticity of substitution is different from zero. Hall's (1988) estimated intertemporal elasticity remains in the range of 0 to 0.1 while it ranged between 0.38 and 0.503 in a subsequent study by Ostry and Reinhart (1992). Sheffrin and Bergin

[8]These include France, Germany, Hong Kong, Italy, Japan, Korea, Netherlands, Singapore, the United Kingdom and the United States which are chosen on the basis of their trade share with Pakistan.

(2000) used values that fell within the range from 0.022 to 1 and found that the model performs relatively better with low values of the parameter. Uribe (2002) uses a value of 0.2, Landeau (2002) and Kydland and Zarazaga (2000) use a value of 0.5 and Darku (2008) uses a value of 0.45 for the intertemporal elasticity of substitution. Following Ostry and Reinhart (1992) and Darku (2008) we use a value of 0.45 for this parameter in this study. In order to obtain the share of traded goods in the total consumption, α, Bergin and Sheffrin (2000) follow Kravis, *et al.* (1982) and Stockman and Tesar (1995) to compute the value of this parameter. The estimates of α by both the studies are two-thirds and one-half respectively. Bergin and Sheffrin mainly use one-half as the value of the share parameter, α, in their empirical study. They have also conducted the calculation by using the value found by Kravis, *et al.* (1982), where α is found to be close to two-thirds. The results are similar with both values of the share parameter, thus we choose $\alpha = 0.5$ for the present study. The discount factor, β, is derived from the world real interest rate. By obtaining the sample mean for the world real interest rate in the data set, $\bar{r}$, the discount factor is calculated as $\frac{1}{1+\bar{r}}$. The discount factor is computed to be equal to approximately 0.96 in the current study.

3. EMPIRICAL RESULTS AND DISCUSSION

3.1. Evaluating the Performance of the Basic Present Value Model of the Current Account

3.1.1. *Testing for Unit Roots*

For evaluating the basic PVMCA and its variant the first step is to see whether the current account and its fundamental drivers are stationary or not. Practically the stationarity of a variable may be constrained by the presence of a unit root and the use of non-stationary time series data may lead to spurious regression. Applying the Dicky-Fuller Generalised Least Square (DF-GLS) unit root test, proposed by Elliott, Rothenberg and Stock (ERS, 1996), we find that change in net output (ΔNO_t), actual current account (CA_t) and the model's predicted or optimal current account $\left(\widehat{CA}_t\right)$ are stationary at levels while net output inclusive of interest payments (NOR_t) and private consumption (C_t) are non-stationary at levels but they become stationary at their first differences (see Table 1). Hence the time series ΔNO_t, CA_t and $\widehat{CA}_t$ are integrated of order zero i.e., $I(0)$, while NOR_t and C_t are integrated of order one i.e., $I(1)$. The inclusion of NOR_t and C_t in the analysis is to verify the stationarity of the actual current account series from the perspective of a long run relationship between these two time series. If both NOR_t and C_t are $I(1)$ and make a cointegrating relationship then the residual series which is the actual current series will be $I(0)$.

Table 1

Unit Root Test

Variables	Level	First Difference	Mackinnon Critical for Rejection of Hypothesis of a Unit Root 1 %	5 %	10 %	Decision	Order of Integration
ΔNO_t	–4.91	–	–2.61	–1.94	–1.61	Stationary at level	I (0)
CA_t	–2.71	–	–2.61	–1.94	–1.61	Stationary at level	I (0)
$\widehat{CA}_t$	–3.13	–	–2.61	–1.94	–1.61	Stationary at level	I (0)
NOR_t	0.21	–6.56	–2.61	–1.94	–1.61	Non-stationary at level but stationary at first difference	I (1)
C_t	3.49	–4.66	–2.61	–1.94	–1.61	Non-stationary at level but stationary at first difference	I (1)

Cointegration between NOR_t and C_t is investigated using Johansen's maximum likelihood method,[9] the results are reported in Table 2. Both trace statistics (λ_{trace}) and maximal eigenvalue (λ_{max}) statistics indicate that there is at least one cointegrating vector between the two time series. We can reject the null hypothesis of no cointegrating vector in favour of one cointegrating vector under both test statistics at 5 percent level of significance. We also cannot reject the null hypothesis of at most one cointegrating vector against the alternative hypothesis of two cointegrating vectors, both for the trace and max-eigen test statistics. Consequently, we can conclude that there is only one cointegrating relationship between the variables under investigation. Thus, a long run equilibrium relationship exists between net output inclusive of interest payments and private consumption in Pakistan. At the bottom of Table 2 we present the likelihood ratio test result of the hypothesis that the vector $[a, b] = [1, -1]$ belongs to the cointegrating space such that $[1, -1]\ [NOR_t, C_t]' = CA_t$ is $I(0)$. It is evident that we fail to reject the null hypothesis and hence it is confirmed that NOR_t and C_t are both not only $I(1)$ but they are also co-integrated such that CA_t is $I(0)$.

Table 2

Cointegration Test Results

Null Hypothesis	Alternative Hypothesis			Critical Values 95 %	P-values*
λ_{trace} rank tests		Eigen values	λ_{trace} rank value		
$H_0 : r = 0$	$H_1 : r = 1$	0.320034	22.03440**	20.26184	0.0282
$H_0 : r = 1$	$H_1 : r = 2$	0.070713	3.520220	9.164546	0.4882
λ_{max} rank tests			λ_{max} rank value		
$H_0 : r = 0$	$H_0 : r > 0$	0.320034	18.51418**	15.89210	0.0189
$H_0 : r \leq 1$	$H_1 : r > 0$	0.070713	3.520220	9.164546	0.4882
$H_0 : \alpha = 1, b = -1$	$\chi^2 = 0.8632$ p-value=0.3271				

**Denotes rejection of the null hypothesis at the 5 percent significance level.
*MacKinnon-Haug-Michelis (1999) p-values.

[9]See Johansen (1988) and Johansen and Juselius (1990).

The derivations in Section 2.1 lead us to formulate the following expression for the validity of the basic PVMCA:

$$\widehat{CA}_t = \begin{bmatrix} 0 & 1 \end{bmatrix} \begin{bmatrix} \Delta NO_t \\ CA_t \end{bmatrix} = CA_t . \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (22)$$

In this case both the actual and the optimal current account series are identical which implies that if the actual current account balance is $I(0)$ then the optimal current account series will also be $I(0)$. This is confirmed from the unit root test results of Table 1 where both the series are $I(0)$. As this finding is in accordance with one of the implications of the basic PVMCA, therefore, it provides evidence in favour of the model.

3.1.2. *Formal and Informal Tests of the Model*

The applicability of the basic PVMCA to Pakistan's data are evaluated by testing some of the important implications of the model. In this regard we proceed by conducting some formal and informal tests using VAR model where we have estimated equations for ΔNO_t and CA_t by applying OLS technique. Following the standard practice both the variables are expressed as deviations from their means since we are interested in testing the dynamic restrictions of the model [see Ghosh (1995); Manteu (1997); Makrydakis (1999); Adedeji (2001); Adler (2002) and Darku (2008)]. On the basis of the Akaike Information Criterion (AIC) and the Schwarz Bayesian Criteria (SBC), a one lag VAR model is chosen which is not surprising for annual data. Table 3 lists the estimated coefficients, the associated standard errors and the residual diagnostic tests from the VAR model along with the computed values of the formal and informal tests of the basic PVMCA obtained for the period 1960 to 2009. Considering the discussion in Section 2.1 about the testable implications of the basic PVMCA, Table 3 reports the standard

Table 3

VAR Estimation and Tests of Restriction of the Basic PVMCA

Dependent Variable	Regressors		Diagnostic Tests: χ^2 (p Values are in the parenthesis)			
	ΔNO_{t-1}	CA_{t-1}	S.Corr	ARCH	Heteroscedasticity	Normality
ΔNO_t	0.201	–0.525	1.242	0.007	0.084	0.524
	(0.146)	(0.102)***	(0.251)	(0.987)	(0.897)	(0.444)
CA_{t-1}	0.057	0.654	0.791	1.086	1.351	0.462
	(0.093)	(0.108)***	(0.328)	(0.296)	(0.249)	(0.784)
Granger Causality Test: F statistic (p Values are in the parenthesis)						
CA does not Granger Cause ΔNO				8.517		
				(0.004)		
ΔNO does not Granger Cause CA				1.145		
				(0.376)		
Tests of Restrictions						
ΔNO_t	–0.131					
	(0.184)			$\frac{\mathrm{var}(\widehat{CA})}{\mathrm{var}(CA)}$=0.722		
CA_{t-1}	0.685					
	(0.208)**					
	χ^2=34.486; p-value=0.000			$Corr(CA,\widehat{CA})$=0.651		

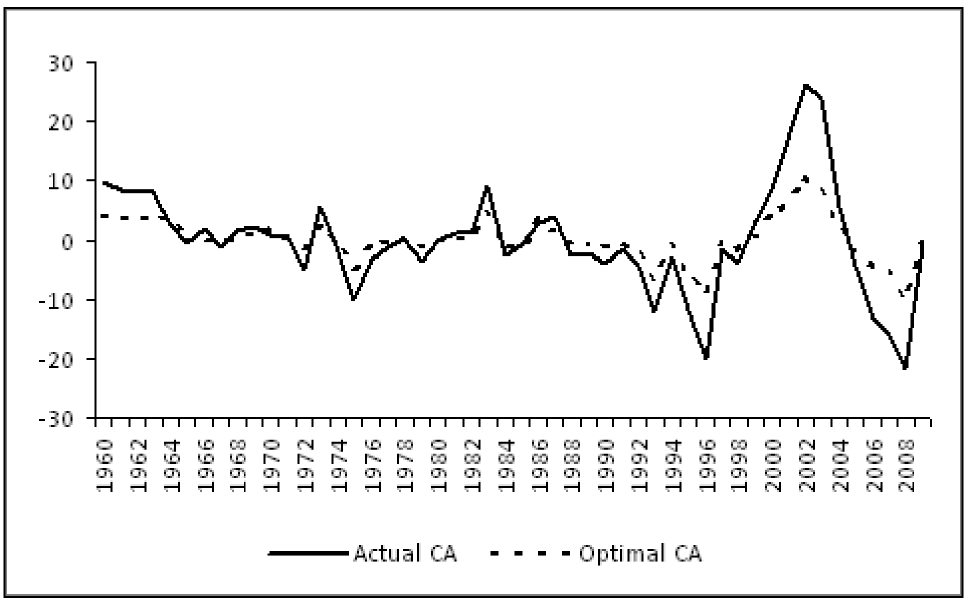
Notes: As both the variables entering the model are expressed as deviations from their means, so, the VAR model is estimated without a constant term. The numbers in the parentheses are the standard errors.

** and *** indicate statistical significance at the 5 percent and 1 percent levels respectively.

Granger causality test result where we reject the null hypothesis that CA_t does not Granger cause ΔNO_t which is suggestive of the fact that the representative agent has superior information. It means that the fluctuations in Pakistan's current account provide a signal about how this agent is expecting net output to change in the future. As a whole this finding constitutes weak evidence in favour of the basic PVMCA. However, we fail to reject the hypothesis that ΔNO_t does not Granger cause CA_t.

For further evidence on the relevance of the basic PVMCA to Pakistan's data we turn to Figure 1 that reflects the time series graphs of the actual current account series and its optimal counterpart. Following Sheffrin and Woo (1990); Otto (1992); Obstfeld and Rogoff (1995); Makrydakis (1999) and Adler (2002) we have used an annual real world interest rate of 4 percent for discounting purposes while calculating the optimal current account series.[10] We know that if the basic PVMCA holds in Pakistan then graphically both the actual and the optimal current account series should differ only by the sampling error. In case there are significant differences in the time series plots of both the variables it will be considered as evidence against the consumption smoothing behaviour of the current account. Despite the fact that basic PVMCA is quite restrictive and simple in structure, the visual inspection of the two series in Figure 1 represents a reasonably good capability of the optimal (or VAR model predicted) current account series to follow the year-to-year trends of Pakistan's actual current account balance during almost the entire period of study. Nevertheless, the actual current account series exhibits relatively more volatility as compared to its optimal counterpart, which is a very common outcome when consumption smoothing model is applied to small open economies [Adler (2002)].

Fig.1. Actual and Optimal Current Account Balances



[10]Most of the empirical computations have been carried out using 2,4,6 and 8 percent real world interest rate but they have almost the same quantitative results [Makrydakis (1999)].

Another testable implication of the model is the equality between the variances of the actual and the optimal current account series. If the variance ratio of optimal to actual current account series is equal to unity then it validates the assumption of high degree of capital mobility and the intertemporal model of current account [Ghosh (1995) and Agenor (1999)]. In Table 5.3 this ratio is 0.722, which is different from unity, and thus indicative of some degree of excessively volatile international capital flows to Pakistan in the sense of Ghosh (1995). It implies that in case of some shocks, Pakistan's consumption smoothing current account flows have been more volatile than justified by expected changes in economic fundamentals i.e., net output.[11] The problem with excessive volatility is that it raised the possibility of inappropriate utilisation of foreign capital for domestic consumption [Ismail and Ahmad (2008)]. As the variance of the actual current account balance is larger than its optimal counterpart, therefore in Figure 1 the time series plot of the former has a larger amplitude than that of the latter. With regard to the correlation coefficient between the two current account series it is found to be moderate i.e., 0.651. The graphs of the two series in figure1 are clearly consistent with this modest relationship between them, hence the model's predicted current account series succeeds in explaining a reasonable portion of the fluctuations in the actual current account of Pakistan.

Now we come to examine the result of the formal and most stringent test of parameter restrictions imposed on estimated coefficients of ΔNO_t and CA_t. Considering that if the basic PVMCA gives a convincing representation of the actual current account fluctuations then Equation 5.1 will hold; it implies that in the context of first order VAR the estimated values of $\Phi_{\Delta NO}$ and Φ_{CA} should be zero and unity respectively. Table 3 reports the result for this statistical test. The estimated values for both the variables are—0.131 and 0.685 respectively. From the perspective of individual testing we find that ΔNO_t is found not to be significantly different from its theoretical value of zero but CA_t is quite different from its theoretical value of unity. For overall testing of the model, our computed value of Wald test statistic (which is distributed as a χ^2 with two degrees of freedom) is 34.486 with *p*-value of zero, which indicates the rejection of the restrictions of the basic PVMCA on the VAR model even at 1 percent significance level. It suggests that Pakistan lacked the ability to smooth consumption through external borrowing and lending in the face of exogenous shocks during the sample period of the study.

Finally, Table 3 also presents results for some diagnostic tests, which involve χ^2 tests for the hypothesis that there is no serial correlation; that the residual follow the normal distribution; that there is no heteroscedasticity; and lastly that there is no autoregressive conditional heteroscedasticity. In all equations the diagnostics suggest that the residuals are Gaussian.

Thus, while the basic intertemporal model is a bit capable of tracing the peaks and troughs of the Pakistan's current account series for the period 1960 to 2009, it remains unsuccessful in capturing the full magnitude of the cyclical fluctuations of the said series. Similarly, while the informal evidence reveals adequacy of the model in Pakistan's case, the formal restrictions of the model are strongly rejected by the country's data. This outcome is supported by a number of empirical studies for other developing countries

[11]It means that capital movements are mainly dominated by speculative capital flows.

including Manteu (1997) for Portugal, Adedeji (2001) for Nigeria, Landeau (2002) for Chile, Ogus and Niloufer (2006) for Turkey, Goh (2007) for Malaysia and Lau, *et al.* (2007) for the Philippines and Singapore. However, our findings are in contrast with those obtained by Ghosh and Ostry (1995) for majority of developing countries in their sample, Callen and Cashin (1999) for India, Lau, *et al.* (2007) for Indonesia, Malaysia and Thailand and Khundrakpam and Rajiv (2008) for India. In all these cases the formal and informal tests have provided evidence in favour of the model.

3.2. Tests of the Extended Present Value Model of the Current Account

As an initial step we apply DF-GLS test for examining the stationarity of the variables entering the VAR model, which reflects the nature of the extended PVMCA. Table 4 presents the results of unit root tests for Δno_t, CA_t $\widehat{CA}_t$ and r_t^c. It is quite clear that the null hypothesis of a unit root is rejected at level for each time series. Hence, all the variables are $I(0)$ which is in accordance with the theoretical description of the extended PVMCA.

Table 4

Unit Root Test

Variables	Level	Mackinnon Critical Values for Rejection of Hypothesis of a Unit Root 1 %	5 %	10 %	Decision	Order of Integration
Δno_t	–5.24	–2.61	–1.94	–1.61	Stationary at level	$I(0)$
CA_t	–2.71	–2.61	–1.94	–1.61	Stationary at level	$I(0)$
$\widehat{CA}_t$	–2.97	–2.61	–1.94	–1.61	Stationary at level	$I(0)$
r_t^c	–7.232	–2.61	–1.94	–1.61	Stationary at level	$I(0)$

Before putting the extended PVMCA for formal and informal testing, it is essential to decide about the lag length to be used in the VAR model. Following the standard practice we have used the two criteria namely, the AIC and the SBC. Both the criteria suggest a lag length of one as optimal for the VAR model. The VAR model's estimated parameters and the present value tests are reported in Table 5. In case of the extended PVMCA, if there exists a uni-lateral casual pattern running from the current account series to changes in net output and the consumption based interest rate it goes in favour of the model informally. From Table 5, it is evident that in the equations of Δno_t and r_t^c the estimated coefficient of CA_{t-1} is only significant in the equation of Δno_t. Thus, there is only uni-directional Granger causality that runs from CA_t to Δno_t while there is no such relationship between CA_t and r_t^c. It implies that the current account lacks any short run predictability for the future consumption based interest rate. So, there is a partial support to the extended intertemporal model from Pakistan's data as far as the first informal test of Granger causality is concerned.

Table 5

VAR Estimation and Tests of Restriction of the Extended PVMCA

Dependent Variable	Regressors Δno_{t-1}	CA_{t-1}	r^c_{t-1}	Diagnostic Tests: χ^2 (*p* values are in the parenthesis) S.Corr	ARCH	Heteroscedasticity	Normality
Δno_{t-1}	0.153 (0.137)	-0.386 (0.163)**	–0.093 (0.115)	1.382 (0.244)	0.081 (0.906)	0.046 (0.937)	0.693 (0.348)
CA_{t-1}	–0.133 (0.157)	0.637 (0.106)***	–0.203 (0.173)	0.527 (0.441)	0.983 (0.303)	1.311 (0.259)	0.836 (0.322)
r^c_t	–0.141 (0.165)	-0.054 (0.113)	0.427 (0.204) **	0.664 (0.361)	0.096 (0.892)	0.701 (0.341)	0.557 (0.432)

Granger Causality Test: F statistic (*p* values are in the parenthesis)

CA does not Granger Cause Δno	8.517 (0.004)
Δno does not Granger Cause CA	1.145 (0.376)
CA does not Granger Cause r^c	1.229 (0.273)
r^c does not Granger Cause CA	1.554 (0.227)

Tests of Restrictions

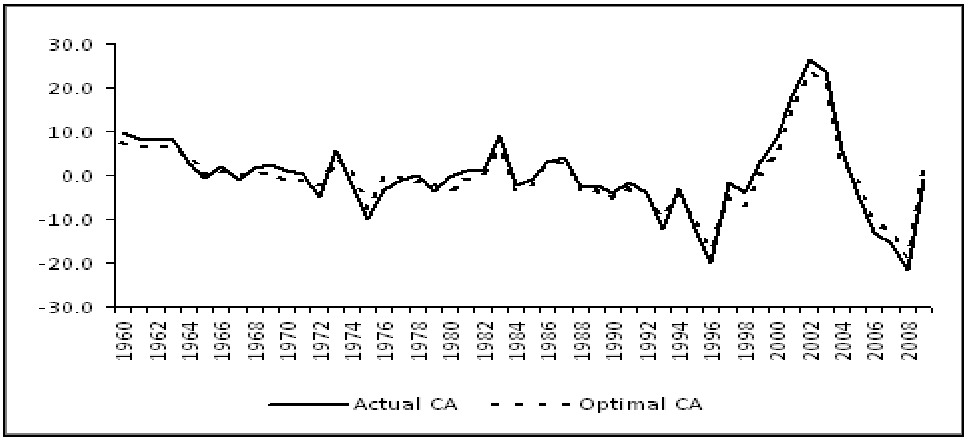
Δno_{t-1}	–0.068 (0.214)	$\frac{\text{var}(\widehat{CA})}{\text{var}(CA)}$=0.883
CA_t	0.776 (0.211)***	
r^c_t	0.015 (0.069)	$Corr(CA, \widehat{CA})$=0.941

χ^2=2.586; *p*-value=0.463

Notes: As all the three variables entering the model are expressed as deviations from their means, so, the VAR model is estimated without a constant term. The numbers in parentheses are standard errors.
** and *** indicate statistical significance at the 5 percent and 1 percent levels respectively.

The next implication of the extended intertemporal model that comes under informal testing is that the time series plots of the actual and optimal current account series should differ only by sampling error. We have used the VAR model parameters given in Table 5 to derive the optimal current account series. The good fit of the model is apparent from Figure 2 where the model's predicted current account series very closely tracks the actual current account path and outcome is relatively better as compared to the case of the basic PVMCA. Hence, it establishes that the extended model has significant capability of predicting the general direction of the actual current balance in Pakistan. Nonetheless, the volatility of the actual current account series is still higher than that of its optimal counterpart. Hence, the higher volatility of the actual current account cannot be attributed to the exclusion of the source through which changes in external shock affect the current account balance of Pakistan. But it is noteworthy that the magnitude of the variability in the actual current account as compared to the optimal current account is lower in the extended model than in the basic model. Furthermore, the ratio of the variance of the optimal current account to the variance of the actual current account and the correlation between the two current account series, which evaluate the performance of the model informally, have shown remarkable improvement over the basic PVMCA. Table 5 shows that both these informal instruments carry the values 0.883 and 0.941 respectively, which are higher than those of the basic intertemporal model. As a result the extended model visually fits the data relatively better than its basic counterpart.

Fig. 2. Actaul and Optimal Current Account Balances



When the formal test is undertaken for judging the validity of the extended model to Pakistan's data, the findings are quite encouraging and support the evidence obtained from the informal tests. With one lag and three variables, the extended model suggests that the hypothesised *k*-vector is [0 1 0]. The actual *k*-vector coefficients on changes in net output, the current account and consumption-based interest rate are –0.068, 0.776 and 0.015 respectively as reported in Table 5. The *t*-statistics indicate that the coefficients on changes in net output and consumption-based interest rate are not statistically different from their hypothesised values of zero. However, the *k*-vector coefficient on the current account is statistically different from its theoretically expected value of unity. With regard to the overall performance of the extended model, the Wald test statistic indicates that the model's restrictions are not rejected with a p-value of 0.463. Hence, the null hypothesis of consumption smoothing is not rejected by the data. This finding implies a vital improvement over the corresponding result for the basic model. Finally, the diagnostic tests in Table 5 indicate that all the three equations in VAR model are well specified and do not violate the Gaussian assumptions.

4. CONCLUSION AND POLICY IMPLICATIONS

Since first introduced by Sachs (1981), the intertemporal approach has been extensively used in the literature to study the evolution of current account balances for different countries and time periods, and it has been extended along several dimensions. The present value methodology developed by Campbell (1987) and Campbell and Shiller (1987) is most widely used to examine whether the theoretical implications of the intertemporal approach are supported by the data. The present study applied the basic PVMCA and its extended version, which allows for the introduction of a time-varying world real interest rate and the real exchange rate, to examine the dynamics of the current account data of Pakistan over the period 1960 to 2009. We find that the basic intertemporal model (the version which does not allow changes in the world interest rate and the exchange rate) formally fails to fit the data in providing a statistically adequate explanation of the dynamic behaviour of Pakistan's current account as the most strict restriction implied by the model are strongly rejected by the data. However, the informal test provides a little support to the intertemporal approach as it reveals some ability of the PVMCA in tracking the direction of movements of the actual current account, although the actual current account series is more volatile than the optimal series.

To explain the current account behaviour of a small developing economy it may be important not only to consider shocks to domestic output but also shocks arising in the world economy in general. These external shocks will generally affect the small economy via movements in the interest rates and exchange rates. Bergin and Sheffrin (2000) identify stochastic world interest rates and real exchanges rates to be incorporated in the model as they show an improved performance of the model in the presence of these variables. When the extended intertemporal model developed by Bergin and Sheffrin (2000) is applied, the study finds a better fit of the data on the part of this model which confirms the role of newly inducted variables in the basic PVMCA in Pakistan. In other words, the external shocks are significantly transmitted to Pakistan via the real interest rate and real exchange rate which then induce an increase to the volatility of the model's predicted current account series to better match the data. Hence, the study is in full conformity with the view of Bergin and Sheffrin (2000) that amending the basic intertemporal model of the current account to include variable interest rate and exchange rates improve its fit substantially. The findings of the extended intertemporal model suggest that the government of Pakistan should continue to pursue policies aimed at integrating the Pakistan's economy into the world economy so that the current account series will continue to respond to external shocks while reflecting consumers' unconstrained optimised choices.

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Economic Freedom, Exchange Rates Stability and FDI in South Asia

ZAFAR MUEEN NASIR and ARSHAD HASSAN

I. INTRODUCTION

Foreign direct investment (FDI) plays an important role in the economic development by enhancing growth and bringing foreign funds, new technology and skills to the host country. The FDI also shows a long-term interest in a local entity by an investor operating in another country. Flow of FDI to specific country is based upon macroeconomic factors, government policies, and long term corporate strategies of multinational corporations. Empirical research provides evidence that size of market, legislative and incentive structure, availability of human capital, reliability and efficiency of financial system, natural resources, macroeconomic environment, governance perception, law and order situation, and physical infrastructure are the some basic determinant for attracting FDI. Economic and fiscal environment are also critical factors for attracting FDI along with a favourable business and investment milieu based on political and legal framework. Considering the importance of these factors the Heritage Foundation developed the Economic Freedom Index (EFI) based on these policy parameters. They included business freedom, investment climate, trade openness, monetary and fiscal environment in the index. This index is widely used by investors in selecting the destination for their investment decisions.

Heritage Foundation defines Economic Freedom as "aspect of human liberty that is concerned with the material autonomy of the individual in relation to the state and other organised groups. The highest form of economic freedom provides an absolute right of property ownership, fully realised freedoms of movement for labour, capital, and goods, and an absolute absence of coercion or constraint of economic liberty beyond the extent necessary for citizens to protect and maintain liberty itself." Gwartney, *et al.* (1996) defined economic freedom for individuals to acquire property without the use of power, fraud or theft and protected from physical invasion by others. The owners of the property are free to use, trade, or offer their belongings as long as their actions do not infringe the same privileges of others. Economic freedom is considered as antithesis of centralised planning and governmental control mechanism. It is replication of democratic political pluralism in economic world. It is a philosophy that promotes entrepreneurship and decentralises economic power and decision making across the economy.

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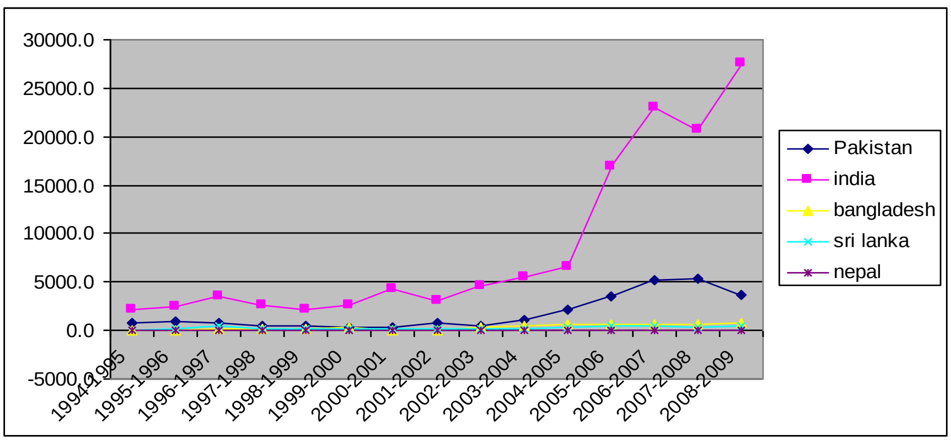
South Asian countries recognise that FDI is potential source of much needed capital, knowledge, technology and access of international markets. To facilitate greater inflows of FDI, many countries in the region have taken important steps to create a more favourable investment climate. Genesis of change can be traced back to late 1970s. In 1977, Sri Lanka started the process of liberalisation and other south Asian countries follow the suit. Pakistan's efforts to attract FDI can be traced back to the advent of deregulation, privatisation, and liberalisation policies initiated at the end of the 1980s. However, this liberalisation process is found uneven across countries and can be termed as hesitant liberalisation. This process is accelerated in the region in early 1990s with the initiation of liberalisation process in India.

FDI to South Asian economies increases from US$ 204 million in 1980 to US$ 3 billion in 1995 and around US$ 9.8 billion in 2005. The increase in FDI inflow, however, is insignificant and share of south Asia in global FDI inflows in 2005 is observed as just 1.1 percent. By 2008, FDI inflows to South Asian economies has crossed US$30 billion mark, however it was still around one percent of the global FDI inflows. Historical patterns of FDI to South Asian region are shown in Figure 1.1.

Fig. 1.1. Trends in FDI in South Asia



The FDI flows in Pakistan have increased from mere US$250 million in 1990 to US$5.2 billion in 2008.[1] However, track record of FDI inflows to Pakistan is not attractive. Number of factors can be identified that contributed in discouraging the foreign investors in investing in the country. These include law and order conditions, power shortage, poor governance, political instability, inefficient fiscal and monetary policies, corruption in higher echelons of government, trade barriers, inconsistency in economic policies etc.

It is worth mentioning that despite market liberalisation process, South Asian countries are not fully realising there latent growth potential. It may be due to the fact that South Asia is still one of the overregulated regions for multinational corporations. These trade restrictions limit potential trade, inflow of FDI and economic growth. In

[1]Besides attractive incentive structure for investment, privatisation of public sector corporations contributed to higher FDI flows in the country.

order to accelerate growth and attract FDI to bridge the resource gap, South Asian nations are required to integrate into world economy through liberalisation, privatisation and deregulation to achieve competitiveness. This means more economic freedom is needed to promote investment. The international experience suggests that economic freedom is prime vehicle for attracting FDI and achieving sustainable growth. Specially, freedom of trade, business and investment accelerate the process of domestic and foreign investment in the country and stimulate the process of sustainable economic growth.

Most of the empirical work on relationship between economic freedom and economic growth is focused on developed markets and no significant study on relationship between economic freedom and FDI in south Asian region is available. Similarly, number of studies exists that explore the role of various variables independently and jointly. However no study captures the joint effect of these policy parameters through an index. The present study is an effort to bridge this gap. The study has the following objectives;

- To study the role of market size and exchange rate in attracting FDI inflows in South Asian countries,
- To explore the role of economic freedom in attracting FDI inflows in South Asia,
- To provide policy guideline for designing effective macroeconomic policies.

This study will help the economic managers of South Asian nations to identify the factors and design policies that are vital for attracting FDI in the region/countries. The paper is organised as follows. Section II provides an overview of literature on the relationship among variables of interest. Section III discusses data and methodological issues. Section IV presents empirical results and the conclusions are provided in the last section.

II. LITERATURE REVIEW

A number of studies focusing on the determinants of countries' attractiveness to FDI inflow highlighted the role of democracy, governance and unwavering macroeconomic environment. For example, Hines (1995) studied the dynamics of US FDI in foreign countries and found that US FDI to corrupt countries declined over time. However, the relationship between corruption and FDI was found insignificant. Okeahalam and Bah (1998) confirmed the results by examining the relationship between corruption and FDI flows. Ayal and Georgios (1998) examined the impact of components of economic freedom on growth rate, output and investment by using OLS method. Results indicated that economic freedom accelerated economic growth through accelerating capital accumulation process. Further, these factors contributed positively in enhancing total factor productivity. El-Naggar (1990) and Collier and Gunning (1999) focused on the role of institutions. This study emphasised that efficient tax regime, property rights and rule of law were some major factors in mobilising foreign as well as and domestic investment.

Wheeler and Mody (1992) explored relationship between host country risk factor and FDI but no significant relationship was observed. Chakrabarti (2001) found that size of market, cost of inputs, trade and non trade barriers, trade openness, growth rate, stability of foreign exchange were major determinants of FDI. Lipsey (1999) included size of market, growth rate, real per capita GDP, a distance variable and a measure of tax rates to examine the determinants of the location of US affiliates in Asia. His findings were in line with Chakrabarti (2001).

Wei (2000) investigated the dynamics of bilateral FDI flows between 12 investing countries and 45 host countries. Results indicated that corruption was significantly negatively related to the volume of FDI. Similarly, Bengoa and Sanchez-Robles (2003) found significantly positive relationship between economic freedom and FDI in Latin American countries. Harms and Ursprung (2001) explored the relationship of political rights and civil liberties with FDI and concluded that significant positive relationship exists among these variables. Adkins, Moomaw and Savvides (2002) concluded that higher economic freedom leads to improved economic performance and that augmented economic freedom had helped countries to move closer to the production frontier. Asiedu (2002) reports that infrastructure development, rate of return, trade openness and country risk factors were important determinant of FDI inflows.

Janicki and Wunnava (2004) found significant role of economic growth, political risk, trade openness and labour cost to explain the flow of FDI to Central and Eastern European countries. Kyrkilis and Pantelidis (2003) examined the determinants of FDI in developing and developed countries and discovered that real GNP, effective exchange rate, and human capital were important determinants of FDI flows. However, openness was found insignificantly related to FDI. Bengoa, Marta, and Sanchez-Robles (2003) examined the relationship between economic freedom and foreign direct investment for 18 Latin American countries for the period 1970 to 1999 by employing panel data analysis. Results showed that economic freedom contributed positively towards inflow of FDI. The economic growth was also found positively related with FDI. Study suggested that human capital, economic stability and liberalised markets may be helpful in attracting long-term capital flows.

Cole (2003) compared various theories of economic growth and analysed the impact of economic freedom on economic growth by employing economic freedom index. He found the relationship significant and robust under different diversified theoretical framework. Similarly, Scully (2002) examined the contribution of economic freedom in determining economic growth and in the distribution of market income by employing structural models. Study analysed the role of government policy in advancing economic progress and effect of economic progress on the distribution of market income. Results revealed that economic freedom promotes economic growth as well as equity. He also found a positive trade-off between economic growth and income inequality. However, this trade off was found small and insignificant in magnitude. Gordillo, Manuel, and Álvarez (2003) investigated the dynamic causal relationship economic freedom, political freedom, democracy and economic growth by employing Kiviet method. Results suggested that economic freedom fostered economic growth but impact of political freedoms on economic growth was insignificant. Similarly, study concluded that democracy accelerates economic growth and economic freedom and in response economic prosperity supports democratisation process.

Chan and Gemayel (2004) reported that economic, financial, political risks and instability related with each risk were critical determinants of FDI in the Middle East. Sekkat and Veganzones-Varoudakis (2007) found that trade openness and investment climate had significant impact on FDI flows to Middle East. This study also found that GDP and GDP growth rate were insignificant in determining FDI inflows to developing countries, including the Middle East. Doucouliagos and Ulubasoglu (2006) studied the interplay of economic freedom and economic growth through a comprehensive literature review of 45 different studies conducted during in recent past. Study revealed that significant positive association exist between economic freedom and economic growth and studies of economic growth that do not include economic freedom as determinant of economic growth are bound to arrive at biased results. Study also suggest that physical investment also influences the explanatory power of economic freedom as exclusion of a measure of investment in physical capital augments the anticipated effect of economic freedom on economic growth.

The review of the literature clearly indicates that economic freedom along with other macroeconomic variables does play a role in attracting FDI flows. This merits investigation of economic freedom's role in attracting FDI in South Asian countries. In the following section, the framework of the study is explained along with the description of the data.

III. DATA DESCRIPTION AND METHODOLOGY

This study examines the relationship among FDI inflows, market size and index of economic freedom for the period 1995-2008 by employing annual time series data. Market size is measured by using GDP. Index of Economic freedom reported by heritage foundation is used as measure of economic freedom. Index of Economic Freedom comprises of a comprehensive set of measures of policy parameters like business freedom, trade freedom, fiscal freedom, government size, monetary freedom, investment freedom, financial freedom, property rights, freedom from corruption and labour freedom. Each component of economic is ranked on 0-100 scale. Highest score may be 100 which is an indicator of most conducive environment for economic freedom. Index of Economic freedom is an equally weighted index of above components. Equal weights are used to avoid biased behaviour toward any specific policy parameter.

1. Methodology and Econometric Model

This study employs multivariate regression analysis in a panel data framework to explore the dependence of foreign direct investment on economic freedom and other factors like market size, investment climate and foreign exchange rate. The panel data analysis helps to explore of cross-sectional and time series data simultaneously. Panel data analysis has been used with assumption of constant coefficients as well as in fixed and random effect setting.

Constant coefficient model assumes that the intercept and slope terms are constant and there are no differences among the data matrices of the cross sectional dimensions. The model of the study is presented in the following equation.

$$LNFDI_{i,t} = \beta_0 + \beta_1 LNEF_{i,t} + \beta_2 LNGDP_{i,t} + \beta_3 REER_{i,t} + \mu_t$$

Where $LNFDI_{i,t}$ is natural logarithm of foreign direct investment in country "*i*" for the year "*t*" and $LNEF_{i,t}$ is natural logarithm of index of economic freedom for country "*i*" for the year "*t*". *REER* is real effective exchange rate and *LNGDP* captures the market size. The μ_t represents the error term.

Common constant method is quite restrictive so more insight can be achieved through inclusion of fixed and random effects in the method of estimation. In the fixed effect method the constant is treated as section-specific so fixed effect model allows for different constants for each section. The applicability of fixed effect model has been tested by using Standard F test. The null hypothesis is that all the constants are same and therefore common constant model can be used.

$$F = \{(R^2_{FE} - R^2_{CC})/N\text{-}1\} / \{(1\text{-} R^2_{FE})/(NT\text{-}N\text{-}K)\}$$

If calculated value is greater than F critical value, we reject the hypothesis that all constants are same. In fixed effect model the cross sectional effect is captured through dummy D_i which represents the countries.

$$LNFDI_{i,t} = \beta_0 + \beta_1 LNEF_{i,t} + \beta_2 LNGDP_{i,t} + \beta_3 REER_{i,t} + \sum D_i + \mu_t$$

An alternative method of estimation is random effect model which assumes that the constants for each section are not fixed but are random. Fixed effect model assumes that each country differs in its intercept term whereas random effect model assumes that each country differs in error term.

$$LNFDI_{i,t} = \beta_0 + \beta_1 LNEF_{i,t} + \beta_2 LNGDP_{i,t} + \beta_3 REER_{i,t} + (v_i + \mu_t)$$

The choice between fixed effect and random effect model is made through Hauseman Test (1978). That is based on the idea that under the hypothesis of no correlation, both OLS and GLS are consistent and OLS is inefficient, while under the alternative, OLS is consistent but GLS is not.

$$H = (\beta^{FE} - \beta^{RE})' [(Var(\beta^{FE}) - Var(\beta^{RE})]^{1} (\beta^{FE} - \beta^{RE}) \sim \chi^2(k)$$

If the value of H statistic is large, the difference between estimates is significant, so null hypothesis that random effect model is consistent is rejected and fixed effect estimators are used. If the value of H statistics is small then random effect estimators is more appropriate.

IV. EMPIRICAL RESULTS

Table 4.1 exhibits the statistical properties of time series data. Descriptive statistics indicates that India attracts highest average foreign direct investment during 1995-2009 which is more than \$7154 million. Average foreign direct investment in Pakistan during said period is \$1630 billion and Bangladesh remains at third position with \$312 million per year. In 2007-2008 south Asian countries receive highest FDI inflows, India crossed \$ 22950 million and Pakistan touched \$ 5409 million which is the highest level in its history.

Table 4.1

Descriptive Statistics
(for the Period 1995-2008)

	Mean	Median	Std Deviation	Minimum	Maximum
Pakistan					
FDI	1629.88	772.80	1765.73	308.00	5409.80
Econ Freedom	55.74	55.89	1.73	53.02	58.42
GDP	89732.00	69430.90	44097.04	52201.09	185429.3
REER	57.33	57.13	7.01	45.02	69.94
India					
FDI	7154.24	3955.65	7275.17	2143.60	22950.00
Econ Freedom	50.49	50.70	2.70	45.09	54.20
GDP	471572.8	380772.6	215594.5	281122.5	960297.0
REER	45.37	45.64	3.31	39.03	50.28
Bangladesh					
FDI	312.78	235.05	259.51	1.90	692.00
Econ Freedom	48.88	49.92	3.73	38.72	52.90
GDP	47668.33	42174.95	13588.91	34120.60	76931.36
REER	59.97	60.52	4.76	52.16	66.66
Sri Lanka					
FDI	258.43	231.00	136.63	56.00	529.00
Econ Freedom	62.28	62.49	2.44	58.41	66.00
GDP	17495.90	14339.91	7366.27	10172.61	36368.41
REER	100.00	99.60	10.22	76.54	113.33

With reference to economic freedom, Sri Lanka ranks the highest with an average score of 62 and Pakistan stands second with 55.9. Bangladesh is placed at last position in the region. India is also found comparatively over regulated market in the region as its index of economic freedom is lower than average of South Asian region. With reference to size, India is the largest market whereas Sri Lanka is the smallest market.

Results of common effect model are reported in Table 4.2 which indicates that LNEF, LNGDP and REER can explain 43.8 percent of the total variation in FDI inflow.

Table 4.2

Panel Data Analysis
Common Effect Model

Variable	Coefficient	Std. Error	t-Statistic	Prob.
	34.059	7.205	4.727	0.000
LNEF_?	–6.592	1.616	-4.079	0.000
LNGDP_?	0.240	0.200	1.199	0.236
REER_?	–0.034	0.013	–2.638	0.011
Adjusted R^2		0.4384		
F statistics		13.5318		
F significance		0.0000		

As Common Constant Method is quite restrictive so Fixed and Random Effects models have also been tested. The null hypothesis is that all the constants are same is tested by using Standard F-test. Here calculated value of F =70.53 is greater than F-critical value at 95 percent confidence level so null hypothesis is rejected. Therefore Fixed effect model is better model.

Finally, In order to make a choice between Fixed Effect Model and Random Effect Model, Hausman test has been applied and results are reported in Table 4.3 below.

Table 4.3

Correlated Random Effects
Hausman Test

		Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
H Statistics		271.8767	3	0
Cross-section Random Effects Test Comparisons				
Variable	Fixed	Random	Var(Diff.)	Prob.
LNEF_?	2.4837	–6.5915	1.0502	0
LNGDP_?	2.8869	0.2397	0.0787	0
REER_?	–0.0288	–0.0341	0.0001	0.52

Above table shows that the value of H statistics is high which indicates that difference between estimates is significant at $\alpha=0.05$.Therefore null hypothesis that random effect model is consistent is rejected and fixed effect estimators are considered most appropriate. Results of fixed effect model are reported in Table 4.4

Table 4.4

Panel Data Analysis
Fixed Effect Model

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNEF_?	2.4837	1.2138	2.0461	0.046
LNGDP_?	2.8869	0.2920	9.8868	0.000
REER_?	–0.0288	0.0097	–2.9601	0.005
BAN—C	–9.8881	4.6029	–2.1482	0.037
IND—C	–12.7837	4.7577	–2.6869	0.010
PAK—C	–20.2733	5.0310	–4.0296	0.000
SLK—C	–14.0955	4.9576	–2.8431	0.006
Adjusted R^2		0.9142		
F statistics		87.0632		
F significance		0.0000		

Results clearly indicate the presence of significant positive relationship between economic freedom and FDI inflows in south Asian countries during period of study. This relationship has economic rationale as economic freedom captures the impact of components like business freedom, trade freedom, fiscal freedom, government size, monetary freedom, investment freedom, financial freedom, property rights, freedom from corruption and labour freedom for a country. Therefore a country that offers the right to create, operate, and close an enterprise without interference from the state and permits individuals and businesses to keep and control their income and wealth for their own benefit and use will definitely attract the foreign direct investment. Similarly, trade openness and low corruption levels also provide confidence to foreign investors and effect their decision regarding location of business. LNGDP is also significantly positively associated with foreign direct investment at 95 percent confidence interval which shows that large markets attract more FDI. Therefore, in South Asia, India attracts maximum FDI followed by Pakistan, Bangladesh and Sri Lanka. Real effective exchange rate is found significantly negatively related to FDI indicating that depreciation in host country currency negatively influences the inflow of FDI to that country. As above studied variables are able to capture most of the important dimensions of decision parameters of investors regarding FDI so above model is able explain approximately 90 percent of total variation in FDI.

V. CONCLUSION

The magnitude of FDI in South Asia remains relatively low. The region despite a supportive macroeconomic environment and financial sector stability has attracted very low amount of FDI inflows. Its share in the world inflows as well as proportion of its GDP is negligible. The reasons are many but in my opinion one major reason is limited Economic Freedom.

In south Asian countries, economic freedom is found significantly positively related to FDI. As Economic Freedom is an important catalyst in attracting FDI in the region, so through Freedom of trade, business and investment these countries can accelerate the process of domestic and foreign investment in the country and stimulate the process of sustainable economic growth. These countries should also improve governance mechanism and control corruption which is necessary to improve Economic Freedom in the country. Therefore, key policy implications for South Asian countries attempting to attract FDI are to create a better investment climate by improving Economic Freedom. The real effective exchange rate (REER) is found statistically significant and negatively related to FDI indicating that these countries should design and develop such policies that provide stability to their currencies. The significant positive relationship between Market Size and FDI inflows is quite logical and indicative of the fact that large markets have more attraction and potential for foreign investment.

The main conclusion of the paper is that by providing a stable, consistent, and transparent regulatory framework along with stable macroeconomic environment, these countries can attract more FDI inflows. It is worth noted that these countries should focus not only on policies to attract FDI but also on the policies that are necessary for FDI to generate a positive development impact in the recipient country.

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Dynamic Relationship between Energy and Economic Growth: Evidence from D8 Countries

SARWAT RAZZAQI, FAIZ BILQUEES, and SAADIA SHERBAZ

INTRODUCTION

Energy is vital to economic growth and it was best demonstrated during the 1973–1974 oil embargo. When oil-producing nations of the Middle East restricted the output, prices increased fourfold in a span of a few months, resulting in serious disruption in the industrialised countries as well as the supplies of raw material from the developing countries.

The energy crisis of the seventies attracted significant investigation into the relationship between energy consumption and economic growth. Overtime, numerous studies conducted to examine this relationship have produced conflicting results: some studies suggest that energy use is highly positively correlated with GDP growth [for example; Chebbi and Boujelbene (2008), Jumbe (2004), Siddiqui (2004) etc.], others support a negative relationship [for example; Okonkwo and Gbadebo (2009), Noor and Siddiqi (2010) etc.]. Similarly, while some studies report non-causality of the relationship [for example; Sarkar, *et al.* (2010), Yusma and Wahilah (2010) etc.], others have reported bi-directional causality [for example; Pradhan (2010), Loganathan, *et al.*, (2010), Omotor (2008) etc.]. Thus, the empirical evidence is varying and conflicting about direction of causality.

D8, also known as Developing-8, is an arrangement for development of co-operation among the following Muslim countries: Bangladesh, Egypt, Indonesia, Iran, Malaysia, Nigeria, Pakistan and Turkey. The idea of cooperation among major Muslim developing countries was raised during a seminar on "Cooperation in Development" held in Istanbul in October 1996. It was after a series of preparatory meetings that D-8 was set up officially and began its activities with the 'Istanbul Declaration' issued at the end of 'The Summit of Heads of State and Government' held in Istanbul on June 15, 1997.

The energy sector is likely to play a vital role in the development of the D8 countries. The complexity of relationship among the variables of energy use and economic activity requires a re-examination of long-term and short-term linkages between energy consumption and real output in the D8 because if the causality in these countries runs from energy to GDP, the energy constraints can have serious implications for the pace of development in these

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economies. The main objective of this study is to investigate the dynamic correlation between energy consumption and economic growth in the D8 countries.

I. ENERGY AND ECONOMIC GROWTH: REVIEW OF LITERATURE

This section reviews some of the previous studies on the relationship between energy and economic growth along with the role of energy sector in economic growth as discussed in the mainstream economic literature.

I.1. Theoretical Background

Although business and financial economists pay significant attention to the impact of oil and other energy prices on economic activity, the conventional theory of economic growth pays little or no attention to the role of energy or any other natural resources in facilitating or promoting economic growth [Stern (2003)]. A fully worked out model of the growth process in which energy is explicitly recognised as a determinant does not seem to exist in economic literature but extensive empirical work has examined the role of energy in the growth process.

Energy is an essential input for growth and development and energy use is also expected to be a limiting factor to economic growth, as other factors of production cannot work properly without energy. It can also be argued that the impact of energy use on growth depends on the structure of the economy, energy intensity and the stage of economic growth of the country concerned. Some service activities may not require the direct processing of materials. However, this can only be true at the micro level and at the macro-level all economic processes require the direct and indirect use of materials, in either the maintenance of labour or the production of capital.

Although the classical economists did not explicitly recognise energy *per se* as a factor of production, they understood clearly the limits which land (nature) imposes on economic activities, especially in agriculture. When classical economists speak of the *"fertility of nature"* (Adam Smith), *"the productive and indestructible powers of the soil*" (David Ricardo), "*the natural and inherent powers of the soil"* (John McCulloch), or speak of the earth as *"a wondrous chemical workshop wherein many materials and elements are mixed together and worked on* (Jean-Baptiste Say)," their language conveys a clear understanding of the contributions of nature to the economy [Alam (2006)]. Hall, *et al.* (1986) argued that energy is the primary factor of production, and labour and capital are intermediate factors of production. Primary is used in the sense of 'cannot be produced or recycled from any other factor' [Hall, *et al.* (1986)].

As discussed by Stern (2003), the neoclassical economists do not even implicitly include energy into their macro-economic framework. The argument is based on the rejection of land as a factor of production since the neoclassicals subsume land under capital. Energy from non-human sources e.g., coal, oil, electricity, food or fertiliser etc, enters the economy only as an intermediate input. The basic model of economic growth, the Nobel-prize winning work by Solow (1956), does not include resources at all in the basic framework. Also, the extensions of this model, that include energy in any form, are only applied in the context of debates about environmental sustainability, not in standard macro-economic functions [Stern (2003)].

Table 1

Evidence from Some Previous Studies

Author(s)	Analysed Countries and Periods	Variables Used	Methodology	Findings/Causality
Khan and Qayyum (2007)	Pakistan, Bangladesh, India, Sri Lanka (1972–2004)	real output, energy, capital and labour	Bound test ARDL	energy consumption to GDP
Asafu-Adjaye (2000)	India, Indonesia, Philippines and Thailand (1973-1995)	energy consumption and income	Granger causality, cointegration and ECM	short-run: from energy to income long-run: 2 cointegrating vectors, energy and price effects were weak.
Chiou-Wei, *et. al.* (2008)	USA, Taiwan, South Korea, Singapore, Hong Kong, Indonesia, Malaysia, Philippines and Thailand (1954-2006).	total energy consumption and real GDP	linear and nonlinear Granger causality tests	short-run: energy consumption causes GDP (Indonesia), bi-directional (Malaysia), nonlinear causal relations
Mehrara (2007)	Iran, Kuwait and Saudi Arabia (1971–2002)	real GDP per capita and energy use per capita	ECM and Toda-Yamamoto procedure	economic growth to energy consumption
Abbasian, *et al.* (2010)	Iran (1967-2005)	national income consumption of electricity, natural gas, coal, petroleum, solid biomass and total energy consumption	VAR, granger causality and also Toda-Yamamoto causality tests.	natural gas consumption leads to economic growth
Loganathan, *et al.* (2010)	Malaysia (1971-2008)	energy consumption and economic performance	Ordinary Least Square Engel-Granger, Dynamic Ordinary Least Square, ARDL, bounds test and ECM.	bi-directional co-integration effect
Islam, *et al*. (2011)	Malaysia (1971-2008)	Energy consumption, population, aggregate production, and financial development	ARDL and cointegration	Cointegrated, economic growth and financial development cause energy use.
Omotor (2008)	Nigeria (1970-2005)	National income, coal, electricity and oil consumption	cointegration and Hasio's Granger Causality test	bi-directional causality
Adeniran (2009)	Nigeria (1980-2006)	Oil consumption, real GDP, coal consumption, and electricity consumption	granger causality and cointegration	Cointegrated and energy consumption causes economic growth
Okonkwo and Gbadebo (2009)	Nigeria (1970-2005)	Economic growth and crude oil, electricity and coal	cointegration and OLS	Cointegrated and positive relationship between current growth and energy

Continued—

Table 1—(*Continued*)

Siddiqui (2004)	Pakistan (1970-2003)	GDP, capital stock, labour force, human capital, exports and energy(electricity, natural gas and petroleum)	granger causality and ARDL	Energy causes economic growth
Abosedra and Ghosh (2007)	Turkey, India, Philippines and Korea(Jan 1985 to Jan 2005) Pakistan (Jun 1994 to Jan 2005)	oil prices and economic growth	cointegration and granger causality	Not cointegrated Short-run: oil prices cause economic growth in Pakistan and Philippines.
Pradhan (2010)	Bangladesh, India, Nepal, Pakistan and Sri Lanka (1970-2006)	Economic growth and energy consumption	cointegration and ECM	energy causes economic growth
Soytas, *et al.* (2001)	Turkey (1960-1995)	GDP and energy consumption	Cointegration and VECM	energy causes economic growth
Lise and Montfort (2005)	Turkey (1970-2003)	GDP and energy consumption	Cointegration and OLS, VECM and granger causality	Cointegrated and GDP causes energy consumption
Altinay and Karagol (2005)	Turkey (1950-2000)	electricity consumption and real GDP	Zivot and Andrews test, Dolado–Lutkepohl test and granger causality test	Electricity consumption causes economic growth
Chontanawat, *et al.* (2006)	30 OECD and 78 non OECD countries	Energy consumption and GDP	Hsiao procedure, cointegration tests and ECM	Bi-directional causality in OECD countries
Joyeux and Ripple (2007)	seven East Indian Ocean countries (1971-2001)	Income and household electricity consumption	Panel cointegration	Not cointegrated
Imran and Siddiqui (2010)	Bangladesh, India, and Pakistan (1971-2008)	economic growth, energy consumption, capital stock and labour	panel cointegration, granger causality and Dynamic OLS	Short-run: neutrality, long-run: Cointegrated, energy consumption causes economic growth
Noor and Siddiqi (2010)	Bangladesh, India, Nepal, Pakistan, and Sri Lanka, (1971-2006)	per capita GDP and per capita energy consumption	Panel cointegration test, granger causality test and FMOLS	short-run: per capita GDP causes per capita energy consumption long-run: negative relationship
Joyeux and Ripple (2011)	26 non-OECD (1971-2007), 30 OECD (1960-2007)	income and total electricity consumption, residential electricity consumption, total energy consumption	Panel cointegration and causality	Cointegrated and income causes energy consumption.

Nicholas Georgescu-Roegen (1972, 1976) was one of the first to comment on the absence of energy in economic thinking of the Marxists and neoclassical economists as they take resources and energy flows for granted and ignore the economy's output of wastes. Roegen (1976) argued that standard economics does not recognise that *"terrestrial resources of energy and materials are irrevocably used up and the harmful effects of pollution on the environment accumulate."*

Overall there is a strong link between rising energy use and economic growth. However, the linkage between these two can be mitigated by a number of factors including shifting to higher quality fuels and technological change aimed at general increases in economic productivity. As explained above there is an inbuilt bias in mainstream production and growth theory to downplay the role of energy resources in the economy. Although there is nothing inherent in economics that restricts this potential role in the economy but there seems to be no particular theoretical work in conventional economic literature today that explicitly recognises this critical role.

II. INVESTIGATING ENERGY USE AND GROWTH LINKAGE: METHODOLOGY

Introduction

Following Soytas, *et al.* this analysis consisted of three key steps. The first step was checking for the stationarity of the series, the second step was testing for cointegration, and the third step was testing for causality in long and short run by developing a VECM and VAR Granger Causality respectively.

Rest of the chapter is organised as; Section 1 discusses the test of stationarity; lag length selection and cointegration test are explained in Section 2; Vector Error Correction Modeling (VECM) is established in Section 3; VAR Granger Causality/Block Exogeneity Wald Tests are discussed in Section 4 and; Section 5 provides the data description.

II-1. Test of Stationarity

To check for stationarity of the series, the Augmented Dickey-Fuller (1979) (ADF) unit root test was utilised. Stock and Watson (1989) and Nelson and Plosser (1982) are among the economists who argue that the causality tests are very sensitive to the stationarity of the series and many macroeconomic series are non stationary [Soytas (2001)]. Therefore, before taking any further step in our analyses, it was necessary to check for the stationarity of Natural Log of Energy Use (Lneu) and Natural Log of Real GDP (Lngdpc) series. The ADF test was conducted from the Ordinary Least Squares estimation of the following equation:

$$\Delta Y_t = \alpha_0 + \beta T + (\rho - 1)Y_{t-1} + \sum_{i=1}^{N} \alpha_i \Delta Y_{t-i} + \varepsilon_t \qquad \ldots \qquad \ldots \qquad \ldots \qquad (1)$$

where Y is the variable of interest, α_0 is the intercept, T is a linear time trend, Δ is the first difference operator, and ε_t is the error term with zero mean and constant variance. The test regression for ADF includes lagged differences of the dependent variable (Y) as independent variables to account for higher-order serial correlation. The hypothesis (H_0: ρ–1=0) that Y is a non-stationary is rejected if the test fails to reject the alternative hypothesis (H_1: (ρ–1) < 0). If the ADF test fails to reject the null hypothesis in levels but rejects it in first differences, then the series contains one unit root and is of integrated order one I (1). MacKinnon (1991) finite sample critical values were used to determine the statistical significances.

II-2. Lag Length Selection and Cointegration Test

Given the importance of selecting the appropriate lag length, selection was based on The Akaike Information Criteria (AIC) and Schwarz Criteria (SC). Johansen Cointegration test was used to determine the number of cointegrating vectors. As explained by Rathinam and Raja (2008), Johansen's methodology takes its starting point in the VAR of order k given by:

$$Z_t = A_0 D_t + A_1 Z_{t-1} + A_2 Z_{t-2} + \cdots + A_k Z_{t-k} + \in_t, \qquad \ldots \qquad \ldots \qquad \ldots \qquad (2)$$

Where A_i's are (n x n) matrix of parameters, Z is an (n x 1) vector containing all n variables in the system (Lngdpc and Lneu), D is a vector of all deterministic terms (intercept, trend, etc.), and $\in_t$ is an (n x 1) vector of white noise error terms. This unrestricted base VAR could be represented as a VECM as

$$\Delta Z_t = A_0 D_t + \Pi Z_{t-1} + \Gamma_1 \Delta Z_{t-1} + \Gamma_2 \Delta Z_{t-2} + \ldots + \Gamma_{k-1} \Delta Z_{t-k+1} + \in_t . \qquad \ldots \qquad (3)$$

$\Gamma_j \Delta Z_{t-j}$ is the first differenced component in the VAR system, where Γ_j is an (n x n) matrix of short term coefficients associated with the lagged values of variables in the system Z_t. ΠZ_{t-1} is the error-correction component, where Π is an (n x n) matrix of cointegrating parameters which characterize the long run relationship among the variables and long run adjustment coefficients in the VEC system. Thus Π consists of (n x r) dimension matrices α and β, where $\Pi = \alpha\beta'$.

The rank of Π matrix indicates the number of possible cointegrating relationship i.e. long run equilibrium relationship among the variables in the system. The rank of Π can be determined by λ_{trace} or λ_{max} test statistics as proposed by Johansen (1988). If the Π matrix has full rank then all the variables in the system are stationary and the error correction mechanism does not exists. If the rank of Π matrix is zero, the short-term dynamics depends only on lagged changes in all variables. The existence of co-integration between the two variables suggests the presence of causality between the variables in at least one direction [Engle and Granger (1987)].

II-3. VEC Modeling

As Engel and Granger (1987) suggest, if cointegration exists between two variables in the long run, then, there must be either unidirectional or bi-directional causality between these variables, thus Vector Error Correction Model (VECM) can be applied to study the direction of long-run relationship between the selected variables as cointegration test does not specify the direction of causality. The VECM for this study can take the following form:

$$\Delta LNGDPC_t = \beta_0 + \sum_{j=1}^{M} \beta_{1j} \Delta LNEU_{t-j} + \sum_{j=1}^{N} \beta_{2j} \Delta LNGDPC_{t-j} + \alpha E_{t-1} + u_{1t} \qquad \ldots \quad (4)$$

$$\Delta LNEU_t = \delta_0 + \sum_{j=1}^{K} \delta_{1j} \Delta LNEU_{t-j} + \sum_{j=1}^{L} \delta_{2j} \Delta LNGDPC_{t-j} + \lambda C_{t-1} + u_{2t} \qquad \ldots \qquad (5)$$

where Lngdpc is the natural log of Real Gross Domestic Product and Lneu is the natural log of energy consumption. E_{t-1} and C_{t-1} are the error correction terms, Δ is the first difference and u's are serially uncorrelated random error terms with mean zero. (M and N), and (K and L) are the optimal lag lengths. $C_{t-1}$is the lagged value of the residuals from the cointegration regression of Lngdpc on Lneu, and E_{t-1} is the lagged value of the residuals from the cointegration regression of Lneu on Lngdpc. Equation (4) can be used to test the causality running from energy use to economic growth while to test the causation from economic growth to energy use, Equation (5) can be used.

Within the VECM formulation of above equations, energy use does not cause economic growth if all βs and α is zero in Equation 4, and economic prosperity, measured by GDP, does not cause energy use if all δs and λ is zero in Equation 5. VECM approach allows us to determine the direction of causality in long run. Significant error correction terms (α and λ) implies long-run causal relationship. Error correction term contains the long-run information since it is derived from the long-run cointegrating relationship. It should be noted that the coefficient of error correction term is a short-run adjustment coefficient correcting long run disequilibrium in dependent variables in each short period. Thus the stability of long-run equilibrium can also be judged from the sign and significance of the error correction term as if it is negatively significant, it shows convergence towards the equilibrium i.e., a stable long-run equilibrium.

II-4. VAR Granger Causality/ Block Exogeneity Wald Tests

The VAR Granger Causality tests were used to determine the short run causal relationship between the two focus variables; energy use and real GDP. The VAR Granger Causality test also provides the direction of causality in short run. In a n-variable VAR of order p, Block-Exogeneity test looks at whether the lags of any variable Granger-cause any other variable in the system. Sargent (1976) has proposed a simple procedure called the direct Granger procedure for testing causality. Consider two stationary variables Y and X for which the regression equations are

$$Y_t = \sum_{i=1}^{p} \alpha_{iY_{t-1}} + \sum_{i=1}^{p} \beta_i X_{t-1} + u_t$$

$$Y_t = \sum_{i=1}^{p} \delta_{iY_{t-1}} + \sum_{i=1}^{p} \gamma_i X_{t-1} + v_t$$

The Wald test is used to test whether all the lagged values of X in the Y equation are simultaneously equal to zero. X Granger causes Y if $\sum \beta \neq 0$ and, if both $\sum \delta \neq 0$ and $\sum \beta \neq 0$, then there exists a bidirectional causality between Y and X.

II-5. Data Description

The annual data for the D8 countries; Bangladesh, Egypt, Indonesia, Iran, Malaysia, Nigeria, Pakistan, and Turkey from the year 1980 to 2007 is used. The data for energy consumption, measured by energy use (kg of oil equivalent per-capita) and GDP in million US dollars at year 2000 constant prices is collected from 'The World Development Indicators (2010)' by the World Bank. The data for total population is also gathered to convert the energy use (kg of oil equivalent per-capita) to total energy use (kg of oil equivalent).

III. INVESTIGATING ENERGY USE AND GROWTH LINKAGE: RESULTS AND DISCUSSION

In this section, the results of the estimation conducted on the data of all the D8 countries are discussed. The estimation was done using the statistical package of Eviews 5 and the obtained results are presented below.

III-1. Results of Stationary Test

The results of ADF test of stationarity are summarised in Table 2. For all countries, evidence was found in favour of the null hypothesis that both series contain unit roots at level, as t-statistics for all variables are less than the critical values at, respectively, 1 percent, 5 percent and 10 percent levels from ADF test. However, we reject the null hypothesis for the first differences of all series i.e., the results of the first differenced variables show that the ADF test statistics for all the series are greater than the critical values at 5 percent and 10 percent levels. Therefore, it is concluded that both series are integrated of the order 1 i.e., I (1) for all the countries. Thus cointegration tests can be applied for all countries.

Table 2

Results of ADF Test

Country	Variables	ADF test: Level	ADF test: First diff.	Order of Integration
	Lngdpc	0.26	–5.68*	I(1)
Bangladesh	Lneu	0.34	–3.51*	I (1)
	Lngdpc	–0.89	–2.66*	I (1)
Egypt	Lneu	–2.15	–5.07*	I (1)
	Lngdpc	–1.27	–3.77*	I (1)
Indonesia	Lneu	–1.00	–5.50*	I (1)
	Lngdpc	0.75	–3.86*	I (1)
Iran	Lneu	–0.21	–7.21*	I (1)
	Lngdpc	–0.51	–4.01*	I (1)
Malaysia	Lneu	–0.65	–7.45*	I (1)
	Lngdpc	1.75	–4.91*	I (1)
Nigeria	Lneu	–1.18	–4.91*	I (1)
	Lngdpc	–0.75	–3.31*	I (1)
Pakistan	Lneu	–2.14	–4.31*	I (1)
	Lngdpc	–0.31	–5.94*	I (1)
Turkey	Lneu	–0.43	–5.89*	I (1)

*Statistically Significant , 5 percent critical value = –2.981038, 10 percent critical value 2.629906.

III-2. Lag Length Selection

The optimal lag length selection was based on the results of two criteria Akaike Information Criteria (AIC) and Schwarz Criteria (SC).

Table 3

VAR Lag Order Selection Criteria

Country	Lags	0	1	2
Bangladesh	AIC	–3.26	–10.98	**–11.04***
	SC	–3.16	**–10.69***	–10.56
Egypt	AIC	–2.97	–8.99	**–9.03***
	SC	–2.88	**–8.70***	–8.55
Indonesia	AIC	–2.36	**–7.16***	–7.15
	SC	–2.27	**–6.87***	–6.67
Iran	AIC	–1.12	–5.59	**–5.99***
	SC	–1.02	–5.30	**–5.51***
Malaysia	AIC	–1.86	**–6.67***	–6.62
	SC	–1.77	**–6.38***	–6.13
Nigeria	AIC	–3.60	**–8.94***	–8.66
	SC	–3.51	**–8.65***	–8.18
Pakistan	AIC	–4.09	**–10.84***	–10.68
	SC	–3.99	**–10.55***	–10.20
Turkey	AIC	–3.84	–8.24	**–8.34***
	SC	–3.74	**–7.95***	–7.85

*Indicates lag order selected by the criterion.

The suggested optimal lag lengths by both the AIC and SC are presented in the Table 3. Although for most of the countries, the selected number of lags to be included was same by both criteria like in the case of Indonesia, Iran, Malaysia, Nigeria and Pakistan, but under circumstances where there was a discrepancy between the appropriate lag order, for example in case of Bangladesh, Egypt and Turkey, the selected lag order for the respective country was chosen on the basis of the results of SC as it is more accurate and thus is preferred by most of the economists including Geweke and Messe (1981).

III-3. Results of Short-run Causality between Energy Use and GDP

The results of investigation of short-run relationship between energy use and GDP by application of VAR Granger Causality/Block Exogeneity Wald Tests are presented in Table 4.

Table 4

VAR Granger Causality/Block Exogeneity Wald Tests

	Dependent Variable Lneu			Dependent Variable Lngdpc			
Country	Excluded	Chi-sq	Prob.	Excluded	Chi-sq	Prob.	Causality
Bangladesh	Lngdpc	5.26*	0.02	Lneu	0.25	0.61	GDP→Eu
Egypt	Lngdpc	13.14*	0.00	Lneu	0.03	0.86	GDP→Eu
Indonesia	Lngdpc	0.53	0.46	Lneu	1.53	0.22	Neutrality
Iran	Lngdpc	2.21	0.33	Lneu	10.38*	0.00	Eu→GDP
Malaysia	Lngdpc	15.50*	0.00	Lneu	0.16	0.68	GDP→Eu
Nigeria	Lngdpc	1.62	0.20	Lneu	25.33*	0.00	Eu→GDP
Pakistan	Lngdpc	9.02*	0.00	Lneu	0.97	0.32	GDP→Eu
Turkey	Lngdpc	2.95*	0.08	Lneu	0.21	0.65	GDP→Eu

*Indicates statistically significant.

From the results of VAR granger causality test above, it is concluded that there is a uni-directional short-run causality from real GDP to energy use in Bangladesh, Egypt, Malaysia, Pakistan and Turkey, as the null hypothesis of non-causality is rejected at 5 percent or 10 percent level of significance. However, this is not the case for test of causality from energy use to real GDP as the null hypothesis cannot be rejected for these countries. Thus in the short run higher rate of economic prosperity encourages energy use in Bangladesh, Egypt, Malaysia, Pakistan and Turkey but higher rates of energy use do not have an effect on the economic development in the short-run. For the energy exporters Iran and Nigeria, the opposite direction of causality can be observed as energy use significantly causes the economic growth even in the short-run as the null hypothesis of non-causality is rejected at 5 percent or 10 percent level of significance in both states without a feedback affect. In Indonesia, however, the neutrality hypothesis could not be rejected in the short-run i.e. neither energy use nor the economic growth caused each other in the short-run in Indonesia as the null hypothesis of non-causality could not be rejected at 5 percent level of significance.

III-4. Results of Long-run Cointegration between Energy Use and GDP

The results of Johansen Cointegration test are summed up in the Table 5. The Johansen cointegration technique has been used because of its ability to capture the properties of time series, to produce estimates of all possible cointegrating vectors and to provide test statistics for the number of cointegrating vectors.

Table 5

Results of Johansen's Cointegration Test (between Lngdpc and Lneu)

Country	No. of CE's	Trace Statistic	Critical Value	Max-Eigen Statistic	Critical Value	Conclusion
Bangladesh	H_0: None*	39.27	20.26	33.15	15.89	Cointegrated
	H_0:At most 1	6.12	9.16	6.12	9.16	
Egypt	H_0: None*	24.69	23.34	17.11	17.23	Cointegrated
	H_0:At most 1	7.58	10.67	7.58	10.67	
Indonesia	H_0: None*	21.16	20.26	14.01	15.89	Cointegrated
	H_0:At most 1	7.15	9.16	7.15	9.16	
Iran	H_0: None*	27.05	20.26	19.55	15.89	Cointegrated
	H_0:At most 1	7.51	9.16	7.51	9.16	
Malaysia	H_0: None*	13.18	12.32	13.18	11.22	Cointegrated
	H_0:At most 1	0.00	4.13	0.00	4.13	
Nigeria	H_0: None*	24.87	20.26	15.79	15.89	Cointegrated
	H_0:At most 1	9.08	9.16	9.08	9.16	
Pakistan	H_0: None*	18.74	20.26	16.30	15.89	Cointegrated
	H_0:At most 1	2.43	9.16	2.43	9.16	
Turkey	H_0: None*	33.70	20.26	27.85	15.89	Cointegrated
	H_0:At most 1	5.85	9.16	5.85	9.16	

*Denotes rejection of the hypothesis at the 0.05 or 0.1 level.

The estimated cointegration results between energy use and real GDP for all countries indicate that the two series have at least one cointegrating relationship in all countries. This is because the null hypothesis of H_0: r = 0 against r ≤ 1 is rejected at 5 percent or 10 percent level by either one or both of the criteria. One cointegrating equation means that there exists either a uni-directional or bi-directional long run relationship between energy use and GDP in these countries, and any change in one or both variables would most likely have implications on each other in the long term. These results suggest that the annual time series data from 1980 to 2007 appears to support the proposition that in the D8 countries there is a dynamic relationship between energy use and GDP.

III-5. Results of Long-run Causality between Energy Use and GDP

The VECM results for long-run causality and stability of the long run equilibrium relationship between energy use and economic prosperity are displayed in the Table 6.

Table 6

Summary of VECM Results (Dependent Variable= Lngdpc)

Country	Dependent Variable =Lngdpc	ECT D(Lngdpc)	ECT D(Lneu)	Causality
Bangladesh	0.55*** (5.72)	0.05*** (5.30)	0.11*** (3.83)	GDP↔Eu
Egypt	0.11 (1.57)	–0.60*** (–4.51)	–0.47 (–1.06)	GDP→Eu
Indonesia	1.15*** (12.60)	0.13** (1.97)	0.249*** (3.92)	GDP↔Eu
Iran	0.71*** (10.28)	–0.15*** (–2.22)	–0.30*** (–4.34)	GDP↔Eu
Malaysia	0.55*** (23.67)	–0.02*** (–3.58)	–0.02*** (–2.49)	GDP↔Eu
Nigeria	1.69*** (7.40)	0.05 (1.09)	0.09*** (4.36)	Eu→GDP
Pakistan	1.11*** (50.20)	0.27*** (2.21)	0.45*** (4.48)	GDP↔Eu
Turkey	1.04*** (52.52)	0.82*** (3.73)	1.06*** (5.94)	GDP↔Eu

*, **, *** indicates significant at 10 percent, 5 percent and 1 percent respectively.
t-values in parenthesis.

III-5-i. *Bangladesh*

For Bangladesh in the long run, there exists a bi-directional causality between the focus variables, as indicated by the significant error correction terms. The results also indicate that there is a positive relationship between energy and economic growth and one time relative increase in energy use will lead to 0.55 times relative increase in real GDP, as is indicated by the high level of significance and positive sign of the coefficient of Lneu.

Both the error correction terms for Bangladesh are highly significant. The error correction terms are positive which means that any exogenous shock in one of the variables will lead to divergence from equilibrium. An exogenous shock in the energy use will lead to 11 percent movement away from the original equilibrium every year while in case of a shock in the GDP, there will be 5 percent divergence from equilibrium per year. Thus the equilibrium is unstable in case of Bangladesh. Thus it can be concluded that in the net energy importer Bangladesh, energy use drives the economic development and the economic progress also has an influence on the energy use in the long-run.

III-5-ii. *Egypt*

The VECM results, reported in table, provide evidence of weak long-run relationship between the two variables for Egypt as the coefficient of energy use is not significant. The weak relationship can be attributed to the fact that Egypt's main exports consist of non-petroleum products such as ready-made clothes, cotton textiles, medical and petrochemical products, citrus fruits, rice and dried onion, and more recently cement, steel, and ceramics along with natural gas. Egypt's main imports consist of pharmaceuticals and non-petroleum products such as wheat, maize, cars and car spare parts (Wikipedia)

The adjustment coefficient for GDP is significantly negative as it should be, suggesting that the speed of adjustment of energy use towards the equilibrium in the long run in case of an exogenous shock is very high at 60 percent per year. On the other hand the error correction term for energy use, although negative, is insignificant indicating that all the adjustment towards the equilibrium is being done by the GDP. Thus it can be concluded that there is uni-directional causality between the focus variables in the short as well as long run where causality runs from GDP to energy consumption in the short-run as well as the long run. The long run findings are consistent with the findings of Costantini and Martini (2010) who also found the direction of causality running from GDP to energy use in the long run for their panel of OECD and non-OECD countries.

III-5-iii. *Indonesia*

In the long run in Indonesia, causality runs from the real GDP to energy use with a feedback affect and one time relative increase in energy use will lead to 1.15 times relative increase in the GDP. The error correction terms for GDP and energy use in Indonesia are highly significant. Thus feedback affect in the long run is found as the error correction terms (or adjustment coefficients) are significant.

The adjustment coefficient for energy use is positive and the speed of divergence from equilibrium as a result of an exogenous shock is of 25 percent a year. Also the adjustment coefficient for energy use is positive and significant. An external shock in GDP in Indonesia will lead to divergence of 13 percent per year so it can be concluded that in Indonesia there is bi-directional long run causality between economic growth and energy use but the equilibrium is unstable. Therefore, in Indonesia the energy use causes real GDP in the long run with a feedback affect. The findings for Indonesia are similar to the findings of Asafu-Adjaye (2000).

III-5-iv. *Iran*

The results provide a positive link between energy use and economic growth in case of Iran i-e one time relative increase in energy use will lead to a relative increase of 0.71 times in GDP. Iran is the second largest oil and natural gas producer in the world. High oil prices in recent years have enabled Iran to increase its export revenue and amass $100 billion in foreign exchange reserves through its exports. Thus an increase in energy use in the economy would lead to higher exports revenues (Wikipedia).

The adjustment coefficients are negative in both cases, suggesting that the speed of adjustment of energy use, in case of an exogenous shock, towards the equilibrium in the long run is 30 percent every year. Thus the equilibrium is stable. The error correction term for GDP is also negative indicating that in case of disequilibrium due to an exogenous shock, GDP will lead to convergence towards equilibrium at the rate of 15 percent every year. Thus there is uni-directional causality between the focus variables where energy use leads to economic growth in the short- run but bi-directional causality exists in the long run in Iran.

III-5-v. *Malaysia*

The VECM results for Malaysia provide evidence in favour of a significant bi-directional causality between economic development and energy consumption. The adjustment coefficients are highly significant advocating the long run bi-directional causality from energy use to real GDP in Malaysia. Moreover the relationship between the two is positive i-e onetime relative increase in energy use will bring relative increase 0.55 times in real GDP. The error correction term for a shock in GDP is highly significant and negative, therefore suggesting there is a long-run causal correlation from economic growth to energy use and the per year speed of adjustment towards equilibrium is slow at 2 percent in case of a disequilibrium caused by an external shock in GDP. The adjustment coefficient for energy use is also negatively significant.

Thus the long run equilibrium in Malaysia is stable and any disequilibrium due to an external shock will be corrected at the speed of 2 percent adjustment every year. Thus it can be concluded that energy consumption is influenced by economic growth in Malaysia with a feedback affect. These results are similar to inferences drawn by Loganathan, *et al.* (2010).

III-5-vi. *Nigeria*

In the long run, as suggested by the VECM results, there is uni-directional causality between the energy use and real GDP where there is a positive correlation between energy use and GDP and one time relative increase in energy use leads to a relative increase of 1.69 times in economic development.

The adjustment coefficient for energy use is highly significant, therefore suggesting there is a long run causal correlation from energy use to economic growth with no feedback and the per year speed of divergence from equilibrium is 9 percent in case of a shock in energy use because the sign of the error correction term for energy use is positive. Thus the equilibrium is an unstable one for Nigeria as it shows divergence from equilibrium in the long-run. The adjustment coefficient of GDP, although insignificant, also has a positive sign indicating to an insignificant causality from GDP to energy use in long run.

This can be attributed to the heavy dependence on oil as a source of revenue exposes the vulnerability of the Nigerian economy to global energy dynamics. Thus it can be concluded that energy use influences economic growth in Nigeria where increased energy use boosts GDP but the equilibrium in the long run is unstable. Adeniran (2009) also established long-run causality from energy to economic growth in Nigeria.

III-5-vii. *Pakistan*

In the long-run, as suggested by the VECM results, there is bi-directional causality between the energy use and real GDP where there is a positive correlation between energy use and GDP and one time relative increase in energy use leads to a relative increase of 1.11 times in economic development as indicated by the positive sign of energy use coefficient.

The adjustment coefficients are highly significant for energy use and GDP, therefore suggesting there is a long-run causal correlation from economic growth to energy use with feedback. The per year speed of divergence of adjustment coefficient of real GDP from equilibrium is 27 percent in case of an external shock because the sign of the error correction term of GDP is positive. Thus the equilibrium is an unstable one for Pakistan as it shows divergence from equilibrium in the long-run. The adjustment coefficient of energy use is also positively significant indicating to an unstable relationship between the two in long-run. Any external shock in the energy use will disturb the equilibrium and will lead to 45 percent divergence every year.

This can be attributed to the fact Pakistan is net importer of oil and virtually imports most of its fuel from other countries. The heavy dependence on oil imports to keep the production afloat exposes the vulnerability of the Pakistani economy to global energy dynamics. Thus it can be concluded that energy consumption and economic growth are influenced by each other in Pakistan where increased energy use boosts GDP but the equilibrium in the long run is very unstable. These results are in coherence with the findings of Pradhan (2010).

III-5-viii. *Turkey*

In the long-run there is evidence of bi-directional causality from the VECM results for Turkey, where causality runs from real GDP to energy consumption with a feedback affect. The relationship is also positive and highly significant i.e., onetime relative increase in the energy consumption will bring a relative increase of 1.04 times in real GDP.

The error correction terms are highly significant and both are positive. These results indicate that there is a long run bi-directional causality between energy use and economic growth but the long run equilibrium is not stable as suggested by the positive sign of the error correction terms. Thus any external shock will lead to a divergence in GDP of 82 percent every year and even higher in energy use. In the long run the economic situation of Turkey and energy use both affect each other. Moreover, for the period of 1980-2007, Turkey's long run equilibrium is very unstable. The same direction of causality was found by Aktas and Yilmaz (2008).

III-6. The Essence of Gathered Evidence

Apergis and Payne, (2009) synthesised the often conflicting results obtained by the literature into four hypothesis. According to the "growth hypothesis", energy consumption is a complement of labour and capital in producing output and, as a consequence, it contributes to growth. The "conservation hypothesis" implies that real GDP is not affected by energy conservation policies aiming at curtailing energy consumption and waste and improving energy efficiency. If the "neutrality" hypothesis holds energy consumption and real output will not have a significant connection. Finally, the "feedback" hypothesis suggests that more energy consumption results in increases in real GDP, and *vice versa*.

Table 7

Direction of Short-Run Causality in the D8 Countries

Feedback Hypothesis	Growth Hypothesis	Conservation Hypothesis	Neutrality Hypothesis
–	Iran	Bangladesh	Indonesia
–	Nigeria	Egypt	–
–	–	Malaysia	–
–	–	Pakistan	–
–	–	Turkey	–

From the gathered evidence, in the short run, the “growth hypothesis” is true for Iran and Nigeria, both energy exporters, where support for the hypothesis that energy use contributes to growth has been established. Thus energy use is an important determinant of economic development in both of these countries in the short-run and a shortage of energy would have serious repercussions for the pace of development and prosperity.

The “conservation hypothesis” where GDP is not affected by the energy use but itself has implications for energy use has been proved for Bangladesh, Egypt, Malaysia, Pakistan and Turkey in the short-run. In these countries, energy use does not have an influence on the growth process while GDP has an effect on energy use. Therefore, in these five countries, energy conservation may be viable without being detrimental to economic growth in short-run.

The estimation results support a “neutrality hypothesis” for Indonesia in the short-run pointing out that for the selected sample, the energy use and real GDP did not have significant implications for each other at least in the short-run. While in no case a support of the “feedback hypothesis” was established in the short-run.

Table 8

Direction of Long-run Causality in All D8 Countries

Feedback Hypothesis	Growth Hypothesis	Conservation Hypothesis	Neutrality Hypothesis
Bangladesh	Nigeria	Egypt	–
Indonesia	–	–	–
Malaysia	–	–	–
Pakistan	–	–	–
Turkey	–	–	–
Iran	–	–	–

In the long run, the results confirm that the “growth hypothesis” is true for the sample period in Nigeria. Therefore in Nigeria energy consumption has important insinuations for the growth and prosperity of the economy. Nigerian economy, as explained in the situation analysis, is overwhelmingly dependant on the exports of oil. Despite its huge energy reserves, the country faces acute shortage of financial resources and infrastructure to fully utilise them and as a result is still an under-developed economy. The Nigerian government heavily relies on the oil exports as they form the principal contributor in the total national revenue. The results of estimation suggest that in Nigeria, energy conservation policies may hinder economic growth in the long-run. Thus it is not a superior choice for Nigerian government to adopt energy conservation policies without diversifying the manufacturing and export base.

The “conservation hypothesis” is true for Egypt according to the long run investigation of the correlation between energy and economic growth for the selected years. Thus, it implies that in Egypt energy use does not determine pace of economic development and growth. The rationale of such result is that Egypt’s main exports consist of non-petroleum products such as ready-made clothes, cotton textiles, medical and petrochemical products, citrus fruits, rice and dried onion, and more recently cement, steel, and ceramics along with natural gas. The exports of petroleum products are minimal as compared to other exports. Egypt's main imports consist of pharmaceuticals and non-petroleum products such as wheat, maize, cars and car spare parts (Wikipedia). Therefore energy sector does not play the leading role in Egyptian economy and thus, energy conservation policies will not harm pace of economic development in Egypt.

The "feedback hypothesis" was established by the results of estimation of long run causality for Bangladesh, Indonesia, Iran, Malaysia, Pakistan and Turkey. This finding leads to the conclusion that energy sector is a major player in these economies and it has huge impact on the national income and development of the economies. Both of the variables have dynamic effect on each other. These findings are appropriate for these countries as Iran and Indonesia are major energy exporters and are prominent members of OPEC[1] while Malaysia and Turkey are among the fastest growing energy markets. The economies of these countries are, thus, massively dependent on their energy export revenues and thus there is a bi-directional causality between the real GDP and energy use as more energy production (i.e., a part of energy use) results in more national income with a feedback affect i.e., increased economic prosperity results in increased energy production and use. The economies of Pakistan and Bangladesh are facing energy shortages but are in developing phase where economies rely heavily on the energy use to ensure economic development. Both countries are net importers of energy. Therefore import payments have significant implications for the national income and any change in energy use will lead to a change in GDP and *vice versa.*

The evidence of "neutrality hypothesis" was not found in case of any of the D8 countries in the long-run. Thus the outcomes of estimation support the evidence that energy sector is an important part of the economies of the developing countries and it has dynamic affect on the economic standing of these countries. The energy sector thus needs proper attention of the governments of these countries as flawed, defective and misguided policies can injure the economy gravely for a long period of time.

IV. CONCLUDING REMARKS AND POLICY IMPLICATIONS

Energy plays a critical role in an economy on both demand and supply sides. On the demand side, energy is one of the products a consumer decides to buy to maximise his or her utility. On the supply side, energy is a key factor of production in addition to capital, labour and materials. This implies that there should be a causal relationship running from energy consumption to national income or GDP as well as vice versa. Consequently, governments as well as individuals and firms, motivated by financial or humanistic interests and who value access to energy as one of the basic human rights, are now making progress to provide energy to higher percentages of population throughout the world.

Keeping in mind the vital and critical role of energy in the process of development, this study aimed at developing the link between energy consumption and real output for the D8 countries including Bangladesh, Egypt, Indonesia, Iran, Malaysia, Nigeria, Pakistan and Turkey in both short as well as the long-run. The study was based on annual data covering the period 1980- 2007 for all countries. VAR Granger causality test was applied for the investigation of short-run causality between energy use and economic

[1]For the sample period, i.e., 1980-2007. Indonesian membership of OPEC was suspended in 2008.

growth in all countries while to determine the long-run causal relationship, cointegration test based on Johansen technique and Vector Error Correction Model (VECM) were employed.

The short-run estimates of the VAR Granger causality provides support for ‘growth hypothesis’ in Iran and Nigeria, of the “conservation hypothesis” in Bangladesh, Egypt, Malaysia, Pakistan and Turkey, and of a “neutrality hypothesis” for Indonesia for the selected years. The ‘evidence of a ‘feedback affect’ in the short-run, could not be found in any case.

The Cointegration tests supported the evidence of cointegration among the real output; measured by GDP and energy use in all the member countries. The VECM results confirmed that in the long-run, the “growth hypothesis” is true for the sample period in Nigeria while “conservation hypothesis” is true for Egypt. The “feedback hypothesis” was established by the results of estimation of long-run causality for Bangladesh, Indonesia, Iran, Malaysia, Pakistan and Turkey. The results based on the long-run analysis by VECM suggest that energy consumption plays an important role in enhancing productivity in all the countries except Egypt in long-run and energy use has important implications for these developing countries in the long-run. The results support the evidence of causality running in either one or both directions between energy consumption and GDP in all the countries in the long as well as in the short-run except Indonesia in the short-run. On the whole, results suggest that the economies of most countries are energy dependent and shortage of energy may negatively affect the economic growth which eventually results in a fall in income, employment and broadly, social welfare.

The important policy implications drawn from this study are that in order to achieve rapid economic growth, members of the D8 should adopt a policy of energy sector development on priority basis. The results of estimation reveal that there is energy sector has uni-directional or bi-directional long-run implications for the economic growth in these countries. These D8 countries are, as concluded by the situation analysis, rich in renewable resources of energy like tidal, air, solar, biomass etc. Therefore, there is need to build new dams, installation of wind power plant and tidal energy projects to expand the energy production capacity especially in the countries facing energy crunch such as Bangladesh, Pakistan and Turkey.

Bangladesh, Pakistan and Turkey should try to avoid or minimise the import of crude oil at massive costs which are resulting in depletion of foreign currency reserves. For the achievement of this objective, the masses in these countries should be educated about the use of renewable energy to decrease dependence on fossil and traditional sources of energy. Moreover, policy orientation needs a drastic modification to focus on utilisation of endogenous resources. There must be short-term and long-term planning regarding the energy demand and supply in the economy. Finally these countries should pursue energy conservation policies in such a way that is not detrimental to on economic growth.

As for the energy exporting countries, the results show that energy consumption plays an important role in these economies in short as well as long-run. These countries need to reduce their over dependence on the energy sector for the economic growth and development and diversify their economies. The analysis of the current situation exposes the overdependence of these economies on the energy exports. The countries such as Iran and Nigeria need to broaden their industrial and export base from only natural resources to varying energy intensive industrial products. Furthermore, Nigeria should develop the domestic infrastructure and make sure of an environment conducive for foreign investment. Iranian and Malaysian governments have historically been giving huge amounts in respect of subsidies to the energy sector, as mentioned in the overview of the energy sector of the respective countries. These countries need to adjust their prices in accordance with the international market prices.

As for Malaysia and Indonesia, two of the fastest growing economies in East Asia, the demand of energy is growing at very fast pace in these countries. These countries, it is feared, will have to face energy crunch in near future. As it has been established by the outcomes of the estimation, energy has long-run insinuations in both economies therefore, the respective governments should plan ahead to avoid possible chaos due to energy crisis. For that purpose, there is a dire need of popularising the use of renewable energy, which might be the only solution to problems related to energy demand and supply.

While this analysis conclusively demonstrates dynamic causal linkages between energy consumption and economic growth, it should be stressed that the usual production function also includes capital and labour. Hence, in future work, the techniques employed in this study can be readily extended to other multivariate systems, where energy consumption and real income are exposed to other economic factors such as capital stock and employment to improve the model. The sample size of 28 years may also be increased for better inferences.

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Rooftop Rain Water Harvesting Technology and Women Time Allocation in District Bagh and Battagram Pakistan

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1. INTRODUCTION

Water is essential requirement of life and accessibility to safe drinking water is the fundamental right of every human being [IUCN (2004)]. It is not only an essential component of primary health care but it also plays a vital role in livelihood security and national economic development [Mustafa, *et al.* (2009)]. With the passage of time water is becoming a scarce resource all over the world. It is scarcer in low income countries, where majority of the poor resides in the rural areas, results in water allocation problems [Xinshen, *et al.* (2005)]. This scarcity is due to number factors like, agricultural intensification, industrialisation, and increasing population pressure. It is the dire need of time to formulate some practical strategies to address the issues of water crisis. In this regard a number of approaches including Rain Water Harvesting (RWH) are being practiced.

RWH is one useful approach to conserve, store and utilise rain water from different catchment areas. In addition to sustainable supply of water for domestic consumption, this technology will ease out the pressure from existing water sources. RWH is an old but useful approach to channel and use the rainwater in productive manners [Li, *et al.* (2000) and UNEP (2009)]. It has special importance for Pakistan as the country is confronting acute water shortage. World Bank (2005) has already declared Pakistan as water stressed country in South Asia. Supplying water in hilly areas is time consuming, hazardous, and costly business with numerous risks involved with it [Baguma, *et al*. (2010)]. World Bank (2005) also recognised that RWH is the most suitable and viable approach for hilly areas of Pakistan.

Given the increasing risk of water crisis in Pakistan, some agencies have taken the initiatives to ensure the sustainable supply of water in rural areas. In this regard Earthquake Rehabilitation and Reconstruction Authority (ERRA) has initiated a project of Rooftop Rain Water Harvesting (RRWH) technology in seismically sensitive areas of Pakistan. This project has been scaled up from its pilot to full fledge implementation phase which includes almost all earthquake affected districts of KPK and AJK Pakistan.

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Governments of Pakistan along with a number of donor agencies are supporting this project right from its conception. The project has targeted rural communities of earthquake affected areas, who are most vulnerable with respect to water availability. Present study is the evaluation of pilot phase of the project and it analyses the technology with special reference to women time allocation in those communities.

The rationale of the study is that, before this technology woman were fetching water far from their dwelling units which required large amount of time to visit the source of water every day. After the implementation of the technology it is assumed that women time of water fetching has significantly reduced. Based on this presumption that RRWH technology has altered the time allocation of women in respective communities, present study aims to investigate the overall impact of technology on women time allocation.

2. RRWH TECHNOLOGY AND WOMEN TIME ALLOCATION

Since this is the first ever initiative when RRWH technology is being formally implemented at large scale, there is paucity of literature on the subject from Pakistan. Authors could not find any study in Pakistan on RRWH technology and specifically its impact on time allocation. However, some studies on RRWH technology with special reference to time allocation were found from abroad but most of the authors studied the phenomena theoretically and have not tested the impact empirically. Study has cited some of the relevant research in following paragraphs.

Lehmann and Tsukada (2009) and examined rainwater harvesting with reference to health and time allocation. They conclude that this technology reduces cost incurred on health as well as time allocation for curing sick people, which could be used for profitable activities. Similarly, young children (both male and female) can go to school who are otherwise busy in fetching water. Furthermore, this system improves the sanitation and hygiene facilities to rural population by providing them water at home on sustainable basis.

Baguma, *et al.* (2010) studied rainwater harvesting with reference to human health and time allocation. Using the data and empirical evidences they concluded that this technology reduces cost incurred on health as well as time allocation for curing sick people, which could be used for profitable activities. They have indirectly reckoned the saving of time. Study also reported that, due to this technology young children (both male and female) have the time which they were spending to collect water before this technology. Now they can go to school who are otherwise busy in fetching water. Moreover, this system improves the sanitation and hygiene facilities to rural population by providing them water at home on sustainable basis. Study also argued that this technology has reduces the associated risks.

In Kenya, Elizabeth, *et al.* (2006) has conducted a research on water, women and social organisations. They have conducted a survey of some villages to investigate water-women nexus. Findings of the study exposed that, safe and easily accessible water has brought a range of benefits to those households, especially through activities where women have special responsibilities. Study reported that, households with improved water access have saved time, improved health, cleaner clothes, and increased production of tea seedlings, milk and vegetables, with the net result of significant increases in income controlled by women.

3. THEORETICAL CONSIDERATIONS AND ECONOMETRIC SPECIFICATION

This section briefly describes the channels through which the Rooftop Rain Water Harvesting (RRWH) technology and other control variables affect the women time allocation. Theoretically speaking, the RRWH technology is expected to have positive effect on women time allocation in terms of reducing their time which they are spending on water fetching. The RRWH technology has huge potential in terms of water supply and it facilitates women by providing them required amount of water which is otherwise brought from distanced water sources. Consequently, this facility saves their time which can be used in other productive and healthy activities.

Hence, one may expect positive impact of the RRWH technology on time allocation in rural and hilly areas. This variable of 'RRWH' is quantified by using a dummy variable where "1" represents the household possessing this technology (also called the "treated group") and "0" represents the household where this technology is not provided (also named as "control group"). On the other hand, the women time allocation is quantified as the 'TWT' total work time which they allocate in different activities time. The control variables used in the women time allocation model include Region, age of the women (Age), household income (HHInc), and education of the woman (Edu), distance from water sources (DWS), and social activities time (SAT).

The variable "region" is quantified using '1' for Bagh and '0' for Battagram. This variable is incorporated in order to investigate whether there is any impact of regional differences. "Age" denotes the age of water fetching woman. The expected sign of its coefficient is positive, because with the increase in age, women allocation of time is expected to increase. Because the body and the resistance weaken as the woman enters to older age group. Subsequently, a positive sign of the coefficient may also be expected.

Education, taken as the years of schooling of the water fetching woman, is expected to improve the women time allocation for the reason that the educated women are comparatively better aware of the productive allocation of time. Therefore, its expected sign is positive. DWS measures the distance of water source from dwelling unit in kilometers and its probable sign is negative, HHInc is the income of a household which may affect time allocation negatively because women time allocation may reduced due to increased purchasing power for goods and services from market. SAT is the social activities time which women allocate in their daily routine to interact with their friend, relatives and neighbours. Expected sign of its coefficient is positive. In the light of above discussion, the following econometric specification can be given:

$$TWT = \alpha_0 + \alpha_1 RRWH + \alpha_2\, Region + \alpha_3\, Ages + \alpha_4\, HHInc + \alpha_5\, SAT + \alpha_6\, Edu + \alpha_7\, DWS + \varepsilon \quad \ldots \quad (1)$$

In order to estimate the above equation Ordinary Least Square methodology was used.

4. METHODOLOGICAL ISSUES

4.1. Overview of the Study Area

Study area includes two villages; one from district Battagram and, other from Bagh where RRWH project has been initiated. Battagram is a district of Hazara division in Khyber Pakhtunkhwa province in Pakistan. Total land area of the district is 1301 square kilometers and the estimated population in 2004-05 was 361,000 [Battagram (2007)]. This district is located at 90 km from Abbottabad and 240 km from the capital of Pakistan Islamabad. Three main languages; Pashto, Hindko and Gojri are also spoken in the district. English and Urdu are also spoken and understood in offices. Battagram obtained the status of district in July 1993 when it was upgraded from a Tehsil and separated from Mansehra district [Battagram (2007)]. Before Battagram obtained the status of district, it was a Tehsil of the Mansehra district.

RRWH technology has been executed in Saroona, a village of Allai which is one of the two Tehsils, or subdivisions, of Battagram district. The geography of Allai valley is such that it is bounded by Kohistan on the north and east, by the Kaghan valley, Nandhiarh and Deshi of Deshiwals on the south, and by the Indus river on the west. Valley has been ruled by Khans (tribal rulers) until 1949, than it became the part of Pakistan [Battagram (2007)]. The residents of Allai valley were badly affected by the massive Earthquake on October 8, 2005 which destroyed the ‘cable way’; a way to allow residents to cross the Indus River. Pilot phase of RRWH system was implemented in Saroona which is one village of union council of Allai. The total no of households of Saroona village are 330 [Battagram (2007)]. The total population of the village is 5000, whereas the average household size is 8. In pilot phase the facility of RRWH was provided to 50 households.

Bagh is one among the eight districts of Azad Jammu and Kashmir, Pakistan. Total territory of the district is 1,368 square kilometers [Bagh (2007)]. Bagh district has three sub-divisions, namely Dhirkot, Bagh and Haveli. It is said that name of the city is from a *Bagh* (garden) which was set up by the landowner of the area, which is now forest department. As a result, the area that is now the district headquarters was named “Bagh”. This city was badly affected by the Earthquake on October 8, 2005 which destroyed the overall infrastructure of the district.

Survey of present study has been carried out from, Chitra Topi, which is the project site of RRWH. It is a village of union council Topi in district Bagh. This village is situated in the North East of Bagh city at an altitude of 7000 feet above from sea level and on a distance of 18 KM main city of Bagh. Topography of most of the Bagh city is based on hilly terrain. Number of the households in this village are 274. Total population of the village is 1918 in which males are 940 and females are 978. Overall literacy rate of the village is above 80 percent [Bagh (2007)]. The main clans of the Chitra Topi are Suddhen, Mughal, Qureshi. Suddhen is the most influential clan that take the lead and dominate in taking decisions at the local level.

4.2. Survey Methodology

To collect the data survey was carried out through personal interviews of respondents in the selected villages of both districts (Bagh and Battagram). This survey was based on pre-tested questionnaire which was followed to construct a sound and well-developed questionnaire. Population of the present study is based on two groups; the one provided with RRWH systems is called the “treated group”, while the other using the traditional water supply sources within the same localities is entitled the “control group”. The purpose behind this sampling pattern is to investigate comparative impact analysis of RRWH system.

In order to conduct the analysis, the study has taken the entire population of treated group. Because treated group was of 50 household in each village. Sample from control group of population was picked for analysis using Random Sampling technique. The methodology is selected for the reason that all samples of the same size have an equal chance of being selected from the population. Secondly the population in control group was homogenous with respect to water supply. Lastly, the approach was suitable provided the resource limitation, location and facilitation. The optimum sample is the one which maximises precision per unit given the cost, and by this criterion, Random Sampling is often superior over other methods.

5. RESULTS AND DISCUSSIONS

5.1. Descriptive Analysis

In descriptive analysis some of the important variables regarding water fetching women are presented. These variables includes; their Ages, Education, Social Activities Time, Sleeping Time, and Distance from Water Source, Per Day Time for Water Fetching, Persons Involved in Water Fetching, Daily Saved Time due to RRWH and its spending are included. In addition to overall sample results, statistics of the both regions are also presented separately (Table 5.1a). These summary statistics are clearly indicating the variations in sample across the villages. Moreover, these findings are contributing yielding a support to interpretation and understanding of econometric results.

Table 5.1(a)

Average of Women Ages, Education, Distance from Water Source (Km), Social Activities Time (Hrs), and Sleeping Time (Hrs)

Regions	Women Ages (Years)	Women Education (Years)	Distance from Water Source (kms)	Social Activities Time (hrs)	Sleeping Time (hrs)
Bagh	34	7	0.6	0.7	7
Battagram	33	0	1	0.5	7
Overall	33.5	3.5	0.8	0.6	7

Table 5.1 (a) shows that average age of water fetching women is 33 years in the overall sample, as well as at village level. Moreover, 12 years as minimum and 65 years as maximum age were reported across the sample. This information shows that on average water fetching women in both regions are young, which is understandable because it is a tedious job and it is difficult for old women to perform it. On the other hand it is the most potential age group which has comparatively higher opportunity cost of time. The water fetching time of women could be resourcefully utilised by adopting this alternative technology for water supply.

Women Education is very crucial variable of the study, because it affects the overall socio economic conditions of women, especially in decision making regarding employment, time allocation in domestic activities, maternal health, sanitation and hygiene, and their medical checkups etc. The difference of education and its impacts are highlighted by the present study, because women education is totally different across the two regions (Table 5.1 a). Average years of schooling for women in Bagh are 7, whereas in Battagram there were no educated women. Furthermore, in Bagh maximum years of schooling was 16 years but in case of Battagram there was only one women which had 7 years of schooling, and it was the highest in that area.

Distance from water source is the average distance women have to walk while carrying the water. This variable has special importance with reference to women health and their time allocation. Survey of present study revealed that average distance from water source is 0.6 kilometer in Bagh while it was one kilometer in Battagram. This means that on average women have to walk more in Battagram, so they may be more vulnerable to water fetching hazards. Minimum distance reported in Bagh is 0.1 kilometer and maximum is 2 whereas, in Battagram it is 0.2, and 3 kilometers, respectively.

In rural areas, women often interact with their neighbours, relatives and close friends during the usual routine, which come under their social activities time. So, study has investigated their social activities time in order to analyse its pattern and impact on women comfort in both communities. Overall per day average time allocation for social activities is around one hour, but among both villages, it is higher in Bagh and lesser in Battagram. Because women in Battagram region are not allowed to go out of their homes. The minimum per day average time allocation for social activities is zero and maximum is 3 hours for both communities (Table 5.1 a). This is the social capital of rural women which help them in easing out the stress and managing daily life problems.

Sleeping time of women is very crucial indicator with reference to women wellbeing. On average reported sleeping time of women was 7 hours in both villages (Table 5.1 a) whereas, minimum and maximum time was 5 and 9 hours, respectively. This shows that there was no such dilemma of sleep shortage in these regions, as people go earlier for sleeping due to tiresome work routine. And in mountainous areas, people avoid working and moving in late evening and prefer to sleep early. Moreover, in the sample areas there are no such provisions like cable, internet etc. where people can engage themselves for long after evening.

Per Day Time for Water Fetching is an important variable with regard to women time allocation. It is determined by the distance of water source. Average water fetching time in Bagh and Battagram was 4 and 6 hours, respectively. The average water fetching time in Battagram was higher by 2 hours, which was due to the higher average distance of water source from dwelling unit (Table 5.1 a). Minimum time required for fetching water reported in Bagh was 0.25 hour whereas; in Battagram it was one hour. Similarly, maximum time allocated to water fetching in Battagram was 12 hours a day while, in Bagh it was 10 hours.

Another important variable regarding water fetching is Persons Involved in Water Fetching. Study reveals that on average each household had 2 individuals who were fetching water in both regions. Single person in fetching water reflected as minimum number of water fetching individuals in both villages (Table 5.1 b). Maximum number of water fetching individual was 4 and 5 in Bagh and Battagram respectively.

Table 5.1 (b)

Average of Per Day Time for Water Fetching, Persons Involved in Water Fetching and Daily Saved Time

Regions	Per Day Time for Water Fetching (hrs)	Persons Involved in Water Fetching	Daily Saved Time (hrs) Due to RRWH System
Bagh	4	2	4
Battagram	6	2	6
Overall	5	2	5

Daily Saved Time in hours is a crucial variable of the present study. It is based on women saving of time which become possible after getting installed the RRWH System. Findings of the study yielded that in both villages women save on average 6 hours of daily water fetching time due to this facility (Table 5.1 b). Notably, minimum time saving was 2 and maximum was 10 hours in both study areas. Findings of the present study are in line with the study of Elizabeth, *et al.* (2006). It is worthwhile to mention that, this saving of time due to RRWH technology was being invested in productive activities by the women.

These activities includes, entertainment and social activities, agriculture and livestock, domestic work, education and awareness etc. (Table 5.1 c). Findings yields that women from Bagh are spending 20 percent of their saved time in entertainment and social activities which indicates that they have the social capital and they are doing investment to enrich it. Social capital plays a vital role in women welfare because, they discuss their daily life problems and get or offer help within their networks.

Contrary to Bagh, women in Battagram are not spending their saved time in social activities and have zero social interaction with other women in communities on regular basis. The reason behind this is that culturally women in Battagram rarely go out of their homes, so they cannot form such networks with other community members as of Bagh. This is important finding of the study because it indicates the strength of social networking in both regions.

Table 5.1 (c)

Saved Time Utilisation by Women

	%age of Average Saved Time Allocated for Different Productive Activities at each Location			
Regions	Entertainment and Social Activities	Agriculture and Livestock	Domestic Work	Education and Awareness
Bagh	20	26	34	20
Battagram	0	25	70	5

Agriculture and livestock is the main sector of rural economy everywhere in the world. Because it provides food, fiber, fodder and livelihood sources to rural population. Moreover, due to having enough available land and less off farm income opportunities, rural household prefer to cultivate crops for their sustenance. Study exposed that women are utilising almost 25 percent of their time saving in agriculture and livestock in both regions (Table 5.1 c). It means that agriculture and livestock is getting almost equal attention and share of women's saved time in Bagh and Battagram.

In domestic work women from Battagram are dominating over women of Bagh in allocating saved time. Study estimated that they are spending 70 percent of their saved time in domestic activities which is almost double of that in Bagh. The reason is that women from Battagram had no time allocation for social activities which is being used in domestic work. Moreover, they have less education and mobility out of their houses, which compel them to use saved time in domestic work. Education and awareness includes time allocation in getting formal or informal education, children tuition, or other awareness related activities at household level. It also grabs more attention of women in Bagh, because level of women education is higher in this area. They are spending 20 percent share of their saved time in education and awareness activities whereas; in Battagram it is 5 percent.

5.2. Econometric Analysis

Using OLS technique study analysed the impact of RRWH technology on women time allocation. Dependent variable is Total Work Time ‘TWT’ of water fetching women from early morning to night. Explanatory variables includes focused variable ‘RRWH’ and some controls. Study computed several models for women time allocation form model 1 to 4 with different specifications in order to check the robustness of the results. Model 1 is the baseline model that includes relevant variables.

Amongst the explanatory variables Rooftop Rain Water Harvesting ‘RRWH’ is a dummy which is used as proxy for ‘RRWH’ where ‘1’ stands for treated group and ‘0’ for the control group. It is the key or focused variable of the study and included in model to look into its impact on women total work time. Findings yielded that, ‘RRWH’ has positive relation with ‘TWT’, dependent variable. Positive sign of variable was expected and its value is significant. It is very prominent finding of the study, which means that total available work time excluding water fetching time has increased due to saving of time which otherwise invested in water fetching.

And that time is being utilised in productive activities like children brought up, agriculture and livestock, social activities and entertainment, and domestic work. Saving and productive usage of time has already been confirmed by the cross tabulations presented in descriptive findings’ section. It is important to mention here that might be total saved time was not being fully utilised, but even if women are using part of that time saving, still it is resourceful and it enhances the wellbeing of communities which are using RRWH technology.

Region ‘REGION’ is also a dummy variable, included in analysis to investigate the regional difference of time allocation. The construction of this dummy is such that ‘1’ represents Bagh and ‘0’ symbolises Battagram. The variable is significant with negative sign which was expected. The reason of negative sign is that, both regions of the study are different with respect to socio economic and cultural aspects. For instance, as explained above education level is different in both districts. Additionally women access to health, education, nearest market and transportation service is comparatively better in Bagh as of Battagram. Moreover, regional income disparity is also found by the study, which is due to different levels of on and off farm available job opportunities and role of agriculture and livestock across the regions.

Table 5.2

OLS Model of Women Time Allocation Model

Variables	Model 1	Model 2	Model 3	Model 4
CONS	13.294	13.287	13.287	13.221
	(31.88)***	(32.00)***	(24.50)***	(33.11) ***
RRWH	1.910	1.907	1.913	1.921
	(6.74)***	(6.88)***	(6.88)***	(6.78)***
REGION	–0.984	–0.982	–0.864	–0.902
	(–3.16)**	(–2.42)**	(–2.40)**	(–2.92)**
AGES	0.018	0.018	0.018	0.021
	(1.57)	(1. 57)	(1. 58)	(1.63)
HHINC	–6.09e-06	–6.09e-06	–6.09e-06	
	(–0.47)	(–0.47)	(–0.47)	
SAT	0.112	0.112	0.110	0.111
	(0.67)	(0.69)	(0.67)	(0.68)
EDU	0.017	0.017		
	(0.38)	(0.38)		
DWS	–0.007			
	(–0.02)			
No. of Obs	370	370	370	370
R^2	0.1285	0.1285	0.1281	0.1277

Note: Robust *t*-statistics in parentheses. *Significant at the 10 percent level. **Significant at the 5 percent level. ***Significant at the 1 percent level.

Women Ages 'AGES' was included in model to identify the impact of women age on women time allocation. The variable was found to be insignificant with expected sign. The reason of insignificance of this variable is that on average women age was 33 years and data has reported less variation in women ages. From this, one may conclude that within this age group which comprised almost all young women, comparatively vulnerability to disease is very less, and could manage their domestic work easily. So women age has no affect on total work time.

Household Income 'HHInc' is very important variable engulfed in model. It is almost insignificant with negative sign which was expected. Since there were no such employments opportunities for women, where they can offer their services to market, they cannot avoid the household jobs. Secondly, there is no trend of hiring house maids and servants in those communities, due to which a women from household having higher income cannot use the services of someone else to reduce the time for domestic work. Thirdly, it is due to the social structure of male dominant society, where women have very less share in decision making. And they follow the set norms of society and do not demand more than what they have.

Social Activities Time 'SAT' is highlighted as a predictor of total work time. But this variable is also insignificant having lowest value of its coefficient. Reason of insignificance of this variable is that, when women go out of their homes for some work they get the company of other women, which is their SAT as well as work. For instance, when they go for shopping, fetching of water or herding their animals in range lands, they get the company of their friends and neighbours. Due to this reason their social activities time cannot exactly isolated from their work time and is not significant in model.

Education of Women ‘Edu’ was taken in to model to analyse its impact on overall women time allocation pattern. Women education is insignificant in model and it has two reasons. One is that study have dominant sample from Battagram where there is almost zero education of women as compare to Bagh. Secondly, since all women in our sample are either housewives or the most responsible member of their household, they have to spend a good chunk of daily time for domestic work, and they cannot avoid it even if they are educated. Thirdly, over there women did not have such employment opportunities as of urban, so they prefer to manage their domestic work, because culturally every potential woman in rural household has to share the burden of family.

Distance from Water Source ‘DWS’ is comprised in model to examine its impact on time allocation. This variable is not significant because of shorter distance of water source. As the average distance of water source from dwelling unit is 1 kilometer that is not large for the people of hilly area. Secondly in each household there was more than one woman which was fetching water, so time of water fetching was distributed. Due to which it has no significant impact on overall time. Moreover, distance from water source is not the sole determinant of time allocation to water fetching and total work, but there are some other factors like nature of tracks and travel hurdles which determine the women time allocation.

R^2 shows the overall goodness of fit, which is significant in case of model 1. In model 2 study excluded the ‘DWS’ which has the lowest value of its coefficient and is not explaining the dependent variable. Exclusion of this variable has not altered the sign or significance of any variable. All other variables are remained same. In model 3, study dropped the ‘EDU’ which was also insignificant. Dropping this variable out of model, make no change in the sign or significance of any other variable in the model 4. So, we can say that this variable is also not a predictor of the women time allocation. Study eliminated the ‘HHInc’ from model 4 due to its insignificance. Elimination of this variable is also justified because still all variables are same with their sign and significance.

6. CONCLUSION AND POLICY IMPLICATIONS

Present study is the assessment of RRWH technology to investigate the impact of technology on women time allocation. Mainly there are two parts of the present study. First part is based on descriptive analysis which reports the potential of technology in saving the time of water fetching women. This part of the study has also reported that saved time of water fetching is being utilised by women in advantageous activities. In this regard level of awareness and understanding of the technology is found to be the most important determinant of effectiveness of the technology in terms of accruing the optimum benefits.

Second part is based on econometric analysis which yielded that there is significant positive impact of RRWH technology on women time allocation. Study exposed that technology has reduced the time allocation for fetching water. Findings endorsed that this system is very viable, profitable, women friendly, and sustainable source of water supply. The findings of the present study have following policy implications.

(1) Firstly, the technology is very useful because it is saving time which is being productively utilised. Therefore present study recommends that the technology should be extended and installed in all other areas.
(2) The system has special importance with reference to women well-being, because it reduces the time and fatigue involved in fetching water. Study proposes that women of those communities should be trained to utilise their saving of time for some productive activities.
(3) Present study has found that education and awareness of supported population played significant role in accruing the benefits of any development. Based on this finding, study proposes that in order to ensure the maximum benefits of any facility, beneficiaries should be educated and trained so that they could get maximum out of that.
(4) RRWH is environmental friendly in many respects like it increase water and soil conservation, ensure sustainable water supply, put less pressure on existing water sources, has no such negative externality, and enhances the poor's resilience against drought conditions. So in order to ensure environmental sustainability this technology should be promoted at large scale.

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Green Growth: An Environmental Technology Approach

GHULAM SAMAD and RABIA MANZOOR

1. INTRODUCTION

Green growth policies provide strategies to overcome the economic policies, which have devastating impact on the sustainability of the country growth pattern. The growth that sustains development and increases the opportunities of jobs and income with low environmental degradations. Sustainable economic growth is achieved through the green environmental technologies to maintain and restore environmental quality and ecological integrity, while meeting the needs of all people with the lowest possible environmental impacts. It is a strategy that seeks to maximise economic output (GDP) while minimising the ecological burden.[1] United Nations Economic Social Commission for Asia and Pacific (UNESCAP) in his theme paper on green growth based green growth on five tracks namely, (a) green tax and budget reform, (b) development of sustainable infrastructure, (c) promotion of sustainable consumption and production, (d) greening the market and green business, (e) economic-efficiency indicators. One of the basic purpose of the green growth is to facilitate green accounting, economist are of the view that there is need for GDP measuring to include green accounting as the existing national income accounts excludes environment. The growth, which considered the inter-temporal welfare considered the social discount rate, aggregate supply and demand analysis in the context of environmental degradation and considering the structure change of the economy is defined as green growth.

In recognition of the global challenges the rapidly rising green house gases emission is one of the important challenges the ecology/ecosystem has to face. The International Energy Agency (IEA) technology perspective assess the strategies to reduce the carbon dioxide (CO^2) emissions to 14 Gtfor 2050 keeping the 2005 as a baseline emission 62 Gt. The cost effective combination of technologies to reduce the CO^2 emissions from the baseline of 62Gt to 14Gt are: Carbon dioxide Capture and Storage (CCS) industry and transformation (9 percent), CCS power generation (10 percent), nuclear (6 percent), renewables (21 percent), power generation efficiency and fuel switching (7 percent), end use fuel switching (11 percent), end use electricity efficiency (12 percent), and end use fuel efficiency (24 percent).

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[1]United Nation and Economic Commissions of Asia Pacific (UNESCAP).

The reduction in GHGs requires technological change; technologies at general and cleaner technologies specifically are useful for development of most the low carbon economies. Technology includes all tools, machines, instruments, housing, clothing, communication and skills etc, which we used to produce new things and are very meaningful in growth and development. Green technology is defined as: “The development and application of products equipment’s and system used to conserve natural resources and environment which minimise and reduces the negative impacts of human activities.”[2] There are four pillars of green technology policy namely energy, environment, economy and social. In energy technology promote the efficient uses of resources. Technologies conserve and protect the environment and minimise the adverse impacts in environment, improve the economic development through the technology and innovation. Moreover, the International Technology Center (ITC) defined the green technology as: “Goods and services to measure, prevent and limit pollution, to improve environmental conditions of the air, water, soil, waste and noise related problems which are affordable, adaptable and available at the market of distributed use and export” This study is considering technological opportunities as the development of green technology, transfer of green technology and diffusion of green technologies.

1.2. Accelerating the Climate Change Technology

Eco-innovation strategies are needed to accelerate climate technologies vis a vis to overcome the market barriers that exist all along the technology development chain for mitigation and adaptation technology. The markets for climate technology are imperfect and extensive with barriers to full and fast market diffusion. Therefore more innovative, internationally coordinated and integrated innovation strategies are needed to scale climate technology at the speed needed to counter climate change impacts. Public private strategies are needed to complement pricing mechanism and enabling polices.

Limiting the concentration of green house gases in the atmosphere is largely a problem of technological innovation. Climate innovation polices will be necessary to accelerate rates and performance improvements and cost reduction of technologies.[3]

1.3. Access to Climate Technologies

Climate change presents significant challenges for developing countries. Therefore developing countries urgently need the climate change technologies. Developing countries need to employ climate change technologies in order to prevent climate disaster. Climate change technology development will benefit developing countries directly by providing useful technologies due to the support for endogenous climate change, research and development, management of developing countries intellectual assets, climate change technology, commercialisation, awareness programs and periodic assessment. International climate change discussion leading to Copenhagen and beyond present and provide opportunities to link climate change technology transfer with development of national innovation systems in order to achieve concrete results for developing countries. Intellectual property rights will have to become a tool of developing countries in their struggle to gain access to climate change technology.

[2]http://www.gpnm.org/e/articles/Definition-of-Green-Technology-by-KETTHA-Ministry-of-Energy-Green-Technology-and-Water-a5.html 6 Oct 2010.

[3]WIPO conference on Innovation and Climate Change.

To assess these technologies faces some barriers like economic, human capacity related barriers and institutional barriers. Smaller developing countries are confronted with many such barriers to development and transfer of technology. A range of economic and trade related instruments provide opportunities for multilateral action to promote climate-relevant innovation and technological transformation provide, an “enabling environment”. Governments of the developed and developing countries start a number of programs focusing on green innovation and emphasise the renewable energy resources in 2008-2009. Development and transfer of technology has emerged as a basic building block in the crafting of a post 2012 global regime on climate change. New government involvements in R&D programs may prove to be beneficial in this regard and climate negotiators representing governments should be better able to influence the direction of industry. The private sector may be encouraged to extend the benefits of new technology by entering into mutually beneficial arrangements with foreign joint venture partners.

1.4. Environmental Innovations

Eco-innovation strategies are needs to accelerate climate technologies *vis a vis* to overcome the market barriers that exist all along the technology development chain for mitigation and adaptation technology. Therefore more innovative, internationally coordinated and integrated innovation strategies are needed to scale climate technology at the speed needed to counter climate change impacts. Climate innovation polices will be necessary to accelerate rates and performance improvements and cost reduction of technologies. The green environmental technologies focus on innovations. In the global debate the environmental innovations are taking place as of inventions and innovations in general. Innovation in environmental technologies can reduce the cost of materials, cost of productions and increase the rates of production and attractiveness of products in marketplace.

To support the development of environmental technology the four areas like intellectual property rights, research and development, market size (GDP) and environmental taxation are very important.

1.4.1. *Environmental Innovation and Intellectual Property Rights (IPRs)*

Recent years have witnessed a growing trend towards the appropriation of climate change technologies by intellectual property rights (IPRs). If this trend is to continue, IPRs are likely to play a key role in determining access to these technologies. If highly priced, access to protected interaction between Intellectual Property and the transfer of climate related technology could provide the basis for more efficient and evidence-based discussion. In developing countries the strengthening of Intellectual Property Rights regime speed up the global competition for capital and green technology [Maskus (2005)].

International Center for Trade and Sustainable Development [ICTSD (2008)] presented that the IPRs promote innovation and knowledge. Relationship of IPRs and transfer of climate related technology would be helpful to increase the awareness and understanding. IPRs have deep implications for the future of global warming, reduction of emission and energy saving technology. A clean technology industry depends on stronger protection of IPRs eventually the stronger IPRs regime speed up the process of innovation and development. Relationship between the IPRs and entrance in environmentally sound technologies leave the impact on technological progress, development, and economic growth [Maskus (2010)].

The above discussion concludes that through proper enforcement of intellectual property rights can achieve the development in environmental technology. Intellectual property plays a crucial role in trade and technology transfer. The enforcement of IPRs encourages economic growth and provides incentives for technology innovation. Similarly, the enforcement of IPRs encourages transfer of climate related technologies. The World Bank's Global Economic Prospects Report in (2002) confirms, "Across the range of income level, IPRs are associated with greater trade and FDIs flows, which in turn translate into foster rate of economic growth and development". Eventually, this flow of FDIs leads to the development of environmental technologies. The required and acceptable IPRs regimes bring efficiency, new innovations and the progress in research and development, which contribute into the development of environment technologies in the economy.

1.4.2. *Environmental Innovation and Research and Development (R&D)*

Research and development (R&D) expenditures is an essential part of climate policy, might lead to substantial efficiency gains and help containing climate policy costs. R&D induced by a climate policy might a need for additional R&D expenditure policy in ordered to foster technology diffusion and to overcome the various innovation market failures such as the underinvestment in R&D in the private sector. Active research and development created the new production of knowledge and technological change. New research and development produced the high quality of goods. Research and development increased because the higher degrees of technology transfer [Walz (1995)]. Research and development increases the innovation in environmental technology [William, *et al*. (1995)]. Developing countries successfully reduced the GHGs emissions through the research and development expenditures and achieved the energy efficient technologies [David and Roger Bate (2010)]. In contrary Langinier, *et al.* (2009) extended the arguments that the innovations factor leads to the research and development.

The above discussion briefly concludes that research and development (R&D) introduces the environmentally friendly technology to reduce the environmental damages. New production of knowledge and technological change can be increase through the active research and development. New innovations and inventions can achieve due to the research and development.

1.4.3. *The Environmental Innovations and Market Size (GDP)*

The positive dynamics in expansion in market size (GDP) is believed to expand the innovative activities in the economies. One possible reason for this expansion is industrial growth, which leads to invention and innovations mostly by achieving economies of scale. But still direct role of market size in innovations are not clear from the theory, whether it help in increase in R&D, reduction in taxes, provision of other incentives etc. Contrary, to the conventional economic growth phenomenon, we are replicating it into green growth phenomenon. The demand for the green products in the green markets size may contribute in green R&D, imposition of green taxes, structure change at the level of industries. This eventually may leads to green innovations. We are assuming that the environmental technologies are developed by the market size (GDP).

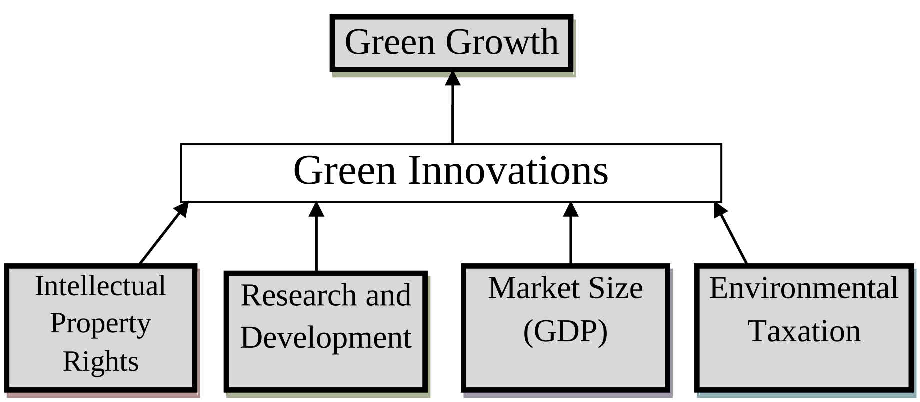
New technologies support high volumes of goods and it brings more companions in the economy and thus innovations are growing fast. Large markets adopt more technological changes and market size is also affected with new technologies. When the market size increases then the environmental technologies enhance because when the GDP of one economy rise then they are able to invest more in green technologies.

1.4.4. *Environmental Innovations and Environmental Taxes*

Taxes may have led the positive impact on environmental innovation and economy. Environmental tax credits encourage innovative behavior and the cleaner production techniques are more helpful in this sense [Organisation for Economic Corporation and Development (2008)]. Korea is badly affected by the urban air pollution. Government introduces the emissions trading schemes and reduced the emissions by larger and smaller emitters through the environmental taxation [OECD (2009e)]. Switzerland's federal government imposes the tax on volatile organic compound (VOCs). Adaptation of technology and innovation is much more in larger firms and less in smaller firms due to the financial and information constraints [OECD (2009a)].

Sweden imposes the taxes on the emissions of nitrous oxide. New technology of nitrous oxide emissions abatement required the new innovations and innovation contribute ongoing emissions reductions and continuing declines in abatement cost [OECD (2010)]. Air pollution from motor vehicles produced the emissions and for sake of the emissions reduction government imposed the taxes. Government gives their attention to enhance the innovative and environment friendly technologies. In nutshell, taxes have the positive effect on the environmental innovation [OECD (2010)].

The environmental taxation has a positive impact on green innovations because the government imposes the taxes on the polluters to reduce the level of emissions and provide the clean environment to the people. Specific environmental taxes e.g. CO_2 taxes will support the innovation in environmental/green technologies and also reduces the activities of high pollution. When the pollutants paid the taxes then increase the creation of new innovation, because the adaptation of incentives in order to minimise the tax payments. In this result potential innovation, production innovation, process innovation and organisational innovation are also goes up. Transfer of innovations among countries is due to the taxes in addition to the creation of innovations. Taxation brings about a full range of innovations, including new products and enhanced production techniques. The above theoretical framework is depicted as:



The graph clearly depicts the four important areas like IPRs, R&D expenditures, market size measured by country GDP and environmental taxations which ultimately has impact on green innovations and these green innovations eventually leads to green growth.

1.5. Objectives of the Study

The implications of Intellectual Property Rights (IPRs) for inventions and innovations are debatable in the literature. Although, the literature [Maskus (2005); Archibugi and Filippettic (2010)] focuses more on the positive role of the IPRs for innovations, while the maturity level of the Industry/Firm structure are important considering the implications of IPRs. One of our objectives of this study is chalk out the role of IPRs in innovations in general and green innovations particularly. To understand the process of eco-innovations this study identifies three other direct determinants like research and development (R&D), market size and environmental taxations. However we are mainly focusing on environmental taxations whether the environmental regimes works in green innovations. We don’t have the data for green R&D, therefore we are considering overall R&D expenditures but its significance becomes less while linking it with green innovations. But one of our objectives is to find the role of R&D in green innovations.

Given the brief introduction of the problem stated earlier, this study addresses the problem of IPRs, environmental taxation, and R&D in green innovations in developed countries and would derive lessons for Pakistan. The specific objectives are following:

(1) To find the impact of enforcement of Intellectual Property Rights (IPRs) in environmental innovation.
(2) To assess the role of Research and Development (R&D) in environmental innovation.
(3) To ascertain the role of environmental taxation in environmental innovation.
(4) To derive the Policy implication from empirical results of the study.

1.6. Organisation of the Work

Section 1 of this study includes definition of key terms, problem and purpose statements. Section 2 describes data description and methodology. Section 3 covers empirical estimations and results. Section 4 concludes the study with recommendations

2. DATA AND METHODOLOGY

2.1. Variables Specifications

2.1.1. *Environmental Technology (Green Patents)*

To know the action patterns and trends between technology the World Intellectual Property Organisation (WIPO) present the data by field of technology. Patent statics by technology field are based on the “fractional counting” method. WIPO in June 2010 convert the International Patent Classifications (IPC) symbol into 35 corresponding fields of technology. In 2007 most applications are in computer field technology, electrical machinery and telecommunication and due to these technologies the highest annual growth rate was observed by 2003-2007.

On the other hand the OECD static database focus on the environment-related technology because climate change is hot issue and the environment related technologies plays an integral role in tackling climate change. A total of 65 different IPC classes were identified that dealt with purification of gases and emissions control. Three major technologies were categories, which are improvement in engine, treating pollutants produced before they are released into the atmosphere and reduce evaporation emissions.

2.1.2. *Intellectual Property Rights (IPRs)*

A number of studies have attempted to measure IPRs protection cross-nationally. Measurement of IPRs has become a critical issue for international business, scholars and practitioners. In this regards Rapp and Rozek's (1990s) attempted to quantify IPRs, they used patent laws as a proxy for IPRs of 159 countries. Patent laws are marked on a zero to five scale, where zero present a country with no patent laws and five represent a country having laws consistent with the standards established by the US chamber of commerce intellectual property task force. Furthermore, Seyoum (1996) also used the US chamber of commerce's minimum standard for his criteria. However, his 0-3 scales of IPRs protection components where constructed from survey sent to IPRs practititioners. Seyoum constructed four variables such as patents, copyrights, trademarks and trade secrets for his analysis. Shrewood proposed a third measure of IPRs protection that combined the personal interviews. The protection scores range from 0-103 and where developed for eighteen countries.[4]

To properly tackle the issues of measurement Ginarate and Park constructed IPRs index for 110 countries in the sample having data range from 1960-2005. It ranges in values from zero to five. Higher values of the index indicate stronger level of protection. In Rapp and Rozek and Syoum did not include a component for enforcement in their study, methods of differentiations is missing for example between "inadequate laws" are "seriously flawed" laws or between "generally good laws" and laws that are "fully consistent" with the minimum standards. In Seyoum's study it is unclear, on which criteria the raw data were reduced to a 0-103 scale. Sharewood's procedure is based on his experience. There exist no set rules while judging how many points to subtract for judicial independence, etc.

2.1.3. *Research and Development (R&D)*

Research and Development is one of the important components of invention and innovations. In this context environment technologies are largely depending on the R&D generally and green R&D expenditure specifically. Research and development expenditures improve the new innovative products and introduce the environment technology. R&D expenditures would help in commercialisation of new technologies, create new business and reduces the risk through the research and development. This study hypothesised that the environment technology will efficiently increase with the help of the overall research and development expenditures. But limitation of green R&D expenditures data, we did not use it.

[4]Ghulam Samad "Intellectual Property Rights and Economic Growth" 2007, pp. 711–722.

2.1.4. *Market Size (GDP)*

Market size (GDP) is an important explanatory variable of the development of environment technology. Market size is a measurement of the total volume of a given market. When determining market size it is very important to define the measurement as preciously as possible. There are three ways to measure the market size such as bottom-up approach, top-down approach and end-user purchases. It is assumed that market size led the positive impact on development of environment technology.

2.1.5. *Environmental Taxation*

Environmental taxation is considered the most important explanatory variable of the development of environment technology. Environment related taxes encourage innovations and then environment technologies are developed. Benefits of the environment related taxes are when higher pollution costs make it economically inviting to invest in the development of new greener technologies. Taxes on pollution provide cleaner incentives to polluters to reduce emissions and seek out the cleaner alternatives. Environment related taxes can provide significant incentives for innovation and these incentives make it attractive to invest in research and development activities to develop environment technology. Environmental taxation plays a key role in introducing and developing the environment technology. Environment related taxes will always lead to innovative and the adaptation of new technology and processes. Taxes are the base of the new technology and innovations that should make monitoring easier and most cost effective. Environment related taxes introduce the full range of innovation as well as new products and improved production techniques.

2.2. Data Description

This study included 11 developed countries namely Australia, Austria, Canada, Finland, France, Germany, Japan, Korea, Sweden, United Kingdom and United State based on the balanced data design for the 2000-2005. We faced many problems in the unbalanced data design for the 1995-2007. Therefore we used the balanced data in this study. Although, the unbalanced data estimations are given at the annexure. The green patents quantify the dependent variable of environmental technology. The data on Environmental technology is taken from the OECD, Patent Database (June 2008). The data on research and development (R&D) is taken from OECD statistics catalogues. Market size (GDP) is an important explanatory variable of the development of environment technology taken from the *World Development Indicators* (2008). The data of environmental taxation is also taken from OECD statistics catalogues.

2.3. Specification of the Model

The dependent variable is Environmental Technology and explanatory variables are Intellectual Property Rights (IPRs), Research and Development (R&D), Market size (GDP) and Environmental Taxation through the Tax rate of Patrol and Tax rate of Diesel. The general equation of this study is

Env.Tech = f [IPRs, R&D, Market size (GDP), Environmental Taxes (TRP, TRD)]
$(\text{Env.Tech})_{it} = \alpha_i + \beta_1 (\text{IPRs})_{it} + \beta_2 (\text{R\&D})_{it} + \beta_3 (\text{M.S})_{it} + \beta_4 (\text{TRP})_{it} + \beta_5 (\text{TRP})_{it} + V_{it}$
(i= 1, 2…N; t= 1, 2 …T)
$V_{it} = \mu_i + \sum W_{it}$

Where:

ET = Environmental Technology, IPRs = Intellectual Property Rights, R&D = Research and Development, M.S = Market size (GDP), TRP = Tax rate of Patrol, TRD = Tax rate of Diesel and $\mu_i$is unobservable individual country specific effects and $\sum w_{it}$ is other disturbances.

2.3.1. *Pooled Least Square Estimation Techniques*

Fixed Effect Model (FEM) or Random Effect Model (REM) is used on the base of the balanced data design for 2000-2005. Hausman test is used to approve the validity of FEM or REM. The reason for this time period is that it contains a sizeable amount of data available for a large cross section of countries. In pooled least square estimation two techniques are used

- Fixed Effect Model (FEM)
- Random Effect Model (REM)

2.3.2. *Fixed Effect Model (FEM)*

Fixed Effect Model (FEM) using dummy variables is known as the least square dummy variable models. FEM is appropriate in situation where the specific intercept of countries may be correlated with one or more regresses. Even if it is assumed that the under lying model is pooled or random, the fixed effect estimators are always consistent. In fixed effect the constant is treated as specific group. This means that the model allows for different constants for each group. So the model is

$Y_{it} = \alpha_i + \beta x_{it} + \mu_{it}$

To understand this lets consider the following model [Asteriou, *et al.* (2006)]

$Y_{it} = \alpha_i + \beta_1 x_{1it} + \beta_2 x_{2it+} \beta_3 x_{3it+\ldots\ldots+} \beta_4 x_{4it} + \mu_i$

This can be rewritten in a matrix notation as:

$Y = D\alpha + X\beta' + \mu$

$$Y \;=\; \begin{bmatrix} y1 \\ y2 \\ . \\ . \\ yn \end{bmatrix} D = \begin{bmatrix} iT & 0 & 0 \\ 0 & iT & 0 \\ 0 & 0 & iT \end{bmatrix}$$

$$\begin{bmatrix} x11 & x12 & x1k \\ x21 & x22 & x2k \\ xn1 & xNk & xNk \end{bmatrix} \text{a} = \begin{bmatrix} a1 \\ a2 \\ . \\ . \\ aN \end{bmatrix}, \beta = \begin{bmatrix} b1 \\ b2 \\ . \\ . \\ bN \end{bmatrix}$$

Before assessing the validity of the fixed effects methods, to do this the standard F-statics is used to check fixed effects against the simple common constant OLS method.

H_0: $a_1=a_2=\ldots\ldots\ldots\ldots.a_N$

F-statistics:

$F= [(R^2_{FE}-R^2_{CC})/ (N-1)]/ (1-R^2_{FE})/ (NT-N-K)\tilde{}F (N-1, NT-N-K)$

Where R^2_{FE} is the coefficient of determination of the fixed effect model and R^2_{CC} is the coefficient of determination of the common constant model. If F-statistics is greater than the F-critical, then null hypothesis is rejected.

The Fixed Effects models may frequently have too many cross-sectional units of observations requiring too many dummy variables for their specification. Too, many dummy variables may sap the model of sufficient number of degrees of freedom for adequately powerful statistical tests. Moreover model with many such variables may be plagued with multi-co linearity which increase the standard errors and their by drains the model of statistical power to test parameters. If these models contain variables that do not vary within the groups, the parameters estimations may be precluded. Although the model residuals are assumed to be normally distributed and zero mean at constant variance, so there could easily be country specific heteroskedasticity or autocorrelation overtime that would further plague estimations.

It ignores all explanatory variables that do not vary over time. It means that it does not allow using other dummies in the model. This is not useful, when it is required to consider such dummies. It considered large number of degrees of freedom, which is a major cost. It makes it very hard for any slowly changing explanatory variables to be included in the model, because they will be highly collinear with the effects. The fixed effects model controls for all time invariant differences between countries, so the estimated coefficients of the fixed effect models cannot be biased because of omitted time-invariant characteristics like as culture, religion, gender, race, etc. one side effect is that they cannot be used to investigate time-invariant causes of the dependent variables.

Technically, time-invariant characteristics of the countries are perfectly collinear with the cross-sections dummies. Substantively, fixed effect models are design to study the causes of changes within a cross-sectional. Time-invariant characteristics cannot cause such a change, because it is constant for each person.

2.3.3. *Random Effect Approach*

The crucial distinction between Fixed and Random Effect is whether the unobserved countries effect embodies elements that are correlated with the regressors in the model, not whether these effects are stochastic or not. Random effect model (REM) is consistent even if the true model is the pooled estimator. If the dummy variables do in fact represented a lack of knowledge about the model, why not express this ignorance through the disturbance term. This is preciously the approach suggested by the proponents so it is called Random Effect Model (REM).

The Random Effects Model
Original equation

$$y_{it} = \alpha_i + \beta_1 x_{1it} + \beta_2 x_{2it} + \ldots + \beta_k x_{kit} + \varepsilon_{it}$$
$$y_{it} = \alpha_i + \beta_1 x_{1it} + \beta_2 x_{2it} + \ldots + \beta_k x_{kit} + \lambda_i + u_{it}$$

Remember $€_{it} = \lambda_i + \mu_{it}$ λ_i is now a part of error term

This approach is appropriate if observation is representative of a sample rather than the whole population. The Fixed Effect or LSDV modeling can be expensive in terms of degrees of freedom, if we have several cross-sectional units. Dummy variables in fact represent a lack of knowledge about the true model. The proponents of random effects model suggests to use the disturbance term U_{it} in ordered to capture the true effect.

Instead of treating α_i as fixed, now assume that it is a random variable with a mean value of α_1 (no subscript here) and the intercept value for an individual country can be expressed as:

$$\alpha_{1i} = \alpha_1 + \lambda_i \quad i = 1, 2, 3, 4 \ldots N$$

Composite error term $€_{it}$ consists of two components, λ_i which is the cross sectional or countries specific error component and U_{it}, which is the combined time series and cross-sectional error components.

$$€_{it} = \lambda_i + U_{it}$$

The random effects model therefore takes the following form:

$$Y_{it} = (\alpha + \lambda_{ii}) + \beta_1 X_{1it} + \beta_2 X_{2it} + \ldots\ldots\ldots + \beta_k X_{kit} + U_{it}$$
$$Y_{it} = \alpha + \beta_1 X_{1it} + \beta_2 X_{2it} + \ldots\ldots\ldots + \beta_k X_{kit} + (\lambda_i + U_{it})$$

Obvious disadvantage of the random effect approach is that one should make specific assumption (i.e. country specific effects are uncorrelated with the exogenous variables included in the model) about the distribution of the random component. If the unobserved group-specific effects are correlated with the explanatory variables, then the estimates will be biased and inconsistent. An advantage of the Random Effects is that you can include the time-invariant variable. In the Fixed Effects model these variables are observed by the intercept. Random Effects assumed that the entity's error term is not correlated with the predictors, which allows for time-invariant variables to play a role as explanatory variable.

In Random Effect you need to specify those countries characteristics that may or may not influence the predictor variables. The problem with this is that some variables may not be available therefore leading to omitted variable bias in the model.

Disadvantages of the Random Effects are that one has to specify the conditional density of μ_i given:

$$X_i = (X_i 1 \ldots X_i t),\ f(\mu_i \backslash x_i),$$

While μ_i is unobservable. A common assumption is that f $(\mu_i \backslash x_i)$ is identical to the marginal density f (μ_i). However, if the effects are correlated with X_{it} or if there is a fundamental difference among individuals units, i.e., conditional on X_{it}, Y_{it} cannot be viewed as a random draw from a common distribution, common Random Effect model is mis-specified and the resulting estimator is biased.

The Fixed Effects model assumes that each country differs in its intercept term (In FEM intercept vary across α_i of cross-sectional units while in REF, intercept is constant), whereas the Random Effects model assumes that each country differs in its error term. When the panel data is balanced one might expect that the Fixed Effects model will work better. In other cases, where the sample contains limited observations of the existing cross-sectional units, the random effect model might be more appropriate. The usefulness of fixed effects model and random effects model depends upon the assumptions one makes about the possible correlation between cross-sectional specific error components λ_i are constant and X's regressors. If assumption is λ_i and X's are uncorrelated, REM may be appropriate. Whereas if λ_i and X's are correlated to the FEM may be appropriate. These are the two fundamental differences in the two approaches.

In order to further investigate about whether fixed effects model or random effects model is more useful, so called Hausman test is used. Given a panel data model where Fixed effects would be appropriate the Hausman tests investigates whether random effects estimation could be almost as good. Hausman statistics may be viewed as a distance measure between the Fixed Effects and the Random Effects estimators.

Hausman test uses the following test statistics:

$$H = (\beta^{\wedge FE} - \beta^{\wedge RE})' \, [\mathrm{var}\,(\beta^{\wedge FE}) - \mathrm{var}\,(\beta^{\wedge RE})]^{-1} \, (\beta^{\wedge FE} - \beta^{\wedge RE}) \sim x^2\,(k)$$ [5]

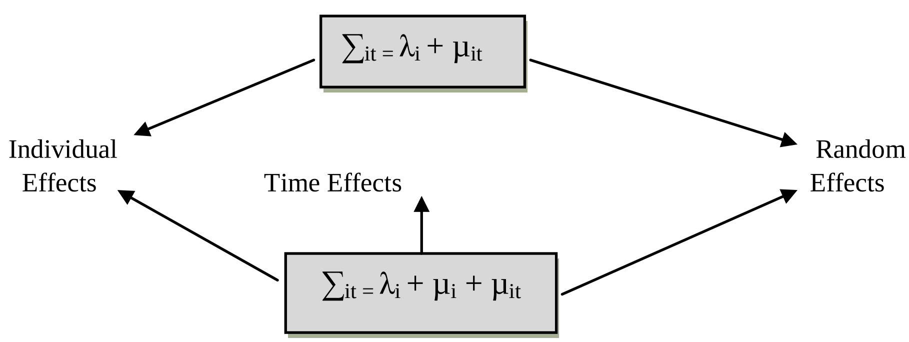
For this test null hypothesis is;

H_O: Random Effects model coefficients are consistent and efficient.
H_1: Random effects are inconsistent.

If the value of the Housman statistics is high, then the difference between the estimates is significant, it rejects the null hypothesis and the random effect model is inconsistent.

In contrast low value of the statistics implies that the random effects estimator is more appropriate.

2.3.4. *One Way or Two Way Error Component*



One way error components means, it includes Individual Effect and Random Effect.

$\sum_{it} = \lambda_i + \mu_{it}$, Where the λ_i is the individual and μ_{it} is Random Error.

Two Way error component means, it includes the individual effect, random effect and time effects.

$$\sum_{it} = \lambda_i + \mu_i + \mu_{it}$$

Where λ_i is individual effect and $\boldsymbol{\mu_i}$ is random error and $\boldsymbol{\mu_{it}}$ is the time effects.

Two way error components cannot be applied to unbalanced data, and the one way error components is applicable to the balanced or unbalanced data. This study used the One Way Error Components. The One Way error component is applied to the balanced data design for the 2000-2005.

3. EMPIRICAL ESTIMATION AND RESULTS

3.1. Empirical Findings

In order to estimate the pooled least square estimation techniques of fixed and random effect, we are going to check the stationarity of panel data by employing panel unit root test introduced by Phillips-Perron Fisher (Fisher-PP) Unit Root Test. It considers the Kernel (Bartlett) method to correct for autocorrelation. We also check for the individual intercept to include individual fixed effects, individual trend and intercept to include both the fixed effects and trend, finally none to include no regressors. These results are exhibited in Table 1.

Table 1

Panel Unit Root Tests

Null: Unit Root (assuming individual unit root process)			
	Phillips-Perron Fisher Unit Root Test (Chi-Square)		
Pool Series	Individual Intercept	Individual Trend and Intercept	None
CTRit	53.270	50.290	264.777
	(0.0002)	(0.0005)	(0.0000)
TRPit	120.000	279.730	578.887
	(0.0000)	(0.0000)	(0.0000)
TRDit	2.772	2.772	2.772
	(1.000)	(1.000)	(1.000)
GreenTit	41.06	29.11	68.89
	(0.0081)	(0.1415)	(0.0000)
R&D it	180.36	165.95	1200.54
	(0.0000)	(0.0000)	(0.0000)
GDPit (Ist	30.031	24.4000	47.711
Difference)	(0.1177)	(0.3266)	(0.0012)
IPR it	12.476	12.476	12.476
	(0.9467)	(0.9467)	(0.9467)

Figures in parentheses are representing the P-values.

The Table 1, clearly depicting that each specification of the panel unit root test (individual intercept, individual trend and intercept and none) rejects the null of unit root hypothesis for all the series that is combined tax on petrol and diesel (CTRit), the tax rate on petrol (TRPit), the green technology (GreenTit), are stationary at i.e. I (0), except the GDP I (1). The remaining two pool series i.e. tax rate on diesel (TRDit) and intellectual property right index (IPRit) are non-stationary. On the whole when we are using the combined tax rate we can say that the series are stationary, therefore, we proceeds for the pooled least square estimation techniques of fixed and random effects method.

The Pooled Least Square (Balanced or Unbalanced) Fixed Effect and Random Effect Models are used to estimate equation and the results are presented in Table 2 and Table 3 at the end of the chapter. We are not considering the unbalanced estimation the reason is that the data is not frequently available for all years. Therefore, we used the balanced data and the results are highly significant in the balanced data. Since, there are no significant differences in the results of the above mentioned results. Their magnitudes are different but their signs are same, therefore the results have been interpreted in a combined manner. But here focus on the Fixed Effect because the results are highly significant in the Fixed Effect.

The individual results of the tax rate on patrol and tax rate on diesel are put in the Annex 1 and Annex 2. Whereas, the results of the combine tax rate are highly significant and positive as compared to individual results of the tax rate on patrol and diesel. The preliminary results show that the coefficients of the most of the standard explanatory variables carry the expected signs and are statistically significant.

Fixed Effect is shown clearly in Table 2. It further depict that combine tax rate (CTRit) which is defined as the tax rate on patrol and tax rate on diesel, carries the expected sign and is highly significant. The finding shows that the combined tax rates have the positive relationship with the green technology and 86.76 percent green technology is increased due to the combine tax rate. One reason for this significant relationship is that if there is tax imposed on polluters then there would be the level of emissions and activities of high pollution. Taxes on pollution provide clear incentives to polluters to reduce emissions and seek out cleaner alternatives. By placing a direct cost on environmental damage, profit maximising firms have increased incentives to economise on its use, compared to other environmental instruments, such as regulations concerning emission intensities or technology loss environment related taxation, as it encourages both the lowest cost abatement across polluters and provide incentives for abatement at each unit of pollution. When the pollutants pay taxes then the creation of the innovation is came because of the adaptation of incentives in order to minimise the tax payments and in this result potential innovation, production innovation, process innovation and organisational innovation are came. These incentives make it commercially attractive to invest in R&D activities to develop technologies. Taxes equate the marginal damages from pollution with the marginal cost of pollution abatement. Taxations bring about a full range of innovation, including new products and enhanced production techniques. Taxes on pollution provide cleaner incentives to polluters to reduce emissions and seek out the cleaner alternatives.

Table 2

Fixed Effect

Dependent Variable: Green Technology
Method: Pooled EGLS (Cross-section weights)
Total Pool (balanced) observations: 726
White cross-section standard errors and covariance (d.f. corrected)

Variables	Coefficient	St. Error	t-Statistic	Prob.
C	3.7545	0.0959	39.1118	0.0000
CTR	86.7693	8.6120	10.0753	0.0000
IPR	–11.3401	0.8387	–13.5195	0.0000
R&D	1.3198	0.6414	2.0576	0.0400
GDP	0.0209	0.0006	32.4154	0.0000
R-Squared	0.69			
Adjusted R-Squared	0.69			
F-Statistic	117.6160			
F-Statistic (Prob.)	0.0000			
Durbin-Watson stat	0.3867			

Table 3

Random Effect

Dependent Variable: Green Technology
Method: Pooled EGLS (Cross-section weights)
Total Pool (balanced) observations: 726
White cross-section standard errors and covariance (d.f. corrected)

Variables	Coefficient	St. Error	t-Statistic	Prob.
C	0.0473	0.3177	0.1489	0.8816
CTR	253.5789	4.8319	52.4799	0.0000
IPR	–40.9286	4.6384	–8.8238	0.0000
R&D	15.9355	6.9019	2.3088	0.0212
GDP	0.0326	0.0011	28.5715	0.0000
R-Squared	0.59			
Adjusted R-Squared	0.58			
F-Statistic	259.7878			
F-Statistic (Prob.)	0.0000			
Durbin-Watson stat	0.2498			

Another reason is that taxes on motor vehicles are major source of revenue for 11 developed countries government and taxes are the base of new technology and innovation that should make monitoring easier and most cost effective. Taxes lower the prices of permits but recover some of the wind fuel gains that firms receive by not having to buy their permits at auction. The scope of the expanded use of the environmentally related taxes in 11 countries is great, especially in addressing climate change. This result is corresponding with the (Organisation for Economic Cooperation and Development, 2008). [OECD (2009); OECD (2009a) and OECD (2010)].

This study finds that for developed countries with the strengthening of IPR regime, the green technology is declining. The coefficient associated with IPR indicates that with a one unit increase (more strengthening) in the IPR index, the green technology declines by 11.34 percent. It means that the empirical results do not support positive relation between IPR and green technology in developed countries. The possible reason for this negative relationship might be the structure of the industries in the developed countries. Furthermore, enforcement of IPRs would not affect the green innovations in these industries. The structure of these industries has reached at the mature level and changing structure would cost those more instead of converting in to green innovations. Moreover, the IPRs enforcement index in these countries almost reached at the maximum of 5 (means full enforcement). Therefore, further IPRs enforcement wouldn't work. The Clean Development Mechanism (CDM) also verifies these study findings that the developed countries instead of changing their structure towards green technologies they are purchasing carbon credits from the developing countries.

Research and Development is defined as creating the new production of knowledge and technological change, it is significant and carry the expected signs. The findings show that there is a positive relation in R&D and green technology: green technologies are increase 1.31 percent due to the R&D. The coefficient of R&D indicates that as a result of 1 percent increase in the R&D, the green technologies increase by the 1.31 percent. The reason of this significant relationship is that new innovations and inventions are overcome due to the R&D. New R&D produces the higher quality of goods; create the new production of knowledge, technological change and higher degrees of technology transfer. R&D expenditure helps in commercialisation of new technologies, create new business and reduce the risk through the R&D. Active R&D reduces the green house gas emissions and energy efficient technologies. This result is subsequent with the [William (2006); David and Roger Bate (2010)].

Market Size (GDP) has a significant impact on the green technologies of the Developed countries. In this regard the results are highly significant. The coefficient of the GDP indicates that as a result of 1 percent increase in GDP the green technologies increases by the 0.0209 percent. The empirical analysis favors the positive role of GDP in green technologies. When GDP increase then the Purchasing Power Parities increase and over the time Government realise about the environmental degradation and then there is progressive increase the green taxes. When taxes are levied from the polluters then polluters favor the green technologies rather than the taxes. This result is corresponding with the [David and Roger Bate (2010); Maskaus (2005); Thomas (2006); Steiner (2009)].

3.2. Econometric Tests

We applied the Hausman test to further investigate about whether fixed effects model or random effects model is more useful. The Hausman test favored the null of Fixed Effect Technique instead of alternative of Random Effect Technique. Also, apply Durbin-Watson d test to check for autocorrelation in time series and cross sectional data to identify the autocorrelation problem if any. This test assumes inclusion of intercept in regression model and there are no missing observations. In this case, the validity of this test is not useful to interpret for balance panel data. The value of D.W. test is irrelevant in case of small time series which in this case is only five years, with eleven cross sections. However, we are considering this test to fulfill the basic requirements. Similarly, the first assumption violates the applicability of Constant Coefficient Method. However, D.W. d statistic value can be usefully interpreted for balanced panel data (Fixed and Random effects). The value of the Durbin-Watson Statics is closed to 2 if the errors are uncorrelated. The values of D.W. Stat for balanced data (2000-2005) are 0.034. We already explained when the time period is short and there is no need to take the lags because the minimum values are not matter in this case.

White General Hetroscedasticity, White Heteroscedasticity Variance and Standard Error methods were applied respectively to check and correct the problem of Heteroscedasticity, The usefulness of the White Heteroscedasticity Variance and Standard Error on Weighted Least Square (WLS) is that it does not assume, rather determines variance (σ_i^2). The problem of Hetroscedasticity is more common in cross sectional data than in time series data, because it deals with members of cross country population at a given point of time, such as individual consumers, or their families, firms, industries, or geographical subdivisions like state, country, city etc. [Janjua and Samad (2007)]. Therefore, we explained the results of Fixed Effect estimations

4. CONCLUSIONS AND POLICY IMPLICATION

It is an open secret that the Environmental technology is perceived as an important source of reducing the emissions and to improve the efficiency in market(s). Such technologies play a vital role in tackling with the issues like climate change. Moreover, Green environment technologies focus on the innovation that resultants in minimising the degradation of environment; reduce the green house gas emissions, improve the health, conserve the use of natural resources and also promotes the use of both renewable and non-renewable resources. Such innovations, also reduces the cost of materials, cost of production, increase the rates of production and attractiveness of products in the market place.

Our research has also proved that the promotion of environment technology and eco-innovation provides many benefits for business; fostering innovation, cutting production cost, creating jobs, reducing pressures on the environment and encourage competitiveness. Limiting the concentration of green house gases in the atmosphere is largely a major concern of the technology innovation.

The empirical results do not support the positive relation between the IPRs and green technologies in developed countries. Because the enforcement of IPRs does not affect the green innovations, as the organisation of these industries reached at mature level and changing structure would cost those more instead of converting into green innovations.[6] Moreover, the IPRs enforcement index in these countries almost reached at the maximum of 5[7] (means full enforcement). Hence, the developed countries, instead of changing their structure towards green technology, are purchasing carbon credits from the developing countries.[8] Nevertheless, our literature

[6]This view is discussed by Dr Zahiruddin Khan, IESE NUST in International conference on Green Technology organised by COMSTECH.

[7]Ghulam Samad, "Intellectual Property Rights and Economic Growth" 2007.

[8] CDM Mechanism.

review of IPRs has a positive impact on eco-innovation, but this very study shows a negative relation. The possible reason for this negative relationship might be the structure of the industries in the developed countries. Furthermore, the enforcement of IPRs would not affect the green innovations in these industries. Because, the structure of these industries reached at the mature level and changing structure would cost those more instead of converting into green innovations. The Clean Development Mechanism (CDM) also verifies the said study.

Research and Development (R&D) plays positive and increasingly significant role in innovation and environmental technologies. Emphasising R&D introduces the environment friendly technologies to reduce the environmental damages. Environment technologies are largely depending on R&D generally and green R&D. R&D expenditure improves the new innovative products and initiates the environment technologies. R&D expenditure would help in commercialisation of new technologies, create new business and reduce the environment degradation. R&D resultants in the production of environment friendly and higher quality of goods, that ensures sustainable development. Such products would also be helpful in minimising pollution and minimising its other externalities.

Environmental taxation also plays a key role in introducing and developing the environmental technologies because environment related tax leads to innovation and adaptation of new technologies and processes, both at micro and macro level. Taxes generate and huge income for the government which would be used to invest in the eco-technology. Environment related taxes introduce the full range of innovation, new products and new production techniques. Such taxes also provide significant incentives, both for consumers and producers that would trigger the revolution and innovative and environment friendly ideas in the field of science and technology.

The Important Policy Implications Are

- Management of Intellectual Property Rights (IPR) based on eco-innovation.
- National intellectual property legislation should be updated and refined and imposed.
- The role of ministries (environment), organisations/institutions, and Word Intellectual Property Organisation (WIPO) should emphasise on the role of IPR and Green technology development.
- R&D base should be strengthened, which will encourage innovative efforts to invent environment friendly products.
- An effective environmental taxation needs to be introducing keeping in mind the willingness to pay of the individuals of the proposed community.

Annexures

ANNEX-I

Fixed Effect

Dependent Variable: Green Technology
Method: Pooled EGLS (Cross-section weights)
Total Pool (balanced) observations: 726
White cross-section standard errors & covariance (d.f. corrected)

Variables	Coefficient	St. Error	t-Statistic	Prob.
C	3.6618	0.1029	35.5731	0.0000
IPR	–12.8528	0.7805	–16.4668	0.0000
R&D	4.7400	0.7232	6.5537	0.0000
GDP	0.0207	0.0007	28.4744	0.0000
TRP	85.4756	22.4118	3.8138	0.0001
TRD	86.5914	13.3584	6.4821	0.0000
R-Squared	0.73			
Adjusted R-Squared	0.72			
F-Statistic	131.1818			
F-Statistic (Prob.)	0.0000			
Durbin-Watson stat	0.3957			

ANNEX-II

Random Effect

Dependent Variable: Green Technology
Method: Pooled EGLS (Cross-section weights)
Total Pool (balanced) observations: 726
White cross-section standard errors & covariance (d.f. corrected)

Variables	Coefficient	St. Error	t-Statistic	Prob.
C	0.0446	0.5349	0.0835	0.9335
IPR	–34.0442	2.0208	–16.8464	0.0000
R&D	–2.3497	1.2967	–1.8120	0.0704
GDP	0.0346	0.0013	25.5437	0.0000
TRP	468.6140	55.5425	8.4370	0.0000
TRD	–15.6808	62.1877	–0.2521	0.8010
R-Squared	0.60			
Adjusted R-Squared	0.59			
F-Statistic	216.0555			
F-Statistic (Prob.)	0.0000			
Durbin-Watson stat	0.2655			

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Macroeconomic Effects of Global Food and Oil Price Shocks to the Pakistan Economy: A Structural Vector Autoregressive (SVAR) Analysis

MUHAMMAD ARSHAD KHAN and AYAZ AHMED

INTRODUCTION

Recent rise in oil and food prices have been a major cause of concern for policymakers around the globe and Pakistan's economy is not the exception. Changes in the global oil and food prices have been viewed as major source of macroeconomic fluctuations. Upsurge in global commodity prices, particularly food and oil prices during 2007-2008 leads to increase cost of production which hinders industrial productivity and fall in output growth. An unprecedented rise in food and oil prices during 2007-2008, coupled with global recession, financial crises and slowdown in the US economy has posed a number of serious challenges to the world economy. Movements in international commodity prices have been largely considered as a main source of business cycle and there is a plethora of literature that shows a negative correlation between the international commodity prices and macroeconomic performance of oil importing countries through the supply-side and demand-side channels.

It is well documented in the literature that crude oil was trading between US$18 and US$23 in the 1990s. It crossed the US$40 mark in 2004, and rose to around US$60 in 2005. During the summer of 2007, the oil price jumped above US$70 per barrel and even crossed to US$174 per barrel mark in July 2008 before a sharp downturn. This upsurge of oil prices produces adverse impacts on oil-importing countries. The rise in the crude oil prices exerts adverse effect on consumers and producers via pass-through effect on petroleum products. From the consumer standpoint, rise in oil prices causes energy bills to grow, whereas from the producer standpoint, firms contend a rise in unit costs [Lescaroux and Mignon (2008)]. Similarly, food costs have increased sharply since 2007. Prices of rice, palm oil and wheat rose by 62 percent, 94 percent and 107 percent respectively in the first quarter of 2008, compared to 39 percent for overall food prices [Jongwanich and Park (2009)]. It can be argued that higher oil prices have indirect effect

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on consumer prices whereas higher food prices have more direct effect on inflation. This is because oil is productive input but food is consumed directly [Jongwanich and Park (2011)]. A rise in oil prices may causes a drop in productivity, which in turn produces adverse affects on real wages and employment, selling price and core inflation, profits and investment as well as stock market capitalisation [Lescaroux and Mignon (2008). On the other hand, increase in food prices has a sizable impact on overall consumer price level because food accounts for a sizable part in the consumption basket in developing countries [Jongwanich and Park (2011)].

Theoretical and empirical studies showed that increases in oil prices negatively affect macroeconomic activities of oil-importing countries through the supply-side and demand-side channels. Hamilton (1983) argued that seven of the eight postwar recessions in the United States were proceeded by a spike in crude oil prices. Similarly, Brown and Yucel (2002) concluded that rising oil prices proceeded eight of the nine post-World War II economic recessions.

Subsequent to Hamilton's seminal work, a large body of empirical work is devoted to explore the relationship between oil price shock and aggregate economic performance of various economies [for example, Burbidge and Harrison (1984); Gisser and Goodwin (1986); Mork (1989); Mork, *et al*. (1994); Lee, *et al*. (2001) and Cologni and Manera (2008), among other]. These studies can be divided in to three main categories [Tang, *et al*. (2010)]. The first category includes a number of studies that have investigated the theoretical transmission channels through which the oil price increase may reduce potential output and increase inflation [Bruno and Sachs (1982); Barro (1984); Rasche and Tatom (1981); Darby (1982); Burbidge and Harrison (1984); Gisser and Goodwin (1986); Mork (1989); Lee, *et al.* (1995); Hamilton (1996); Hooker (1996); Abel and Bernanke (20010; Pappetrou (2001), among others]. The second category of studies carried out by Mory (1993), Cunado and Perez de Gracia (2003), Lee, *et al*. (2001), Lee and Ni (2002) and Lardic and Mignon (2008) has focused on the empirical investigation on the relationship between change in oil prices and aggregate activities. These studies were verified linear, non-linear and symmetric or asymmetric, the mathematical relationship for developed countries over the period 1970s to the 1990s. The third group of studies, *inter alia,* by Haung, *et al*. (2005), Cologni and Manera (2008) and Leduc and Sill (2004) have targeted on the role of macroeconomic policies in dealing with the oil price shock. These studies have examined the possibility of weakening relationship between oil price fluctuations and macroeconomic activity. Some other studies conclude that oil price deteriorates terms of trade for oil importing countries [Dohner (1981) and Husain, *et al.* (2008)]. Oil prices affect real money balances as it increases money demand, interest rates and retard economic growth [Pierce and Enzler (1974) and Mork (1994)]. Hooker (2002) suggests that the reaction function of monetary authorities is the main driver of second-round effects of oil price shocks; fiscal and monetary policy response may not be neutral to positive oil price shock and negative food price shocks. Oil price generates inflation [Burbidge and Harrison (1984); Hamilton (1983, 1996)].

In developing countries like Pakistan, the government subsidises the food and fuel prices for political reasons and consumers do not face the true market prices of these commodities. The government subsidies distort the price of food and oil products; therefore, consumer prices will not fully adjust to higher international prices [Jongwanich and Park (2011)]. Producers also tend to shift the burden of higher input prices on consumer prices after a time lag. Similarly, exchange rate movements, particularly weakening of domestic currency against U.S. dollar also generate inflationary pressure because oil is denominated in U.S. dollars.

Since 2007-08 Pakistan is facing episode of stagflation—very low economic growth combined with very high inflation. The root cause of current stagflation includes a series of supply-side shocks.[1] These shocks adversely affect the supply-side performance through constraining output growth, which is not sufficient to meet the demand pressures.[2] As a result, there is unprecedented increase in domestic inflation, unemployment and poverty levels [Amjad, *et al*. (2011)].

Against this back drop, the main objective of this paper is to examine empirically the extent to which higher food and oil prices translate into higher domestic prices in Pakistan by employing Structural Vector-Autoregressive (SVAR) modeling approach and Generalised Impulse Response Functions (GIRFs) developed by Koop, *et al*. (1996) and Pesaran and Shin (1998). This technique is unique since it yields outcomes that are invariant to the ordering of variables. We examine the effects of food and oil price shocks on domestic output, inflation, interest rate and exchange rate of Pakistan using monthly data over the period 1990M1 to 2011M7. The rest of the paper is organised as follows: Section 2 discusses the transmission channels of oil and food price shocks. Methodology and specification of SVAR model is outlined in Section 3. Section 4 reports empirical findings. Policy implications are discussed in Section 5, while some concluding remarks are given in the final section.

2. THE TRANSMISSION CHANNELS OF OIL AND FOOD PRICES

It can be argued that in the short-run oil price shocks affect macroeconomic performance through various channels. Theoretical literature has identified six transmission channels through which oil price changes affect the performance of macroeconomic variables [Brown and Yucel (2002); Jones, *et al*. (2004); Tang, *et al*. (2010), among others]. These transmission channels include the supply-side shock effect, wealth transfer effect, inflation effect, real balance effect, sector adjustment effect and the psychological effect. Figure 1 depicts the transmission channels through which raising oil and food prices affect the macroeconomic variables.

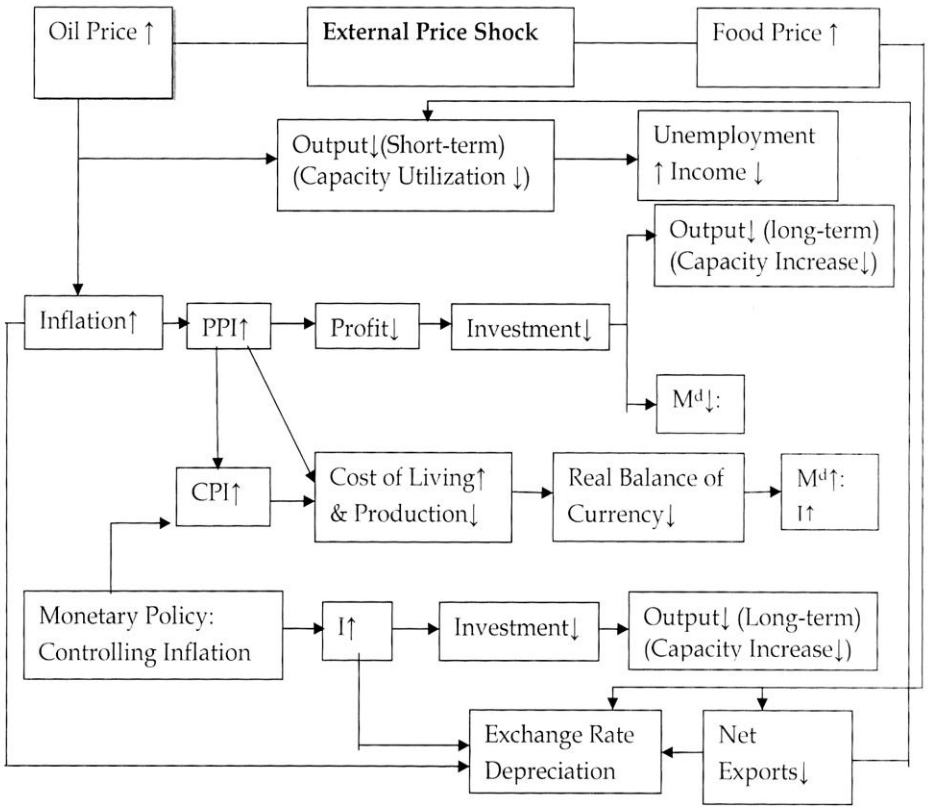
According to supply-side effect, rising oil prices are indicative of the reduced availability of a basic input to production, leading to a reduction of potential output [Lescaroux and Mignon (2008)]. Consequently, there is an increase in the marginal costs of production and the growth of output and productivity are slowed [Lescaroux and Mignon (20080 and Tang, *et al*. (2010)]. The decline in productivity growth negatively affects real wages and increases unemployment [Kumar (20090; Chuku, *et al*. (2010)]. Figure 1 provides an illustration of the supply-side shocks: increase in oil prices reduces

[1]Supply shocks include energy shortages, rising global commodity prices and unprecedented floods in the summer of 2010 [Amjad, *et al*. (2011)].

[2]High borrowings by the government of Pakistan from the State Bank of Pakistan and the Commercial Banking System to finance fiscal deficits, large increases in remittances, high government subsidized prices and large increases in the wages of government employees [Amjad, *et al*. (2011)].

output in the short-run due to the reduction of capacity utilisation which, in turn, increases unemployment and reduces income.[3]

Fig. 1. Transmission Channels of Oil and Food Shocks



Source: Constructed by authors following Tang, *et al*. (2010) and Alom (2011).

The second important transmission channel of oil price shocks is the wealth transfer effect. This channel suggests that increase in oil prices shifts purchasing power from oil-importing countries to oil-exporting countries. A persistent rise in oil price would consider being a significant windfall in revenue and improvement in balance of payments of oil-exporting countries. The transfer of wealth is expected to reduce the aggregate demand of the oil-consumer countries while opposite is expected in the case of oil-producing countries [Galesi and Lombardi (2009)], because it is assumed that marginal propensity to consume in the oil-exporting countries is higher. The oil price shocks in oil-importing countries are transmitted through the demand-side by triggering the reduction of demand for goods and services. High oil prices may affect consumer expenditures via four complementary channels: discretionary income effect, uncertainty effect, precautionary saving effect and operating costs effects [Kilian (2010) and Chuku, *et al*. (2010)]. This implies that an increase in oil prices deteriorates terms of trade for oil-importing countries [Dohner (1981)].

[3]Since oil is considered to be an important factor of production, an increase in its price raises the cost of production. As a result, domestic productivity will be slow.

Besides the slowing down total output, a hike in oil price generates inflationary pressures in the economy [Hooker (2002) and Tang, *et al*. (2010)]. Since oil-based products are an important components of consumer price index. The first round effect of high oil prices is a sudden increase of the headline inflation. However, the degree of pass-through effect depends on the domestic response to the shocks [Galesi and Lombardi (2009)]. Evidence suggests that reduced output and inflation are the two most likely effects of oil price shocks [Chuku, *et al*. (2010)]. An oil price shocks constitutes a cost of production shocks, operating through supply-side effect which produces upward pressure on labour costs and prices [*Ibid* (2010)]. Barsky and Kilian (2004) showed that increases in oil price generate high inflation. This can also be interpreted as price shock second round effects, giving rise to wage-price loops [Galesi and Lombardi (2009)].

According to the real balance effect transmission channel, an increase in oil prices would lead to increase in demand for money. Since the monetary authorities failed to meet growing money demand with increased money supply. Consequently, there is an increase of interest rates and retard of economic growth [Brown and Yucel (2002)]. Alternatively, working through the price-monetary transmission mechanism, oil price shocks can reduce investment due to the reduction in producer's profits and equally reduces money demand (Figure 1).

The monetary policy channel is another important channel through which monetary authorities respond to oil price shocks. For example, tightening of monetary policy through increased interest rates (Figure 1) to combat inflationary pressure caused by rising oil prices, discourage investment and worsens output in the long-run [Tang, *et al*. (2010)]. Brenanke, *et al*. (1997) documented that tightening of monetary policy and oil price shocks produced depressing effects on real economy.

The sectoral adjustment effect channel shed light on the asymmetric impact of oil price shocks within the sectors of the economy. Brown and Yucel (2002) offers the possible explanations for this asymmetry adjustment would be rely on monetary policy, adjustment costs, adverse effects of uncertainty on the investment environment and asymmetry in the petroleum product prices [Lardic and Mignon (2006, 2008, and Lescaroux and Mignon (2008)]. When oil price rises, slowing economic activities is further retarded by adjustment costs. Conversely, when oil price falls, stimulated economic activities is somewhat offset by adjustment costs [Brown and Yucel (2002 and Chuku, *et al.* (2010)]. Such costs could arise from sectoral imbalances and lack of coordination between firms or because energy-to-output ratio is embedded in the capital stock [Brown and Yucel (2002) and Lescaroux and Mignon (2008)]. In the presence of sectoral imbalances, an increase (decrease) in oil price would require contraction (expansion) of oil intensive sectors and expansion (contraction) of oil efficient sectors [Lilien (1982) and Hamilton (1988)]. These realignments in production require adjustments, which cannot be achieved in the short run-known as dispersion hypothesis [Kumar (2009)]. Furthermore, asymmetry in oil prices will result in under-utilisation of resources and rising unemployment.

Finally, psychological effect implies that given the uncertainty about how long will oil prices remain high can adversely affect economic activities by reducing investment demand of firms and consumer's demand-known as the uncertainty channel. Uncertainty causes firms and consumers to postpone irreversible investment and consumption decisions following positive oil price shocks [Burnanke (1983); Pindyck (1991); Ferderer (1996) and Galesi and Lombardi (2009)].[4] If energy-to-output ratio embedded in the capital stock, the firms must choose energy-intensive production process when purchasing capital. For consumer, the uncertainty mainly applies to consumer durables, especially energy-using consumer durables. Uncertainty about future oil price causes upward and downward movements in oil prices. It is worth noting that when future oil prices become increasingly uncertain, the value of postponing the investment (or consumption) decisions increases, and the net incentive to invest (or consume) decreases, thereby dampening long-term prospects of output [Chuku, *et al*. (2010)].

The literature also reveals that food and oil prices are responsible for slowing down world economic growth [Headey and Fan (2008); Abott, *et al*. (2009); Galesi and Lombardi (2009); Hakro and Omezzine (2010); Alom (2011) and Jongwanich and Park (2011)]. The transmission channel (Figure 1) suggest that increase in food prices leads to increase import bills which decreases net exports and causing domestic output to fall—referred net export channel. On the other hand, when food price increases globally the demand for food exports decreases which ultimately reduces net exports—a part of national income [Alom (2011)]. Increase in food and oil prices also increases the demand for money and interest rates which produces adverse effect on exchange rates.

In general it is very difficult to quantify the net effect of oil and food price hike. The pass-through effect of global commodity price changes on domestic prices can be analysed into three channels. First, the direct or the first-round effect, which refers to the rise in prices of energy products. Second, the indirect effect which refers pass-through of higher energy-related costs of production to the prices of other goods and services. Third, the second-round effect, which occurs due to an increase in the cost of living, worker's demands a higher wage in order to maintain their real income [Galesi and Lombardi (2009)]. The effect of the first two channels is likely in the short-to- medium term. However, the second-round effect is expected to be more prolonged and may result, wage-price spiral, causing inflation to accelerate [Galesi and Lombardi (2009)].

Bruno and Sachs (1985) suggest that after the oil price shocks of the 1970s, monetary authorities adopted expansionary monetary policies which eventually aggravated effects on inflation. However, nowadays monetary authorities commit themselves to rapidly counter inflationary measures to enhance the credibility of monetary authorities. Galesi and Lombardi (2009) argued that a credible inflation-countering strategy would create a stable environment of low inflation, anchoring the inflation expectations and influencing the price-setting behaviour.

3. METHODOLOGY: SPECIFICATION OF STRUCTURAL VECTOR AUTOREGRESSIVE (SVAR)

To address the issues related to food and oil price shocks, we make use of Structural Vector Autoregressive (SVAR) modeling approach. The advantage of the SVAR over the other classes of vector autoregressive models is that it has better empirical fit and allows indentifying structural shocks with respect to economic theory. Furthermore, SVAR also makes it possible to examine the net effects of unexpected

[4]It can be argued that when oil prices increase, consumers and producers could postpone their purchases of oil related products and reduce their oil consumption [Galesi and Lombardi (2009)].

change in one or more variables on other variables in the system [Chuku, *et al*. (2011)].[5] To analyse the transmission channels of oil price and food price shocks in Pakistan, we make use with a reduced form Vector Auto-Regressive (VAR) model. Since oil and food prices can directly increases domestic inflation and will cut producer's profit rates, which together with interest rate adversely influences domestic output through the channel of investment.

Following Breitung, *et al.* (2004) we start with the following structural *VAR*(*p*) system:

$$AX_t = A_1 X_{t-1} + A_2 X_{t-2} + \text{.........} + A_p X_{t-p} + \varepsilon_t \qquad \ldots \qquad \ldots \qquad \ldots \qquad (1)$$

Where X_t is a ($n \times 1$) vector of endogenous variables ($X_t = (p_t^o, p_t^f, y_t, m_t, i_t, q_t, \pi_t)$), A is an invertible ($n \times n$) matrix of coefficients of contemporaneous relations on the endogenous variables; $A_i's$ are ($n \times n$) matrices which captures dynamic interactions between the k variables in the model, and ε_t is a ($n \times 1$) vector of structural error terms. p is the number of lags. It can be argued that VAR estimation is very sensitive to lag order of variables. A sufficient lag length may help to reflect the long term impact of variables on others. However, by selecting longer lag length may cause multicollinearity problems and will reduce the degrees of freedom (DOF) [Wooldbridge (2006); Tang, *et al*. (2010) and Chuku, *et al.* (2010)]. Tang, *et al*. (2010) argued that for any $p \geq 11$, the model will become divergent with at least one autoregressive roots greater then unit. Therefore, sequential modified Likelihood Ratio (LR) test suggest that lag order 1-3 is best for this nature of models [Wooldbridge (2006); Tang, *et al*. (2010) and Chuku, *et al*. (2010). SVAR models are more suited to track and identify structural shocks with respect to underlying economic theory [Chuku, *et al*. (2011)]. Hence, it is necessary to impose relevant restrictions on the system of equations to retrieve structural shocks of the model.

The model residuals are assumed to be linearly related to structural shocks, denoted by u_t, so that $u_t = B\varepsilon_t$, where B is ($n \times n$) matrix of structural coefficients representing the effects of structural shocks. It is further assumed that ε_t is mutually orthogonal so that the dynamic impacts of each individual structural shock can be expressed in isolation. Thus, ε_t is a $n \times 1$ vector of the structural shocks assumed normally distributed with zero mean and normalised diagonal variance-covariance matrix $\Omega = I$. Therefore, system (1) can be expressed as:

$$AX_t = A_1 X_{t-1} + A_2 X_{t-2} + \text{.........} + A_p X_{t-p} + B\varepsilon_t \qquad \ldots \qquad \ldots \qquad \ldots \qquad (2)$$

The structural model represented by system (2) must be identified for the purpose of policy analysis and must be given economic interpretation [Leeper, *et al*. (1996)]. The fundamental problem here is that model (2) is not directly observable and cannot directly estimated to derive the true values of ε_t and coefficients in A and $A_i's$. The reduced form of the model (2) can be obtained by pre-multiplying the model (2) with A^{-1} as written below:

[5]We include two external variables, such as oil price and food price.

$$X_t = A_1^* X_{t-1} + A_2^* X_{t-2} + \ldots\ldots\ldots + A_p^* X_{t-p} + u_t \quad \ldots \quad \ldots \quad \ldots \quad (3)$$

Where $A_i^* = A^{-1}A_i$, u_t denotes the reduced-form VAR residuals vector uncorrelated with variables in X_t and normally independently distributed with variance-covariance matrix $\Omega = E(u_t u_t')$. Thus ordinary least squares (OLS) estimation gives consistent estimates of A_i^*. Similarly the estimates of Ω can be obtained from the fitted residuals.

Since only the lagged terms are listed on the right-hand side of the VAR equation and a reduced-form VAR is unable to trace the contemporaneous relationship among variables which causes cross-correlation among residuals series. Although, the covariance matrix of residuals $\Omega = E(\varepsilon_t \varepsilon_t') \neq 1$, but it does not influence the unbiasedness and efficiency properties of estimation [Tang, *et al*. (2010)]. The contemporaneous relationship may affect the impulse responses. As Equation (2) is not directly observable, the solution is obtained through another relation between the reduced form VAR model (3) and the structural VAR model (2) as:

$$Au_t = B\varepsilon_t = u_t = A^{-1}B\varepsilon_t \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (4)$$

The structural coefficients in Equation (2) can be recovered from the reduced-form Equation (3), using relations (4). To identify structural form parameters it is necessary to impose sufficient restrictions on either matrix of parameters *A*, *B* or both. For the just identification we need $(n^2 + n)/2$ restrictions on the *A* and *B*. Furthermore, we need additional $n^2 - (n^2 + n)/2$ restrictions on matrix *B* [Amisano and Giannini (1997)]. In our case we have seven variables model; therefore, we need 21 additional restrictions to estimate the model.

3.1. SVAR Model for the Pakistan Economy

There is no consensus on the number of variables required in SVAR model to provide a plausible interpretation of an economy. Dungey and Pagan (2000) included eleven variables in SVAR, while Kim and Roubini (2000) and Brichetto and Voss (1999) argued that seven variables are enough [Naqvi and Rizvi (n. d.)]. For the smaller economies like Pakistan, world oil and commodity prices are assumed to be exogenous. Hence, we specify a VAR model that involves a set of variables represented by the following vector X_t.

$$X_t = (p_t^o, p_t^f, y_t, m_t, i_t, q_t, \pi_t) \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (5)$$

Where p_t^o is the world oil price in terms of US dollar, p_t^f is the international food price index, y_t is the output proxied by industrial production index, m_t is money supply (M2 definition), i_t is the short-term interest rate proxied by the overnight call money rate, q_t is the real effective exchange rate and π_t^{cpi} is the consumer price inflation proxied by the log difference of consumer price index (CPI). Lower case letters represents the logarithmic form of the variables except for interest rate.

World oil prices and international food prices are the key variables of interest. The variables p_t^o and p_t^f are determined exogenously relative to the policy shocks. They serve as instruments to isolate exogenous monetary policy shocks. Furthermore, world oil and food prices are included to examine the international price shocks on domestic economy. Overnight call money rate and exchange rate are included to captures the effect of monetary policy shocks and exchange rate shocks on other variables.

For the identification, we impose following set of restrictions on the contemporaneous structural parameters following Kim and Roubini (2000), Naqvi and Rizvi (n. d) and Alom (2011). The summary of identification scheme based on the Equation (4), $u_t = B\varepsilon_t$ is as follows:

$$\begin{pmatrix} 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ b_{21} & 1 & 0 & 0 & 0 & 0 & 0 \\ b_{31} & 0 & 1 & b_{34} & 0 & 0 & b_{37} \\ 0 & 0 & b_{43} & 1 & b_{45} & 0 & b_{47} \\ b_{51} & 0 & 0 & b_{54} & 1 & b_{56} & b_{57} \\ 0 & 0 & b_{63} & b_{64} & 0 & 1 & 0 \\ b_{71} & b_{72} & b_{73} & b_{74} & b_{75} & b_{76} & 1 \end{pmatrix} \begin{pmatrix} \varepsilon^o \\ \varepsilon^f \\ \varepsilon^y \\ \varepsilon^m \\ \varepsilon^i \\ \varepsilon^q \\ \varepsilon^\pi \end{pmatrix} = \begin{pmatrix} u^o \\ u^f \\ u^y \\ u^m \\ u^i \\ u^q \\ u^\pi \end{pmatrix} \qquad \ldots \qquad (5)$$

Where $\varepsilon^o, \varepsilon^f, \varepsilon^y, \varepsilon^m, \varepsilon^i, \varepsilon^q$ and ε^π are the structural disturbances, that is, oil price, food price, output, money demand, interest rate, real effective exchange rate and inflation rate shocks respectively, while $u^o, u^f, u^y, u^m, u^i, u^q$ and u^π are residuals in the reduced form equations.

We imposes identifying contemporaneous restrictions on the structural parameters following the information-based approach of Sims (1999), Gordon and Leeper (1994), Sims and Zha (1998), Kim and Roubini (2000), Kim (2001) and Lee and Ni (2002). We assume that oil price is exogenous, this means that food price (p_t^f), output (y_t), money supply (m_t), short-term interest rate (i_t), real effective exchange rate (q_t) and consumer price inflation (π_t^{cpi}) are not determinants of oil prices at period *t*. Equation (2) is food price (p_t^f) function which is assumed to be affected only by changes in oil price (p_t^o). Both oil price and food prices capture the effect of international supply shock on inflation—the cost push inflation. Equation (3) is output (y_t) function which captures demand shock and is assumed to be affected by oil prices, money balances and inflation rate. The fourth equation is money demand function which depends upon the real income proxied by industrial production index, inflation rate and short-term nominal interest rate. The monetary policy reaction function is represented by Equation (5). Sek (2009) argued that interest rate respond contemporaneously, to inflation, output and exchange rate. Therefore, in line with Sek (2009) the monetary policy reaction function includes oil price, money supply, real effective exchange rate and inflation rate. Real effective exchange rate is included to capture the effect of exchange rate shocks on inflation and is assumed to be affected by interest rate, money supply, output, food and oil prices. Finally, inflation rate receives contemporaneous effects of all variables in the system. In other words, inflation rate responds contemporaneously to demand shocks, exogenous supply shocks, monetary policy shocks and exchange rate shocks.

On the whole, the structural shocks consist of various blocks. The first two equations represent exogenous shocks originated from the world economy, the oil price and food price shocks. The third equation describes the good market equilibrium. Equations four and five represent money market equilibrium condition and monetary policy reaction function. Equation six associates to foreign exchange market, while the last equation describing domestic price setting behaviour.

3.2. The Data

We employed monthly data over the period January 1990 to July 2011 for Pakistan. The rationale behind the selection of this period is to capture oil price and global food price shocks of the mid-2008. Our primary focus is to examine the impacts of oil price and international food price shocks on inflation rate, real income, money balances, nominal effective exchange rate and nominal short-term interest rate. To this end, we have selected five endogenous variables ($y_t, m_t, i_t, q_t, \pi_t$) and two external variables (p_t^o, p_t^f) to capture the inter-relationship with in the SVAR framework.

Real GDP (y_t) on monthly frequency is not available; hence we have used an industrial production index as proxy for real GDP. Inflation rate (π_t) is calculated by taking the log difference of the consumer price index (CPI) multiplied by 100. Money supply M2 definition (m_t) is included to capture the influence of monetary sector. This is because the State Bank of Pakistan responds oil price shocks, which may affect the economic activities in Pakistan. For the nominal short-term interest rate (i_t) we have used overnight call money rate. To capture the effects of oil price shocks and food price shocks on exchange rate, we have included trade weighted real effective exchange rate (q_t). For oil prices (p_t^o) we choose the West Texas spot crude oil price in dollar term. We eliminate the influence of exchange rate fluctuations by transforming the dollar price of Pak-rupee using the average corresponding Pak-rupee-U.S. dollar exchange rate. For global food price, we used food price index. Data on these variables are retrieved from the International Monetary Fund's International Financial Statistics-IFS CDROM-2008 and updated using monthly *IFS Bulletins* (various issues). All the variables are expressed in logarithmic form except for interest rate.

4. ESTIMATION RESULTS: STRUCTURAL VAR ANALYSIS

4.1. Impulse Response Analysis

The main objective of this study is to track out the impact of oil price and food price shocks on inflation rate, domestic output, money balances, interest rate and real effective exchange rate by mean of Generalised Impulse Response analysis. In other words, the study mainly traces how domestic variables respond to oil price and food price shocks. For this purpose we estimated SVAR model in levels of the variables. For the policy analysis it is important that one should add sufficient number of lags to remove serial correlation and make the errors stationary (i.e. I (0)) and proceed to the analysis. Hence, there is no need to worry about non-stationarity of the variables.[6] "Sims (1980) and Sims, *et al*. (1990) recommended against differencing even if the variables contain a unit root. They argued that the goal of a VAR analysis is to determine the interrelationships among the variables, not to determine the parameter estimates. Differencing of variables may lose important information concerning the co-movements in the data [Enders (2004), p. 270]". Similarly, McCallum (1993) argues that the estimation of SVAR in levels is appropriate if the error terms of each VAR equations are stationary and serially uncorrelated [Parrado (2001)]. Our preliminary results suggest that residuals characterise vector white noise processes.[7]

The SVAR model is estimated using three lags on the basis of Akiake Information Criteria (AIC). Given the structural factorisation specified by Equation (5), we impose 21 just-identifying restrictions on SVAR model. Table 1 reports the contemporaneous coefficient estimates based on the SVAR model. These coefficients provide baseline intuition of the basic relationship that exists among the variables.

Table 1

Contemporaneous Structural Coefficients

	Coefficients	Standard Error	Z-statistic	Probability
b_{21}	0.057	0.020	2.87	0.004
b_{31}	0.038	0.077	0.493	0.622
b_{34}	1.280	1.088	1.18	0.239
b_{37}	-0.007	0.017	-0.41	0.685
b_{43}	-0.066	0.141	-0.47	0.638
b_{45}	-0.025	0.026	-0.96	0.337
b_{47}	0.043	0.049	0.87	0.382
b_{51}	2.981	3.005	0.99	0.321
b_{54}	132.200	67.440	1.96	0.050
b_{56}	102.145	58.586	1.75	0.081
b_{57}	1.650	0.772	2.14	0.033
b_{63}	-0.002	0.015	-0.11	0.910
b_{64}	-0.323	0.390	-0.83	0.408
b_{71}	3.778	2.153	1.76	0.079
b_{72}	-19.509	9.494	-2.06	0.040
b_{73}	0.157	6.628	0.02	0.981
b_{74}	98.615	62.544	1.58	0.115
b_{75}	-0.257	0.262	-0.98	0.327
b_{76}	-13.026	38.943	-0.33	0.738

Likelihood Ratio (LR) test for over-identifying restrictions: $\chi^2(2) = 4.25[0.114]$.

[6]There are two possibilities: (i) Use a recursive VAR (Cholesky decomposition), but this is *ad hoc* and results are order-dependent, (ii) Impose contemporaneous short-run restrictions on SVAR on levels whether the variables are I(1) or I(0). Add enough lags to get I (0) errors. With these "identifying assumptions", correlations can be interpreted causally. For example, Taylor rule sets the interest rate equal to lagged inflation and unemployment (instrumental variable regression) and is the interest rate equation in the VAR.

[7]The results are available from the authors.

The contemporaneous coefficients will indicate immediate response of domestic prices, domestic output, money balances, interest rate and exchange rate to world oil and food price shocks. We imposed 21 restrictions to just-identified the model. The LR test is 4.25 which indicate that restrictions are valid and hull hypothesis cannot be rejected.

In order to investigate the short-run dynamics we employ Generalised Impulse Response Functions (GIRFs) proposed by Koop, *et al*. (1996) and Pesaran and Shin (1998). GIRFs are more appealing compared to Sims's (1980) orthogonalised impulse response functions as they are invariant to the ordering of the variables [Galesi and Lombardi (2009)]. GIRFs trace out the responsiveness of dependent variable to shocks to each of the variables in the SVAR model. For each equation, a positive standard unit shock is applied to the oil and food prices respectively up to a limit of twenty four months horizon. Since our main interest is to measure the oil and food price shocks on selected macroeconomic variables, we only traces out the responses of independent variables. In our SVAR model we assume that oil prices do not react to disturbances to other macroeconomic variables. The literature suggests that oil price shock usually have immediate and direct effect on inflation and on output, so we choose the ordering $\pi_t, y_t, m_t, i_t, q_t$, while food price react positively to only oil prices.

4.2. A Shock to Oil Prices

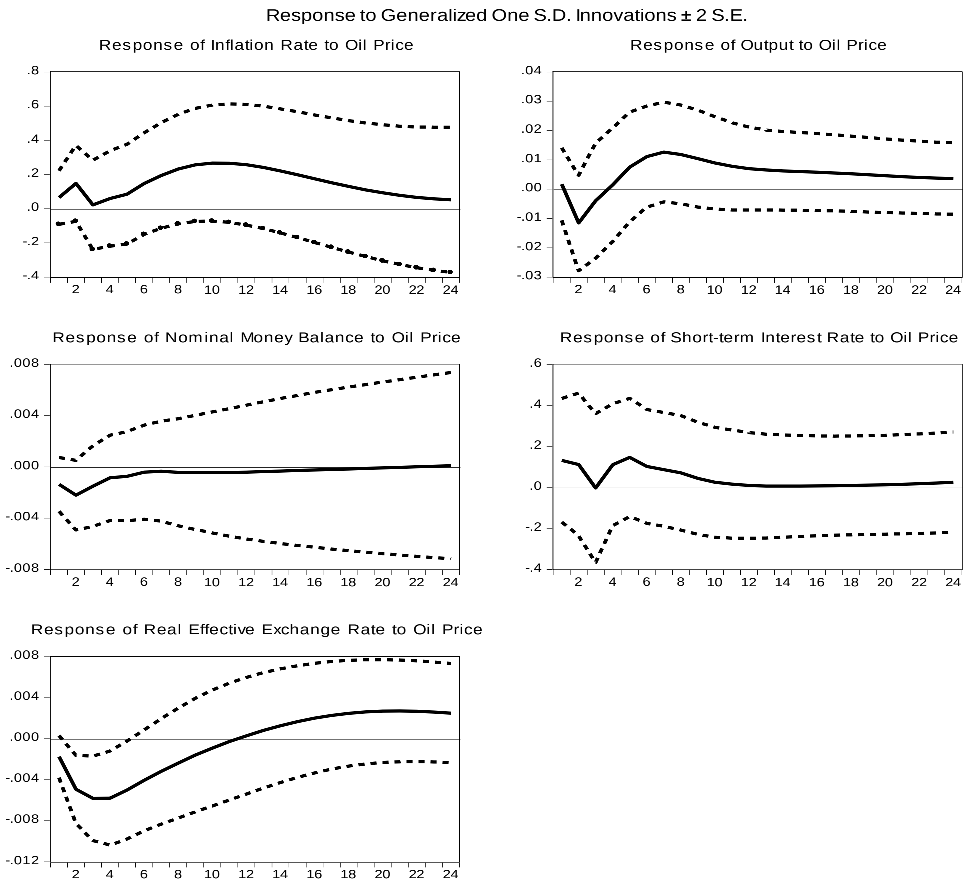
Figure 2 display GIRF of each variable to a positive one unit standard deviation shock to oil prices. As expected, initially inflation shoots up following the oil price shock and after one month it starts declining. After 3-month period inflation starts accelerating and the maximum impact is reaches around 11 to 12-months. This implies that oil price shocks cause inflationary pressure on the Pakistan's economy. Javid and Munir (2011) obtained almost similar results for Pakistan.

We observed negative responses of domestic output following oil price shock. In response to oil price shock, output falls down immediately and hits the bottom at around second month and starts increasing and attains the peak level in seventh month. However, after seventh month output starts declining and remains stagnant over next fourteenth to twenty-fourth month. This implies that after oil price shock output declines quickly and recovers slowly. The pattern of GIRF suggests that oil price increases may reduce the supply of intermediate goods industries and the demand for final goods industries [Lee and Ni (2002)]. Lee and Ni (2002) also obtained similar findings.

The response of money balances to oil price shock is initially negative and after a lag of two months money balances starts increasing and completely dies out after 17th month. This implies that the monetary authorities cut money supply following an oil price shock up to the second month. The rationale for this policy stance could be to check the inflationary pressure that may generated by oil prices. However, after the second month, money supply rises again over and above levels before oil price shock.

The response of short-term interest rate indicates that short-term interest rate declines immediately after the oil price shocks. However, after 3rd month it starts increasing and reaches its maximum level in 5th month, and then it falls slowly and completely dies out over the next 12th months. This result is consistent with monetary contraction after an inflationary oil price shock [Kim and Roubini (2000) and Javid and Munir (2011)].

Fig. 2. Generalised Impulse Responses of a Positive Unit (One S.D) Shock to Oil Prices



The real effective exchange rate appreciates immediately following the oil price shocks up to the fourth months. The real effective exchange rate revert its tendency and starts depreciation over the next 24-months. This implies that the exchange rate appreciation will be transitory and will revert to above its pre-shock levels after all prices and wages have adjusted. This mean-reverting behavior of real effective exchange rate is consistent with the long-run implications of overshooting monetary exchange rate models [Kim and Roubini (2000)].

4.2.1. *Generalised Forecast Error Variance Decompositions Analysis*

The Generalised Forecast Error Variance Decompositions (GFEVDs) analysis provides a tool of analysis to identify relative importance of each dependent variable in explaining the variations in the explanatory variables [Chuku, *et al*. (2010)]. Furthermore, GFEVDs provide insights on the transmission channels through which policy-specific shocks spillovers. The results of GFEVDs over a 24 months horizon for oil price shocks are displayed in Table 2.

Table 2

Generalised Forecast Error Variance Decompositions of Crude Oil Price

Period	Std. Error	p_t^o	p_t^f	y_t	m_t	i_t	q_t	π_t
1	0.080	100.000	0.000	0.000	0.000	0.000	0.000	0.000
4	0.177	93.630	2.340	0.089	0.064	2.538	1.271	0.068
8	0.235	75.661	7.844	2.224	0.183	4.932	7.859	1.296
12	0.268	62.808	8.361	4.734	0.608	6.402	15.242	1.845
16	0.288	55.352	7.373	6.080	0.920	7.438	21.183	1.654
20	0.301	50.992	7.134	6.675	1.086	8.378	23.898	1.837
24	0.310	48.431	7.636	6.784	1.164	9.393	24.201	2.391

Note: Cholesky Odering: $p_t^o, p_t^f, y_t, m_t, i_t, q_t$ and π_t.

As can be seen from the Table 2 that the contribution of oil price shock to output is 6.78 percent over the period of 24-months horizon. This implies that oil price shocks significantly affect real ouput and the impact is persistent over the longer horizon. This result confirms the earlier findings of Javid and Munir (2011). The results suggest that the contribution of the money supply is negilible, it is equal to 0.06 percent and 1.16 percent between 4-month and 24-month horizon respectively. Similarly, the impact of stort-term interest rate is 2.54 percent in 4-months. Its contribution increases over time and reaching 9.39 percent after two years. This implies that the monetary authorities react against oil price shocks.

The oil price shocks explain large part fluctuations in real effective exchange rate. The contribution of oil price shock to effective exchange rate is 1.27 percent in 4-month period. It increases gradually over time and passing over 24 percent after two years. Thus the exchange rate innovations tends to increase over time and more dominate source of fluctuations. This implies that exchange rate innovations may perceived more permanent and tend to pass-through to the domestic inflation faster than any other variable under investigation.

Finally, the impact of oil price shock to inflation over a 24-month horizon ranges between 0.07 percent to 2.39 percent. This low impact of oil price shock on inflation may suggest the existence of domestic price stickiness with respect to international oil prices. In other words, this implies the slow adjustment of domestic prices to international price level.

In overall term, the results suggest that oil price shock significantly affect domestic economic activities. Oil price shocks togather with exchange rate depreciation generates inflationary pressures in Pakistan. The inflationary shocks are mainly explained by real effective exchange rate (24.20 percent), short-term interest rate (9.39 percent) and domestic output (6.78 percent). Therefore, SVAR analysis reveals the topical role of the real effective exchange rate and stort-term interest rate in controling inflation in Pakistan.

4.3. A Shock to Food Prices

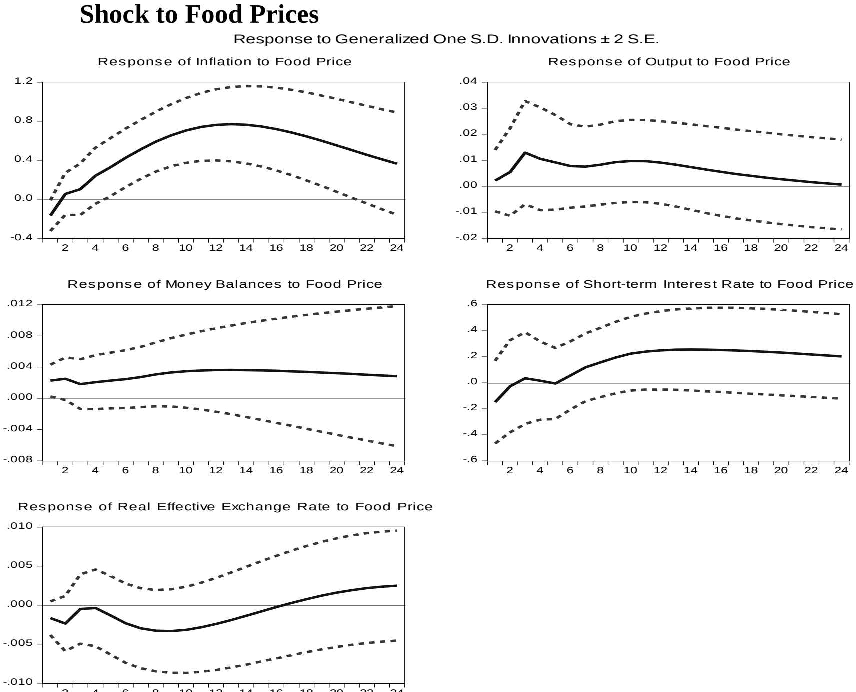
Figure 3 displays the GIRFs of each variable to a positive unit standard deviation shock to food prices. As expected, consumer price inflation shoots up immediately following the food price shock and reaches its maximum levels in 13th month. After 13th month it falls steadily over the next 11-months and remains to above the pre-shock level. This effect of food price shock partially reflects the weight that the food component has in consumer price basket. Since food price is important component of the CPI, therefore, food price shock significantly generates inflationary pressures on Pakistan's economy.

The effect on the output proxied by the industrial production index is clearly different form oil price shocks. Initially output responds positively to food price shock, reached its peak levels in third month. Then it falls gradually and dies out after two years from the shock (i.e. 24th month). This implies that food commodities are different from crude oil prices and are not broadband production factors. Thus a rise in their prices does not generally lead to a decrease in output [Alom (2011)].

The effect on the money balances is not much significant and remains persistent over the horizon of 24-months. However, the response of short-term interest rate to food price shock is positive and reaches at the peak levels in third and 12th months respectively. Then it remains persistent over the next 12-months.

A positive one unit standard deviation shocks to international food prices appreciates real effective exchange rate up to 2-months and then starts depreciation over the next 2- months. Real effective exchange rate starts appreciation following the food price shock and reaches its peak levels in 9th month. Then it depreciates gradually and after 24-month the real depreciation is 0.03 percent. This mean-reverting behavior of real effective exchange rate is consistent with the long-run implications of overshooting monetary exchange rate models [Kim and Roubini (2000)]. However, the mean-reversion is relatively slow than that of oil price shocks.

Fig. 2. Generalised Impulse Responses of a Positive Unit (One S.D) Shock to Food Prices



On the whole, increases in international food prices significantly generates inflationary pressure on Pakistan's economy and also causes exchange rate fluctuations which may considered as major source of disturbance.

4.3.1. *Generalised Forecast Error Variance Decompositions Analysis*

The results of GFEVDs over a 24 months horizon for food price shocks are reported in Table 3.

Table 3

Generalised Forecast Error Variance Decompositions of Food Prices

Period	Std. Error	p_t^o	p_t^f	y_t	m_t	i_t	q_t	π_t
1	0.078	3.120	96.880	0.000	0.000	0.000	0.000	0.000
4	0.177	1.756	92.928	3.348	0.322	0.187	1.075	0.385
8	0.235	1.170	83.945	6.296	0.856	0.087	6.512	1.133
12	0.268	0.807	73.793	7.513	1.069	0.080	15.729	1.008
16	0.288	0.627	64.267	8.736	1.121	0.083	24.255	0.912
20	0.301	0.535	56.862	9.594	1.062	0.073	30.275	1.599
24	0.310	0.540	51.666	10.107	0.974	0.116	33.763	2.84

Note: Cholesky Odering: $p_t^o, p_t^f, y_t, m_t, i_t, q_t$ and π_t.

It can be seen fron the Table 3 that food price shocks explain 3.38-10.11 percent variations in domestic output, 1.08-33.06 percent variations in real effective exchange rate and 0.39-2.84 percent variations in inflation rate. However, GFEVDs reveals that money balances and short-term interest rate are mildly effected by food price shocks. The analysis suggest that the dominant source of inflation in pakistan is the persistent depreciation of exchange rate followed by the food price shocks.

5. POLICY IMPLICATIONS

We found that Pakistan's economy is relatively less affected by international oil and food price shocks. The findings related to oil price shocks suggest that oil price increases adversly affects industrial production. However, the effect of oil price shock on industrial production is relatively small. The reseaon could be that heavy industries in Pakistan are partially dependent on electricity generated by imported oil. Oil accounts for 29 percent of total energy used in Pakistan, while natural gas accounts for 40 percent [Malik (2010)]. The other reason for the reduction of industrial production could be that due to food price hike the labour force in the industrial sector may demand higher wages and thus demand for labour decreases which decreases output in the industrial sector [Alom (2011)]. Furthermore, increase in the price of food products put negative impact on import bills. Food and oil price shocks found to be transmit through interest rate and exchange rate chennels, therefore, other variables are not much responsive to the oil and food price shocks. This result is consistent with the earlier findings of Rafiq, *et al.* (2009). The reason could be the increase in money demand due to excess import bills. Exchange rate is again found to be important channel in terms of food price shock. Besides interest rate, the major channel through which oil and food price shocks transmit to Pakistan's economy are real effective exchange rate because real effective exchange rate is under pressures because of excess import bills due to oil and food price increase.

Our results imply that impact of international oil and food price shocks is transmitted through interest rate and exchange rate channels which create inflationary pressures and constraints economic activities in Pakistan. Therefore, there is need to reduce undue emphasis on international oil and food prices as key determinants of consumer prices inflation and place more emphasises on the prudent monetary, fiscal and exchange rate policies in macroeconomic policy formulation to deal with inflation, recession and poverty. Furthermore, the findings suggest that Pakistan may design effective policy measures to cope with oil price shocks. Renewable energy sources could be the important option to accommodate oil price shocks. To cope with the food price shocks there is need to increase food reserves and enhance domestic food production.

5. CONCLUSION

In this study we have applied SVAR methodology to investigate the short-run impact of oil and food prices on consumer price inflation for Pakistan using monthly data over the period 1990M1 to 2011M7. Generalised Impulse Response analysis reveals that oil and food price shocks have different inflationary effects. The impulse response analysis suggests that following oil price shocks, inflation immediately increases. After second month it follows downward trend up to 4-months. Then it again increases and reaches its maximum levels in 10th month and remains stable over the next 13-months. Whereas, following food price shock domestic price inflation gradually increases up to 12-months and then starts decreasing and remains above the pre-shock level by the end of two years. Furthermore, following a positive oil price shock, output initially decreases and after second month it tend to increases gradually between fourth to seventh month and stabilises over the next 17-months. On the other hand, following a positive food price shocks, output increases up to third month and then starts falling and completely dies out after two years. Similarly, interest rate responds positively following the oil and food price shocks. However, the variation in interest rate due to food price shock is relatively larger than that of oil price shocks. The GIRF reveals that real effective exchange rate is most important source of disturbance following either oil price or food price shocks. In either case initially exchange rate appreciates and then it depreciates gradually over the 24-month horizon.

Generalised forecast variance decompositions analysis also supports the findings based on GIRFs. The result clearly reveals that oil and food price shocks affect output, short-term interest rate, inflation rate and real effective exchange rate. However, among all, real effective exchange rate has seen a dominant source of variations in Pakistan. This implies that supply-side and demand-side disturbances due to external shocks are the major sources of stagflation in Pakistan.

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Factor Utilisation in Manufacturing: Evidence from Pakistan

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1. INTRODUCTION

Many developing countries have experienced 'jobless growth' in recent years, with employment growth either lagging behind economic growth or increasing unemployment rates during times of economic booms. This is particularly seen in the manufacturing sectors, as countries face early 'de-industrialisation' i.e., a fall in the manufacturing sector's share in total employment [Dasgupta and Singh (2006)]. Pakistan is no different as although the manufacturing sector is second only to agriculture in its contribution to GDP, it employs only 13.7 percent [Pakistan (2009-2010)] of the total labour force. Recent changes to capital-based foreign technology have led to the substitution of labour for non-labour factors and hence under-utilisation of the abundant labour force in the country. This is a pertinent issue as Pakistan has the 10th largest labour force in the world making employment creation essential for it to take advantage of this growing demographic dividend. Furthermore, labour market earnings are the main source of income for workers who lack social safety nets and capital and financial assets.

Manufacturing is considered to be the engine for growth, but the lack of employment creation in this sector raises concerns about the sustainability and distribution of this growth. According to Haider (2009), the employment elasticity with respect to GDP in the manufacturing sector is merely 0.02 percent. This may be due to the under-utilisation of labour in this sector. This paper aims to investigate this hypothesis by using the World Bank Investment Climate Surveys data to analyse the extent of utilisation of production, non-production labour and capital in the manufacturing sector of Pakistan and further conducts an industry-wise analysis to examine the relationship between input utilisation, productivity and other industrial characteristics.

Under(Over)-utilisation of a factor implies an 'abnormally' low (high) factor employment conditional on firm productivity; amount of other factors employed and factor costs. Following the framework provided by Pakes and Fernandes (2008) similar study done on the Indian manufacturing sector, we obtain the rate of factor utilisation by

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dividing the actual employment with the optimal employment. The optimal employment is the level which equates the marginal cost of labour with the marginal revenue generated by each additional worker. In the Pakes and Fernanandes study, under-utilisation of labour is attributed to the hiring and firing costs entailed by the labour laws of India, however, in Pakistan these costs are relatively low and underutilisation instead results from lower than optimal wages or skill-mismatch (incompatibility of labour demand and supply), causing firms to substitute away from labour [Fasih (2008)]. To empirically investigate the reasons behind the under-utilisation of labour we compare the utilisation rates of labour and capital across industries in 2002 and 2007. We further use utilisation rates as the dependent variable and analyse its link with other institutional constraints and industrial characteristics such as extent of unionisation, corruption and electricity shortage in that industry. Our main findings suggest a significant extent of under-utilisation of both production and non-production workers, with firms suffering greater losses due to power outages having higher levels of underutilisation. Capital is found to be over-utilised suggesting the adoption of capital intensive technology. Furthermore, union activity is seen to be negatively related to labour utilisation.

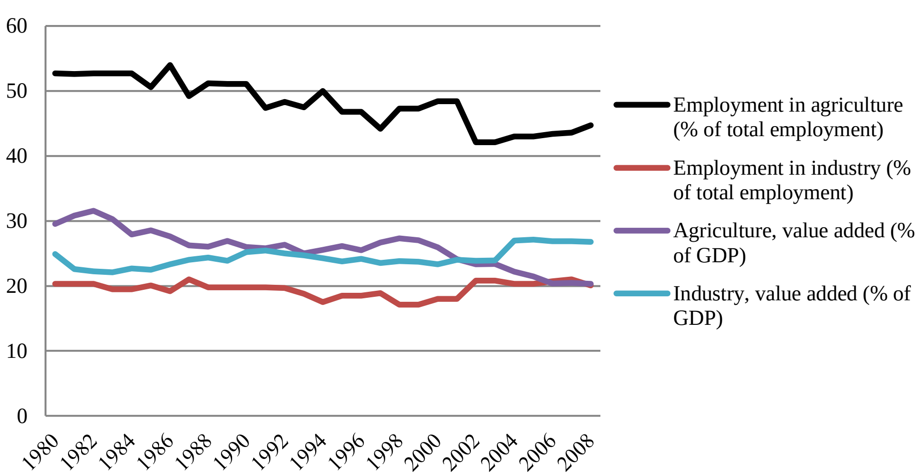
The contribution of this paper is novel as it is the first study explicitly measuring the extent of factor utilisation in the manufacturing sector of Pakistan and distinguishing between production and non-production labour. It also augments the framework of Fernandes and Pakes (2008) by employing the method introduced by Levinsohn and Petrin (2003) to estimate the production function, using intermediate goods rather than investment to proxy for productivity and to account for the endogeneity bias inherent in production function estimation. It further provides policy implications in order to attain employment enhancing growth in the future. The remaining paper is organised as follows: the next section gives a brief background and literature review on the issue of jobless growth, Section 3 discusses the methodology, Section 4 describes the data, Section 5 presents the results and Section 6 give policy recommendations on the basis of these results. The last section concludes.

2. BACKGROUND

As a country develops, through the process of urbanisation the surplus labour in its agricultural sector shifts to the industrial sector until the marginal product of labour (MPL) in the agricultural sector equals the marginal cost of labour in that sector and disguised unemployment is eliminated [Lewis (1954)]. Hence a structural change takes place in the economy with the share of the industrial sector in the GDP and in total employment increasing and the share of agriculture decreasing. This entails high employment elasticity with respect to GDP in the manufacturing sector, so that the rate of absorption of excess labour is close to the rate of growth of GDP. The manufacturing sector hence becomes the engine for growth and development. According to Kaldor's seminal work (1966), this is due to the three laws of economic growth: (1) the faster the growth of the manufacturing sector, the faster the growth of GDP; (2) the existence of increasing returns to scale in the manufacturing sector; (3) the growth for productivity for the entire economy as a whole is related to the growth in output in the manufacturing sector through labour reallocation from the other sectors to the manufacturing sector [Alessendrini (2009)]. Although Pakistan's economy has followed a similar path, with an export-led growth policy leading to an increasing contribution of the manufacturing sector to its GDP, it seems to defy Kaldor's third law as employment growth in manufacturing has not been at par with the growth in the GDP. This has in turn led to an overall 'job-less growth' in the economy.

Pakistan experienced low growth rates and an overall economic downturn during the 1990s and early 2000s. However, the economy began to recover in 2002 resulting from faster growth in the industrial sector reflected in the rise in exports and imports of intermediate goods [Anwar (2004)]. This growth in the industrial sector, which accounted for 25.6[1] percent of GDP in that period, was mainly due to the high growth rates of the large scale manufacturing (LSM) which accelerated exports and resulted in an increase in the foreign exchange reserves. The industrial growth was in part due to increased consumption loans and the utilisation of excess capacity (30–40 percent) created in the mid 1990s due to increased investments in independent power projects (IPPs), cement, sugar, automobile and consumer electronics [Anwar (2004)]. However this pattern of growth did not generate sufficient employment to absorb the growing labour force in the country. Job-less nature of economic growth is evident in Figure 1 below.

Fig. 1. Contributions to the Economy of Agricultural and Industrial Sector



As shown, although the GDP share of manufacturing went up during the period 2002–2007, its employment share remained stagnant. Empirical work done by Haider (2009, 2010) investigates the extent of this jobless growth by estimating labour demand in the seven sectors of the economy and calculating the employment elasticities in these sectors with respect to the growth in GDP. Table 1 indicates that the employment elasticity of large scale manufacturing sector is very low relative to other sectors. Hence, Haider (2009) identifies manufacturing as playing a key role in the job-less growth experienced by Pakistan's economy.

[1]Federal Bureau of Statistics (FBS).

Table 1

Employment Elasticities with Respect to GDP

Sector of Activity	Elasticities
Overall Elasticity	0.41
Agriculture	0.37
Large Scale Manufacturing	0.02
Small Scale Manufacturing	0.85
Construction	0.87
Transport and Communication	0.45
Trade	0.57
Electricity and Gas	0.54
Others	0.68

Source: Anwar (2004).

This pre-mature de-industrialisation is seen in other developing countries as well, such as India and Sri Lanka [Alessindrini (2009); Dasgupta and Singh (2006)]. According to Dasgupta and Singh (2006), at present the employment growth in developing countries is far below that observed in the past for today's advanced countries. This is true not only for slow-growing economies (as in Latin America) but also for fast-growing economies (for instance, India). Employing the Kaldorian framework, Dasgupta and Singh (2006) analyse this issue using a data set of 48 developing countries for the period 1990-2000. They find that excess labour in the agriculture sector in the reference countries either remains there, or enters the informal sector thus increasing the unregistered manufacturing employment. Furthermore, they conclude that the inability of non-conforming structures to satisfy changes in consumer demand or the required changes in production technique that occur during the process of industrialisation, along with the introduction of new technology such as the information and communication technology, may lead to service sector replacing or complimenting manufacturing as the engine for economic growth.

A similar study done on India by Alessindrini (2009) uses a dynamic dataset of 15 Indian states for the period 1980–2004 and finds a strong positive link between agriculture sector demand and employment in manufacturing. He also finds an inverse relation between growth of employment in the informal sector and that in the formal manufacturing sector. He attributes this to a sharp, sudden shift away from labour intensive economic activities to capital intensive ones coupled with a lack of educated and appropriately skilled workforce in the manufacturing sector. Bhalotra (1998), on the other hand, finds evidence of job-less growth in Indian manufacturing through calculating employment elasticities. His findings suggest an aggregate employment elasticity of 0.15 for the reference period. Bhattcharya and Sakhtiwal (2003) find a similar result and attribute their findings to stringent labour laws introduced in India which accelerated union activity as well as wage rates.

Fernanades and Pakes (2008) adopt a different approach towards the issue of job-less growth and define it in terms of labour under-utilisation in the manufacturing sector. They estimate the production function using the Olley and Pakes (1996) method and calculate factor under-utilisation in terms of the percent increase in employment that would result if there were no hiring and firing costs. They find substantial underutilisation of labour and over-utilisation of capital, with the results varying across states. Attributing this result to dysfunctioning labour markets, they further run reduced form regressions to investigate the relationship between factor utilisation, productivity and institutional constraints. According to their study, underutilisation is significant in industries suffering from increased power outages as well as union activity hence wage rigidity. They conclude that liberalising the labour market in states where labour laws are stringent will result in the reduction of the underutilisation of labour and also a rise in wage rates.

Although in Pakistan the labour market is not as rigid as in India and other developing nations, with unions having less bargaining power, under-utilisation of labour may still result in its manufacturing sector due to firstly increased power outages and secondly skill-mismatch and substitution away from labour to capital intensive production. Hence, less than optimal labour employment may be one of the reasons behind the jobless growth witnessed during the past growth spurt of the economy. However, literature investigating jobless growth merely goes as far as calculating employment elasticity and the impact of sectoral reallocation of labour on employment in the manufacturing sector [Haider (2009)]. Under-utilisation as a cause of under-employment has not been analysed. This paper seeks to fill this gap in the literature by not only estimating the extent of underutilisation of labour but also the relation between factor underutilisation, productivity and other industrial characteristics. The following section describes the methodology used to estimate the production function and carry out our empirical analysis.

3. METHODOLOGY

A production technology relates output to inputs of production like capital and labour. Measuring the rate of input utilisation in different industries requires obtaining parameter estimates of this production function so as to compare the optimal level of productive inputs to the actual usage of these inputs. Optimal Input employment is computed by equating marginal revenue productivity (derivative of the sales generating function) to marginal cost (input prices). It is assumed that the sales generating function is a constant elasticity demand function[2] multiplied by a Cobb-Douglas production function.

$$\begin{aligned}
&Sales = P(Y(K,L) \times Y(K,L) \\
&where\ P(Y) = Y^{\varepsilon} and\ \ Y = AK^{\alpha}L^{\beta} \\
&K = Capital\ input \\
&L = Labour\ input
\end{aligned}$$

For the purpose of investigation, production and non-production workers feed in separately into the production technology as the measure of labour. Taking logs of the sales generating functions yields the estimable equation:

[2]To have a log-log relationship between sales and inputs it is assumed that each firm's demand curve has a constant elasticity conditional on the output (or prices of the other firm). [Fernandes and Pakes (2008)].

$$Sales_t = \beta_0 + \sum_{\substack{i=production\,labour,\\ non-production\,labour}} \beta_i L_{it} + \beta_k K_t + \omega_t + \eta_t$$

$where\ \beta_j$: *parameters of sales generating function*

ω_t : *unorthgonal error term*

η_t : *orthogonal error term*

Simple OLS estimation of the above equation not possible due to endogeneity bias induced by correlation between factor input choices and unobserved productivity (ω_t). Such a bias can occur if an unobserved shock like productivity simultaneously determines the level of production as well as employment of factor inputs.[3] This happens because over time firms responding to positive productivity shocks invest in capital and labour inputs and indirectly affect output. Since the level of productivity of a firm cannot be accurately measured or observed so it enters the error term in the regression equation as a component ω_t that is correlated with the input demands.

Consequently, a significant amount of literature has been devoted to dealing with endogeneity of input demands with the initial approaches focusing on Instrumental Variable methods and Fixed effect estimation. The IV solution requires finding a variable that is correlated with the input demands but orthogonal to the unobservables in the production function but finding such a valid instrument is a difficult task. Due to high persistence in the data series on inputs and sales, the instruments used in the literature are weak that negatively affects the results. On the other hand, fixed effect estimator successfully addresses the endogeneity issue only if the assumption of time invariant firm specific unobservables holds true. As a result, these two methods are believed to be ineffective in addressing the issues of endogeneity satisfactorily.

The literature has evolved to find more sophisticated techniques for dealing with this simultaneity bias and consequently two approaches have emerged. The underlying set of assumptions characterises the difference between these two approaches. One follows dynamic panel data techniques for the identification of production functions and has been discussed in papers like Blundell and Bond (2000) who propose an extended GMM estimator to apply to the dynamic representation of the production function equation.

The foundation for the second approach was laid down in the seminal paper by Olley and Pakes (1996) that involved semi-parametric estimation of the production technology's parameters. It employed investment as a proxy to control for the unobserved variation in productivity in estimating the production function.

Levinsohn and Petrin (2003) highlighted few concerns with the choice of investment proxy and instead proposed using the demand for intermediate inputs to control for this correlation. They pointed out that while investment may only respond to unexpected changes in productivity thus only accounting for a small part of correlation, the demand for variable inputs completely adjusts to fully reflect any shock to the productivity process, be it anticipated or unanticipated. Also, in firm level data a significant portion of sample may report zero new investment and dropping out such firms from the analysis to satisfy the 'invertibility condition' may introduce truncation

[3]This was first identified by Marschak and Andrews (1944).

bias. On the other hand, the utilisation of intermediate inputs is normally reported to be non-zero for all firms. Our empirical analysis drawing on this method of Levinsohn and Petrin (2003) uses firm's *electricity consumption* ($Elec_t$) *as* a proxy because unlike other intermediate goods like raw materials and fuel it cannot be stored. This allows us to specify the unobserved productivity ω_t as function of the two state variables: K_t and $Elec_t$. $\phi_t(K_t, Elec_t)$ is approximated by substituting a polynomial in K_t and $Elec_t$. Using this semi-parametric estimation in the first stage yields estimates of β_{pro}, β_{nonpro} and ϕ_t. The second stage then identifies β_{Elec} and β_k from the estimate of ϕ_t.

$$Sales_t = \sum_{\substack{i=production\,labour,\\ non-production\,labour}} \beta_i L_{it} + \phi_t(K_t, Elec_t) + \eta_t$$

Where

$$\phi_t(K_t, Elec_t) = \beta_0 + \beta_{Elec} Elec_t + \beta_k K_t + \omega_t(K_t, Elec_t)$$

Semi-parametric estimation yields the estimates for the parameters of the sales-generating functions, which are then substituted into the marginal revenue productivity function for each type of input (production labour, non-production labour and capital) and equated to their respective marginal costs (wages and rental rates) to calculate optimal labour and capital employment. Factor utilisation is obtained for the years 2002 and 2007 for each type of input as:

$$\frac{ActualFactorEmployment}{OptimalFactorEmployment} \times 100$$

Firm's factor utilisation =
(percent)

An utilisation rate of below (above) 100 percent means that the factor is under (over)-utilised. Post-estimation we calculate the productivity as the residual obtained from the sales-generating function estimation and using Seemingly Unrelated Regression Equation estimation a reduced form analysis is done on input utilisation, productivity, and some institutional characteristics of the firms.

4. DATA

The firm level data on total sales, utilisation of factor inputs and input prices required for our empirical investigation is obtained from the Enterprise Surveys website.[4] These surveys have been conducted by the World Bank in a large number of countries at regular intervals since 2002 to gather company level information on a country's business and investment environment, and to analyse the obstacles faced by the manufacturing and services sectors in an economy.

This paper employs the panel data on Pakistan available for the years 2002 and 2007. Applying stratified random sampling, 402 firms were selected from all four provinces and their characteristics were tracked over time. In order to estimate the production function, data on total annual sales reported by the firms for the last fiscal year deflated by the Producer Price Index is used. For the specification of the labour

[4]http://www.enterprisesurveys.org/

variable, the analysis distinguishes between production and non-production (managerial, administrative and sales positions) workers because our assumption is the utilisation of low-cost production workers will normally differ from relatively educated and high-cost non-production workers so they need to be identified by separate parameters in the production function. Due to lack of information on the replacement value, capital is measured as the net book value (the value of assets after depreciation) of the firm for the last fiscal year while the total annual cost for electricity is used as the intermediate input proxy variable. As opposed to other intermediate inputs like raw materials and fuel, by nature electricity cannot be stored unless a firm generates electricity itself, therefore the fluctuations in consumption of electricity ought to reflect exogenous changes in productivity and can accurately proxy for the unobserved unorthogonal component in the error term. Firm's productivity is then extracted as a residual from the estimation of production function. Ideally an industry specific production function ought to be estimated as these structural parameters will vary with the type of industry but due to the limitation imposed by the scarcity of data only one production function is specified for all industries.

To assess the utilisation of capital and labour by the firms the actual employment needs to be compared to the optimal employment, and for calculating this optimal level the increase in sales due to employing an additional unit of input needs to be equated to the cost of employing that extra unit. If at the actual level of employment the marginal increase to sales is greater than the marginal cost, then the firm is underutilising the input and can benefit from increasing its usage, whereas if the marginal increase to sales is less than the marginal cost then the firm is suffering from over-utilisation of the input and can gain from reducing the input. For the purpose of calculating marginal costs i.e. the cost of employing one additional unit of input, we need information on factor costs (wages and rental rates) faced by the firms. The labour costs are reported in the survey as the average compensation including benefits to production and non-production workers whereas rental rates are approximated using the total rental costs and the measure on capital.

The subsequent reduced form analysis on input utilisation and productivity makes use of the variables similar to Fernandes and Pakes (2008) i.e. unionisation of labour force, percentage loss in sales due to power outages, corruption reported in labour inspections and whether the firm acquired a loan or overdraft from a financial institution. A four equation simultaneous system is then estimated using seemingly unrelated regression and employing these firm characteristics as the 'explanatory variables' and the average utilisation measures of labour and capital and firm productivity as the dependent variables. However, the results can be only presented as correlations (and not cause and effect) but this will help us infer policies regarding utilisation of factor inputs and jobless growth.

5. RESULTS

Applying the modified Levinsohn and Petrin (2003) technique to the data yields the parameter estimates for the production function which are reported in Table 2.

Table 2

Production Function Parameters

Production Labour	0.2176***
	(0.073)
Non-production Labour	0.3894***
	(0.069)
Capital	0.2051***
	(0.074)
Electricity	0.5918***
	(0.149)

Note: Standard errors are reported in parentheses, and '***', '**' and '*' indicate significance at one, five and ten percent level respectively.

The utilisation rates of production and non-production labour, and capital are then obtained for 2002 and 2007 using the method described in the previous section (reported in Table 3). In both the years, our results broadly show under-utilisation of labour and over-utilisation of capital across all firms, thus lending credit to our hypothesis that labour under-utilisation in firms may be one of the explanatory factors for jobless growth in manufacturing.

Table 3

Input Utilisation Industry-wise Averages for 2002 and 2007 (in Percent)

	Production Labour		Non-Production Labour		Capital	
	(I)	(II)	(III)	(IV)	(V)	(VI)
Industry	2002	2007	2002	2007	2002	2007
Food	31	26	49	21	217	118
Garments	63	87	11	23	56	80
Textiles	20	56	29	25	39	42
Chemicals	37	64	12	22	166	88
Electronics	18	89	6	10	94	109
Leather and Leather Products	116	133	31	36	91	114
Other Manufacturing	153	137	57	32	128	196
Average Utilisation	**46**	**79**	**27**	**25**	**105**	**103**

Source: Author's estimates.

However, there exist significant differences within industries and within the two types of labour. During the period of high GDP growth (2002–2007), average utilisation rate of production labour seems to have improved from 46 percent to 79 percent but it is still 21 percent below the optimal level of employment. On the contrary, utilisation rates of non-production labour appear to be stagnant with a heavy under-utilisation of around 75 percent below the optimal in both the years. This may indicate the lack of skills for such jobs or the employees not meeting the requisite qualifications. Consequently, this skill mismatch may have led the firms to over-utilise capital by substituting capital for labour. An interesting thing to note is although capital is over-utilised, its magnitude is not sufficiently high to explain the heavy under-utilisation of labour through the substitution between capital and labour. Employment of capital is only 5 and 3 percent above the optimal level in 2002 and 2007 respectively.

Across industries, there are wide differences in the utilisation rates. In case of production workers, underutilisation is found in Pakistan's main export industries such as Textiles and Garments. In 2002 production labour employment was 80 percent below the optimal for Textiles. This improved in 2007 but labour remained under-utilised, the utilisation rate being 44 percent below optimal. In other industries like Leather, we find over-utilisation of such labour with production labour employment being 33 percent above the optimal in 2007.

Similarly, it is evident from Table 3 that non-production workers are being under-utilised across all industries in both years. Mixed results are obtained for the utilisation of non-production workers across the two years. For some industries, labour utilisation improved between 2002 and 2007 whereas for other industries (Food, Textiles and other Manufacturing) it worsened. Capital utilisation, on the other hand, has substantial variation by industry. In both years, it is over-utilised in some industries and under-utilised in others. This variation in utilisation of labour inputs and capital by industries suggests the need for industry specific policies to generate employment for the growing labour force.

The results from our subsequent analysis using Seemingly Unrelated Regression Equations to analyse the link between firm characteristics, input utilisation and productivity are shown in Table 4. The coefficients, however, do not have a causal interpretation but merely give us the correlation and the direction of the relationship.

Table 4

Utilisation of Production Labour, Non-production Labour, and Capital, and Productivity

Dependent Variable is \ 'Explanatory' Variables	Corruption During Labour Inspections	Degree of Unionisation of Firms	Loss in Sales Due to Power Outages	Loan Provided by a Financial Institution
a. Utilisation of Production Labour	7.56***	–0.309*	–0.117*	–
	(1.47)	(0.188)	(0.07)	
b. Utilisation of Non-production Labour	8.63***	–0.05***	–0.11***	–
	(1.43)	(0.006)	(0.034)	
c. Utilisation of Capital	37.0*	0.341	–0.569*	12.3***
	(20.8)	(0.275)	(0.323)	(2.47)
d. Productivity	0.337***	–0.009**	–0.015*	0.207*
	(0.064)	(0.004)	(0.08)	(0.118)

Note: Seeming unrelated regressions equations estimations used. Standard errors are reported in parentheses and '***', '**' and '*' indicate significance at one, five and ten percent level respectively.

Our results suggest a positive relation between the corruption inherent in a firm and its level of productivity. This is in-line with the finding of Fernandes and Pakes (2008) study on the Indian manufacturing industry, and reflects that more productive firms are more averse to corruption and hence are more likely to report it. The coefficients for the corruption variable in the utilisation equations for production and non-production workers both have a positive sign indicating that a higher incidence of money demanded by government officials during labour inspections results in an improved utilisation of both types of workers by a firm. This may be because firms are reluctant to pay bribe to government officials so they tend to comply with labour regulations and employ optimal amount of labour. In the capital utilisation equation the corruption variable again has a positive coefficient implying that firms who complain more about corruption by labour department officials tend to employ more capital. This may suggest that firms which are more efficient, thus having better utilisation of labour and capital, are more concerned with corruption of labour officials and hence are more likely to report it and also avoid paying money by employing optimal inputs.

The coefficient for the unionisation variable is negative in the productivity equation implying an inverse relationship between these variables. This coefficient is also negative in both the equations for utilisation of production and non-production labour. We infer from this that firms where labour has higher bargaining power and higher and more rigid wages due to the presence of unions, tend to employ less labour and substitute more capital for labour, leading to lower utilisation of labour and higher utilisation of capital. This can also be interpreted in light of the [Insider-Outsider model of Blanchard and Summers (1986)] where the insiders (existing workforce) enjoy favourable position in their firms and set high wages to deter hiring of outsiders, thus resulting in sub-optimal labour employment. Moreover, higher union activity leads to less productive firms due to costs involved in hiring and firing and giving firm-specific training. This in turn reduces the effort put in by the workers as they tend to "shirk" more due to the protection granted to them through union membership. Also, according to Haque, *et al.* (2011) rigid labour laws in Pakistan act as an impediment for firms by increasing the time and complicating the procedure required to deal with their employees. Therefore, the need arises to relax these regulations to allow the firms to become more competitive and utilise labour to their full capacity.

Loss in sales due to 'load shedding' is seen to have a negative relation with the rate of utilisation of production and non-production workers, and with capital as well. As expected, higher losses from power shortages are also observed to be negatively associated with productivity of the firms. This is intuitive as firms aren't able to fully utilise their capacity, resulting in lower productivity and less than optimal factor employment. Evidence on the effect of load shedding on the rate of capacity utilisation in the large scale manufacturing sector of Pakistan was also provided by Kalim (2001) who finds a high level of capacity underutilisation across different industries and estimates that a one percent change in electricity consumption would increase the capacity utilisation by 0.2 percent.

Lastly, the variable controlling for whether the firm has taken a loan from a financial institution, has a positive coefficient in the equations for capital and productivity. This positive relation between attaining a loan and higher productivity indicates that financial institutions are more willing to provide capital assistance to more productive firms to reduce the risk associated with default. Such financing remains important for firms as it allows them to expand by innovating and investing in state of the art technologies. The positive relation in the capital utilisation equations is not surprising as one would expect firms with greater investment through loans to more effectively utilise capital inputs.

6. POLICY CONCLUSIONS

The main results of this paper demonstrate that labour under-utilisation can be one of the driving forces behind the jobless growth and pre-mature deindustrialisation experienced by Pakistan during the period of our analysis 2002–2007. Such under-utilisation is primarily found in the non-production labour force which may indicate lack of skills required for such jobs. This confirms the evidence of under-investment in human capital with only a minimal allocation to the education sector in Pakistan's national and provincial budgets (only around 5 percent in the national budget of 2011-2012). However the issue is not limited to under investment in human capital as there is evidence of substantial skill-mismatch in the industrial sector too. The skills that are acquired by the labour force are not demanded by the industries so industries prefer to employ less labour and more capital leading to job-less economic growth. This explains the capital over-utilisation found in our analysis. In order to remedy this situation, firstly greater investments in human capital is required and secondly, demand-driven vocational training needs to be provided so that labour supply matches labour demand. The quality of education also needs to be improved so that workers have the requisite qualifications demanded by the industries. Furthermore, regulations governing the labour force sector need to be relaxed to allow the firms to allow then to hire workers at their optimal level.

In the current context of severe power outages, this problem has worsened with workers being laid off and industrial plants operating below their full capacity. As seen in our reduced form analysis, losses in sales due to power outages worsens the utilisation of both capital and labour and reduce firm productivity. Pakistan's export sector has greatly suffered as a result, causing a slowdown in export-driven economic and employment growth. A recent report by the World Bank (2011) on South Asia finds that due to the industrial load shedding there has been a massive loss of about 400, 000 jobs in Pakistan. The solution lies in encouraging investment in power sector and promoting the emergence of Independent Power Projects (IPPs), and reducing the circular debt that plagues the power sector. Once this power shortage has been dealt with, firms will be able to operate at full capacity, reducing under-utilisation of labour hence boosting employment growth.

7. CONCLUSION

This paper aimed to investigate the utilisation of factors in Pakistan's manufacturing sector and explore labour under-utilisation as one of the major causes of the job-less growth experienced by Pakistan in the past decade, with a distinction being made between production and non-production workers. Using the Levhinson and Petrin (2003) method to estimate the production function, firm level estimates were obtained for labour and capital-utilisation in 2002 and 2007, as well as for productivity. Furthermore, industry wise averages were obtained in order to gain further insight into the issue of lagging employment growth. Our results give evidence of labour under-utilisation and capital over-utilisation in the manufacturing sector, with the results varying across industries. Interestingly, Pakistan's main industries such as textiles and garments, and important industrial cities, suffer the most from under-utilisation of labour. Our reduced form estimates suggest that power outages and capital substitution may be the main causes of this phenomenon.

Our analysis evokes the need to invest in human capital in order to reduce the growing skill gap that may result in skill-mismatch and hence under employment of labour. Moreover, the need to resolve the issue of power shortage is also emphasised as greater the loss suffered from power outages, less is the labour employed by the firms. However, another major cause of under-employment in the manufacturing sector that is not investigated is the growth of the informal sector in its impact on formal manufacturing employment. Due to the lack of data on the growing unregistered manufacturing sector our study could not carry out this investigation and it is left to future research. Other avenues of further research include conducting an industry specific analysis by calculating industry specific production functions and looking at the relation between structural change, inter-sectoral linkages and labour utilisation in a Kaldorian framework. In addition to this, more recent data should be collected and analysed to observe how the recent economic slowdown has affected labour and capital-utilisation. Such research will help to complete the examination of what has caused the observed job-less growth in Pakistan and hence further suggest policies to deal with this phenomenon.

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Mismatch between Education and Occupation: A Case Study of Pakistani Graduates

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1. INTRODUCTION

The developed economies especially the US and UK started to invest heavily to expand the supply of graduates before 1980s and Freeman (1976) was the first who raised his concerns over this expansion in his research entitled 'Overeducated Americans'. Since the late 1980s, the research on job mismatch has mushroomed in the US as well as in other developed countries.

The initial studies perceived the education-job mismatch as a temporary phenomenon [Freeman (1976)]; however, later the empirics did not support it. The empirical text in various developed regions has mainly focused the 'over-education'[1] which range from 10 percent to 40 percent in various developed countries [Groot and Maassen (2000a)]. These estimates raised serious questions over the validity of conventional views of the labour market; consequently a good debate has started with the emergence of some new theories i.e., the job competition theory and the job assignment theory in which the institutional rigidities, allocation problems and skill heterogeneities were dealt.

Both economists and sociologists have consigned the job mismatch phenomenon as a serious efficiency concern with its pertinent socio-economic costs at individual, firm and national level. At individual level, it would let down the individual's marginal product, though the estimated wage differential differs across the countries.[2] The lower returns to education may also incur some non-transitory costs i.e. lower level of job satisfaction, frustration and higher turnover rate. At the firm level, job mismatch is associated with lower productivity and lower level of job involvement; and in case of

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[1]Over-education explains the extent to which a worker possesses a level of education in excess of that which is required for a particular job.

[2]For UK, 12 percent by Dolton and Vignoles (2000), 18 percent by Dolton and Silles (2003), 23.2 percent by Chevalier and Lindley (2006). For US, 13 percent by Verdugo and Verdugo (1989), 11 percent by Cohn and Khan (1995). For Holland, 26 percent by Groot (1993), 8 percent in Kiker, *et al.* (1997) for Portugal and 27 percent in Budría and Edigo (2007) for Spain.

high turnover rates, firms may have to prevail with extra costs on screening, recruiting and training [Tsang (1987); Sloane, *et al.* (1999)]. At the macro level, the national welfare in terms of monetary welfare and non-monetary would be lowered by under-utilisation of skills [McGuinnes (2006)]. It is also possible that previously well-matched graduates in the economy will be 'bumped down' in the labour market as over-educated workers move into lower occupations thus raising the educational requirements within these occupations [Battu, *et al.* (2000)]. Thus, the rapid educational expansionary policies may not yield the desired real economic benefits [Budria and Egido (2007)].

The subsequent section shows that no study on job mismatch exists in Pakistan; however, Pakistan is also facing this dilemma. Keeping in view the importance for researchers and policy-makers in Pakistan, the present study aims to contribute in knowledge by analysing the incidences of the various types of job mismatches among Pakistani graduates. The rest of the study is organised as follows. Section 2 presents a review of potential presence of job mismatch in Pakistan, followed by measurement issues, theoretical and empirical literature in Section 3. A discussion on data sources and methodology is given in Section 4. The results over the incidences of job mismatch are presented in Sections 5, followed by conclusion and policy considerations in final section.

2. POTENTIAL OF JOB MISMATCH IN PAKISTAN

In Pakistan, no direct study on job mismatch has been prepared; however, there exist awareness about this issue.[3] A variety of barriers including the poor level of information about job opportunities, institutional barriers, geographical barriers, race or gender etc., are causing the job mismatch. Various socio-demographic characteristics and customs are also regarded as a constraint to female's labour market participation [Nazli (2004)]. The gender gap is still high with skewed distribution in terms of economic sector and status [Pakistan (2007b)].

Despite the recent socio-economic developments, the educational system in Pakistan is not coping with the right demand of labour market by mainly imparting education in conventional subjects. Educational policies have been suffered from frequent political undulations and the educational system with outdated curricula is draining the human capital accumulation when Pakistan is hardly investing only 2 percent of its GDP on education [Pasha (1995); Nasir (1999)]. At school and college level, the educational system follows variety of tiers [Haq, *et al.* (2007)]. During 2001-2008 periods, the rapid expansion at the higher education has raised the participation especially among female graduates,[4] while heterogeneity of skills across the regions and institutes also rose. The return to education has a declining trend in Pakistan, implies that the country has failed to produce high demand for education [Qayyum, *et al.* (2007)].

Despite rising labour force, the unemployment rates also remained high in the range of 6–10 percent during 2001-10 periods, suggesting that employment generation has not kept pace with the labour force. Meanwhile, quality of jobs and the access to modest earning opportunities still remained an issue. As shown in Table 1, the educated unemployment (matric and above) has increased during FY00 and FY06. It could

[3]Statistics from various rounds of Labour Force Survey, Pakistan (2007a, 2007b, 2008a, 2008b).

[4]In 1947, there were only two universities which jumped up to 54 in 1999 and 132 at present.

Table 1

Educational Attainment of the Unemployed (Age 15+) (%)

Education Level	FY00	FY02	FY04	FY06	Change b/w FY00 and FY06 (Percentage Point)
Illiterate and Pre-primary	47.7	45.7	42.3	44.7	–3.0
Primary and Middle	28.6	27.4	25.8	26.1	–2.5
Matric and Intermediate Education					
Overall	19.3	21.2	24.8	22.4	+3.1
Male	23.2	23.7	28.8	26.1	+2.9
Female	12.2	15.7	15.7	14.3	+2.1
Degree Level Education					
Overall	4.3	5.8	7.2	6.8	+2.5
Male	5	6.4	7.1	6.9	+1.9
Female	2.9	4.4	7.3	6.6	+3.7

Source: Pakistan (2007a).

indicate the poor choice of educational fields [Pakistan (2007b)]. With rising employment participation, the labour market imperfections and imbalances have also rose; with rising job search periods, rising share of informal sector, lower productivity and high risk of vulnerability especially for youth and female [Pakistan (2007a, 2007b, 2008b)].[5] The market is skewed toward influential peoples where job opportunities are predominately reference-oriented rather than skill oriented.

Keeping in view this importance, the on-going study would provide the information on job mismatch and would lay foundation for further detailed studies. It would also help the educational and labour policy-makers to make better decisions especially for the youth which is the greatest asset of Pakistan.

3. DEFINITION, THEORETICAL FOUNDATIONS AND EMPIRICAL REVIEW ON JOB MISMATCH

3.1. Definition and Measurement Issues of Job Mismatch

The phenomenon of job mismatch can be viewed in three dimensions; education-job mismatch, qualification-job mismatch and field of study and job mismatch. Education-job mismatch compares the acquired education by a worker with that required by his/her current job. The empirical work so far has relied on three main methods to measure the required education for education-job mismatch. The first method pertains to 'Job analysts (JA) Method' (*objective approach*), in which the professional job analysts grade the jobs and recommend the minimum educational requirements for a certain job/occupation [Haratog (2000); Battu, *et al.* (2000)]. The second method refers to 'Self-assessment method' (*subjective approach*), where workers are asked directly to give information on the minimum educational requirements for their current job [Sicherman

[5]60.6 percent were considered vulnerable, meaning "at risk of lacking decent work" in 2006-2007 [Pakistan (2007a)].

(1991); Alba (1993)]. The third 'Realised match (RM)' method was found by Verdugo and Verdugo (1989) that measure the degree of education-job mismatch by two variables; years of schooling and occupational group of a job holder. The distribution of education is calculated for each occupation; employees who depart from the mean by more than some *ad-hoc* value (generally one) standard deviation are classified as mismatched workers [Verdugo and Verdugo (1989); Kiker, *et al.* (1997) and NG (2001)].

Qualification is a broad signal of human capital competences because it assimilates the other constituents of human capital (skills, experience) and also the formal education. Educated workers can compensate their skill deficiencies by additional training and learning during their jobs; therefore, the formal education is the part of overall qualification [Ishikawa and Ryan (2002); Neumark and Wascher (2003)]. The attained qualification possessed by the workers, may be lower or higher than the required qualification in their perspective jobs. When this happens, the worker is said to be mismatched in qualification. The two measurement approaches of qualification mismatch have been emerged from the literature; the first, the overall qualification approach (*subjective approach*) is based on worker's perception [Green and McIntosh (2002); Lourdes, *et al.* (2005)], while the second, the specific approach is based by measuring the various specific attained skills possessed by the workers and the required skills in their current job as Lourdes, *et al*. (2005), Jim and Egbert (2005) and Chevalier and Lindley (2006) did.

The field of study and job mismatch analyses the level of match between the individual's field of study and his/her contents of job. The existing three studies have adopted both subjective and education-occupation combination to measure the field of study and job mismatch [Jim and Robert (2004); Robst (2007) and Martin, *et al.* (2008)].

The validity and choice of various measures of education-job mismatch depend on data availability with limitations as well [Leuven and Oosterbeek (2011)]. The JA approach ignores the ability and possible deviation of job levels within a given occupation within same occupational titles [Halaby (1994); Dolton and Siles (2003)]. Second, the required level might change due to new technologies or reforms of workplace organisations [McGuiness (2006)]. Third, the categories of training requirements must be translated into equivalent years of schooling with some consensus [Rumberger (1987)].

The 'subjective' measure might overestimate and/or underestimate the job mismatch in the presence of qualification inflation. Workers in less structured organisations may not always have a good insight about the required level [Cohn and Khan (1995); McGuiness (2006)]. Respondents may also apply different criteria for job requirements, i.e., the actual level of education required to do specific tasks or the formal educational requirements necessary to get the job. However, Green, *et al.* (2002) found that in majority cases, the assessment of education levels needed to do the job tended to match those needed to get the job, suggesting consistency between two subjective approaches.

The third method, the realised method is very sensitive to labour market changes and for cohort analysis. In case of excess supply, it will underestimate the level of over-education and will overestimate in case of excess demand [Kiker, *et al.* (1997); Mendes *et al*. (2000)]. Therefore, the method based on realised matches is the least adequate one for determining over-education and under-education [Chevalier (2003); McGuiness (2006)].

Both the JA and RM measure imply that all the jobs within the same occupational titles require identical skills. These assumptions are obviously naive in those occupations where workers are hired for flexible tasks [Groot (1996)]. Chevalier (2003) argued that widening access to higher education has increased the heterogeneity of skills; whereas, Green, *et al*. (2002) highlighted the potential heterogeneity effects that may arise because of grade drift in UK.[6]

Some studies have measured the level of consistency between different measures of education-job mismatch. Battu, *et al*. (2000) analysed the consistency between WSA and JA measures on panel datasets (1985 and 1990) and found high correlation for females between the two. Jim and Velden (2001), Green and McIntosh (2002) and Lourdes, *et al.* (2005) found the poor correlation between the education-job mismatch and qualification-job mismatch. It is worth noting that the choice of definition has a large effect on the incidence of education-job mismatch. As reported few studies in appendix table 1, majority of the studies have used the job analyst and self-assessment approach and found mixed findings. In some studies, the incidences of education-job mismatch are in close [Battu, *et al.* (2000); Dieter and Omey (2006, 2009)]; whereas, a lot of inconsistency exists in some studies [Hersch (1995); Chevalier (2003)].

3.2. Theoretical Foundations of Job Mismatch

A significant segment of literature on job mismatch considers how this phenomenon be positioned within the context of existing views of labour market; however, there is no unified accepted theory on education-job mismatch.

According to Human Capital Theory (HCT), wages and productivity are fixed in relation to prospective jobs; therefore, over-educated workers have same productivity and thus receive the same wages as compared to those who are on matched jobs [Schultz (1962); Becker (1964)]. The education-job mismatch phenomenon may not necessarily reject the HCT in case of short run existence; however, if it appears to be a long run phenomenon, then no one can save the HCT [McGuiness (2006)]. The opponents of HCT argue that it fails to explain the underutilisation of skills, institutional rigidities and non-competitive labour market [Carnoy (1994)]. Tsang (1987) suggested that the relationship between education and productivity is more multifaceted than the direct and positive relationship as suggested by HCT. World Bank (1999) in “Knowledge for Development” pointed that the private rate of return to higher education was similar to that for secondary schooling. Psacharopoulos and Patrinos (2002) reviewed 98 countries for the period 1960 to 1997 and concluded that higher education gives less return than that on secondary schooling. In Pakistan, Faheem (2008) shows that rate of return for MPhil and a PhD degree is less than that for a master and a professional bachelor degree.

In contrast to HCT, the Job Competition Theory (JCT) highlights the institutional rigidities where marginal products and consequently earnings are associated with job characteristics, and not by individual characteristics [Thurow (1975)]. The allocation on job is based on available supplies of both workers and jobs, workers may possess more education and skills than their jobs necessitate. In the extreme, education simply serves to

[6]Grade drift is drop in quality of education. It will be evident if employers are found to be increasing educational requirements for younger workers. The concept of grade drift is related to heterogeneity as individuals with similar education potentially have significantly different ability levels [McGuiness (2006)].

obtain the job, and there is a zero return to human capital beyond that required to do the job, as all workers in a given job are paid the same wage. Therefore, Mincer model (1974) and the Thurow's model (1975) are two extreme cases, being the first purely supply side driven and the second purely demand side driven.

A third strand of the literature is based on the Assignment Theory [Sattinger (1993)] which asserts that there is an allocation problem in assigning heterogeneous workers to jobs which differ in their complexity. Where the frequency distributions on the demand and supply side are unlikely to match and education mismatches may be a persistent problem if the job structure is relatively unresponsive to changes in relative supplies of educated labour. The majority of studies on education-job mismatch have supported the job assignment theory by rejecting both the HCT and the JCT.[7]

According to the Theory of Occupational Mobility, individuals may choose a lower entry level than those in other feasible entry levels with the higher probability of promotion [Sicherman and Galor (1990)]. According to Job Screening Model, education is used as a signal to identify more able and productive workers when labour market is not perfect [Spence (1973)]. Workers, therefore, invest more on education in order to provide good signals with the hope that it will permit them to be distinguished from other job applicants. The Matching Theory assumes that labour market is not opaque [Rosen (1972); Jovanovic (1979)]. The search cost exists to find a perfect match. Therefore, both employees and employer might have a mutual incentive to agree on a non-optimal match. However, overtime, workers are expected to obtain an improved job.

Some other explanations have also been put forward which appear to be largely unrelated to any major theoretical framework. Theory of differential over-qualification explains the higher probability of being over-education among married women in lesser labour market [Frank (1978)]. McGoldrick and Robst (1996) and Buchel and Ham (2003) suggest that ethnic minorities are likely to be more severely affected. Robest (1995) notes, "those who attend the lowest quality schools may be over-educated throughout their career. Those who attend a better school may be able to work their way upward during their career." Battu, *et al.* (1999) and Dolton and Silles (2001) found a positive influence of regional mobility on the quality of the match while Piracha and Vadean (2012) found higher over-education among the immigrants. Green and McIntosh (2002) argued that if the quality of education falls, this too may encourage employers to upgrade the educational requirements of job, referred as grade drift.

3.3. The Empirical Literature on Job Mismatch

As noted earlier, the wave of supply of fresh graduates in the U.S. triggered first research on education-job mismatch in 1970s. According to Freeman (1976), the excessive number of graduates would trim the return on education, resulting lower investment on higher education. However, his prediction has never materialised in US and in other developed countries. Similarly, in U.K., the over-education ranges from 29 percent to 47 percent with stable rate of return from 1978 to 1996 [Green, *et al.* (2002)]. Through cohort analysis of UK graduates, Dolton and Vignoles (2000) found that 62 percent of the male graduates, who were over-educated in their first job, remained in a

[7]Alba (1993); Groot (1996); Kiker, *et al.* (1997); Sloane, *et al.* (1999); Dolton and Silles (2001); Kler (2005); Chevalier and Lindley (2006); Martin, *et al.* (2008), etc.

sub-graduate position six years after graduation. Despite the increased mobility of over-educated workers, Sloane, *et al*. (1999) found that 40 percent of the graduates were over-educated six years after graduating using survey carried out by the University of Birmingham. Further, the author concludes that the quality of the match not improves with the change of employer.

A number of studies in the developed countries have documented the extent of education-job mismatch. Describing the results very broadly, about a quarter to a third of a nation's employees tend to work in jobs for which they are over-educated, with a somewhat smaller proportion working in jobs for which the required education level exceeds their actual education [Battu, *et al.* (1999); Dolton and Vignoles (2000); and Green, *et al.* (2002)]. Groot and Maassen (2000a) and McGuiness (2006) have catalogued these studies on the basis of methodology used. For job analyst measure, the incidences of over-education range between 11 percent and 40 percent, and under-education between 20 percent and 44 percent. Appendix Table 2 also summarises a number of empirical studies conducted in different developed countries

The literature specifically on qualification mismatch is scarce as existing studies mainly has used the formal education as a substitute of qualification as Hersch (1995), Groot (1996), Battu, *et al.* (1999), Ng (2001), and Frenette (2004) did. A few studies, however, has measured the qualification mismatch conducted by Lourdes, *et al.* (2005) in Spain, Jim, and Egbert (2005) in five developed countries (Spain, Germany, UK, the Netherlands and Japan) and Brynin, *et al.* (2006) in four European countries (Britain, Italy, Germany and Norway).

Few studies have so far been conducted on the field of study and job mismatch. The pioneer research by Robst (2007) in US has estimated the field of study and job mismatch by subjective approach and found that 28 percent of men and 21 percent of women have somewhat related and 19 percent of men and 21 percent of women have complete mismatch between field of study and occupation. In Sweden, Martin, *et al.* (2008) used the various datasets (Swedish Register of Education, Enlistment data from Pliktverket, National Tax Board) and found that 23 percent of men and 19 percent of women are matched, while 16 percent of men and 10 percent of women are weakly matched. Using the data of five countries (Spain, Germany, UK, the Netherlands and Japan), Jim and Egbert (2005) have found that 6 percent of the employees in Spain, 10.4 percent in Germany, 11.1 percent in Netherlands, 18.6 percent in UK and 24.2 percent in Japan were on jobs with matched education but mismatched in field of study.

4. METHODOLOGICAL FRAMEWORK AND DATA DESCRIPTION

4.1. Data Description

The present study has used both the secondary and primary datasets by targeting the employed graduates working in the formal sector who hold fourteen and above year education, named as 'employed graduates'. The rational to choose the graduates and above employees is that the job mismatch phenomenon persists usually at the higher education level. Regarding the secondary dataset, this study has used the two Labour Force Survey (LFS) carried out in 2006-07 and 2008-09. The LFS, 2006-07 comprises of 2,839 employed graduates, while the LFS 2008-09 comprises of 3,896 employed graduates. Across the gender, about 84-85 percent are males while the rests are females in both LFS datasets.

Keeping in view the data limitations in secondary dataset, the primary survey, the Survey of Employed Graduates (SEG) has been conducted in early 2010 in two major cities of Pakistan, Islamabad and Rawalpindi to study the job mismatch phenomenon in depth. It would be more enviable if such study has been conducted at national level; however, time constraints and financial constraints were the most difficult impediment.

At broad level, the targeted universe in the SEG dataset has been divided into the three major groups; graduates in federal government, graduates in autonomous/semi-autonomous bodies under federal government and graduates in the private sector. Table 2 shows the estimated targeted population in the SEG dataset which is 100,386 employed graduates. The Thirteenth Census Report of Federal Government Civil Servants (2003-04) and Annual Statistical Bulletin of Federal Government and Semi-government (2007-08) were used to estimate the graduate employees in the federal government and semi-government. For private sector, the relevant information were gathered from the few private departments i.e. banks, hotels, telecom companies, international donor offices, media (newspaper and broadcasting) from their documented record. For the remaining private sector like hospitals, educational institutions, NGOs, manufacturing and Industry etc, the internet and the other sources were used to know the total numbers of units located in Islamabad/Rawalpindi and then through rapid sample survey, the information were obtained to estimate the employed graduates.

Table 2

Estimated Graduate Employees in SEG Dataset

Sector	Total	Male	Female
Government Sector	25,828	22,389	3,439
Semi-government Sector	38,424	35,535	2,889
Private Sector	36,134	28,317	7,817
Total	100,386	86,241	14,145

To avoid the sampling bias and errors, the proportional stratified random sampling technique was adopted where the published BPS grades for the government and semi-government sectors have been considered as ‘strata’ while the 3-digit occupational codes were used as ‘strata’ for the private sector. Figure 1 shows the distribution of complete sample of 514 graduates across the three major groups according to their relative employment share. All the questionnaires have been conducted by face-to-face interviews.

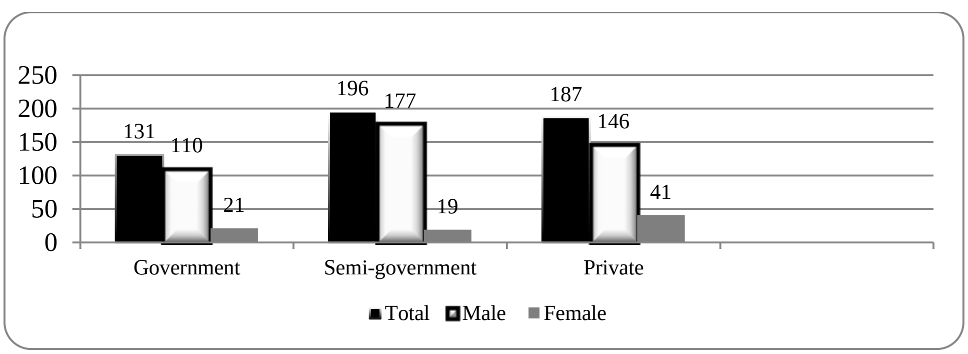

Fig. 1. Sector-wise Sample Distribution

4.2. The Methodological Framework for the Estimation of Job Mismatch

4.2.1. *The Measurement of Education-Job Mismatch*

As discussed in Section 3, the empirical work has relied on three main methods to measure the degree of education-job mismatch which are job analyst (JA) method, worker self-assessment (WSA) method and realised match (RM) method. As the present study has used both the secondary and primary datasets; the secondary dataset (LFS 2006-07, 2008-09) fulfil the requirement of only RM measure. However, the education-job mismatch in this study has been estimated by all the three measures (JA, WSA, and RM) on the basis of SEG dataset.

If E is the actual number of year of education and E^r is number of years of education required for a job, thus over-education (E^o) is represented by;

$$E^o = 1 \quad \text{if} \quad E > E^r \quad \text{and} \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \qquad (1)$$

$$E^o = 0 \qquad \text{otherwise}$$

Similarly, under-education (E^u) is determined as;

$$E^u = 1 \quad \text{if} \quad E^r > \mathrm{E} \quad \text{and} \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \qquad (2)$$

$$E^u = 0 \qquad \text{otherwise}$$

If E^{rj} is the estimated required education level by JA measure and the E^{rs} is estimated required level by WSA measure, then qualification inflation (QI) can be measured as;

$$QI = E^{rj} - E^{rs} \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \qquad (3)$$

A positive value of QI indicates the qualification inflation which means that due to excess supply, the employer has raised the required education level [Green, *et al.* (2002)].

To capture the issues of skill heterogeneity among over-educated graduates, we relax the assumption that graduates with same education level are perfect substitutes and hypothesise that graduates with same education may not be same in their skill endowment. This assumption would also capture the widening access of education at higher level in Pakistan which has increased the heterogeneity of the skills among the fresh graduates. Following Chevalier (2003), a measure of education-job mismatch and occupation-satisfaction has been adopted to capture the idiosyncratic characteristics by segregating the over-educated graduates into two categories; those over-educated graduates who are satisfied over their mismatch are defined as *apparently* over-educated (E^{oa}), whereas those who are dissatisfied are *genuinely* over-educated (E^{og}).[8]

4.2.2. *The Measurement of Qualification Mismatch*

The qualification mismatch can be assessed by comparing the attained qualification/competences and required qualification/competences by each worker and workers are typically classified into over-qualified, under-qualified, and

[8]Job satisfaction has been measure at five point likert scale range from very dissatisfied to very satisfied. For *apparent* over-educated workers, range 1 (very dissatisfied) and range 2 (dissatisfied) was used while for *genuine* over-educated workers range 3 to 5 has been used.

adequately qualified. Unlike to existing subjective methodologies as adopted by Green and McIntosh (2002) and Lourdes, *et al.* (2005) this study has followed the specific approach where initially, the level of nine specific attained and required skills has been estimated in SEG survey on five-point scale, ranging from 1 'not at all' to 5 'a lot'. Through Principal Component Analysis (PCA) method, the weights has been estimated on attained skills and required skills on the basis of mean required level of nine skills by assuming that the workers in same occupations at two-digit occupational coding require the similar types of skills in their jobs. The qualification mismatch has been estimated by comparing the attained skill index and required skill index with (+/–) 0.08 standard deviation (SD) of the mean (0.075 SD for SEG weights).[9]

4.2.3. *The Measurement of Field of Study and Job Mismatch*

One of the most significant type of mismatch in Pakistan, the field of study and job mismatch analyses the level of match between the individual's field of studied discipline and his/her contents of job. Since, no nationally representative dataset of Pakistan provides the information about the field of study and job mismatch; therefore, the field of study and job mismatch has been estimated in SEG dataset by subjective approach with the question: *'how much your current job is relevant to your areas of education?'* The four possible options were; irrelevant field of study, slightly relevant, moderately relevant and completely relevant field of study.

5. THE INCIDENCES OF JOB MISMATCH

5.1. The Incidence of Education-Job Mismatch

Table 3 presents data on the incidence of education-job mismatch by applying the three methods (JA, WSA and RM) on the SEG dataset and the sampled graduates have been classified into three categories; over-educated, under-educated and matched graduates. The LFS datasets by RM measure shows that 30-31 percent of the graduates are mismatched at the national level with the rising incidences of over-education and the falling incidences of under-education between 2006-07 and 2008-09. In both rounds, the female graduates are facing more education-job mismatch than males with more over-education among females and more under-education among males (Table 3).

Regarding the SEG dataset, the estimates show that the incidence of education-job mismatch varies by the three measures (Table 3). First take the case of over-education; it is 15 percent under RM measure, 25 percent under WSA measure and 26 percent under JA measure. Both the WSA and JA show the level of over-education in close as compared to RM measure. The incidence of under-education ranges from 4.5 percent under JA criteria, 10 percent under WSA and to 22 percent under RM approach. Again, the JA and WSA yield lower results than the RM approach.

[9]Standard deviation has been calculated after comparing the both attained and required skill index.

Table 3

The Level of Education-Job Mismatch by Various Approaches (%)

Datasets	Measures	Matched	Under-education	Over-education	N
RM Method on LFS 2006-07	Female	65.7	4.4	30.0	457
	Male	69.4	9.7	20.9	2,382
	Total	68.8	8.9	22.3	2,839
RM Method on LFS 2008-09	Female	60.5	4.2	35.4	577
	Male	71.2	2.3	26.6	3,319
	Total	69.6	2.5	27.9	3,896
SEG, 2010	WSA Method	65.4	9.9	24.7	514
	JA Method	69.5	4.5	26.1	514
	RM Method	63.4	21.6	15.0	514

The close estimates of over-education by WSA and JA approach suggest that graduates have not overstated or understated the educational requirements. It is the pioneer study in a developing country; therefore, it may not be desirable to compare the incidences of education-job mismatch to studies conducted in the developed countries. However, estimates of this study are consistent with the earlier findings that RM method reports the lower incidence of over-education as compared to the WSA and JA methods [Meta-analysis of Groot and Maassen (2000a) and reviewed study by McGuinnes (2006)].

Though it is not rational to compare the LFS dataset with the SEG dataset; however, the higher incidence of under-education in SEG while the lower incidence in LFS through RM measure reflects the excess supply of graduates in the SEG dataset which has overestimated the level of under-education and underestimated the level of over-education in SEG dataset. Similarly, the higher incidence of under-education and lower incidence of over-education also indicate variation in educational distribution within the occupations which, in case of structural changes usually overestimate the required level of education as suggested by earlier studies [McGuiness (2006)].

While dividing the over-educated workers into '*apparent over-educated'* and '*genuine over-educated'*, Table 4 shows that under WSA and JA approaches, about 57 to 63 percent of the over-educated respondents in non-graduate jobs are not too dissatisfied with their mismatch, therefore, they are defined as *apparently* over-educated graduates and the rest (37 percent to 43 percent) who are dissatisfied, are defined as *genuinely* over-educated graduates. These results are consistent to the earlier studies which has captured the issue of heterogeneity [Chevalier (2003); Chevalier and Lindley (2006)].

Table 4

The Level of Genuine and Apparent Over-education (%)

Education-Job Mismatch	WSA Approach	JA Approach	RM Approach
Matched	65.4	69.5	63.4
Under-educated	9.9	4.5	21.6
Genuine Over-educated	10.7	9.7	4.7
Apparent Over-educated	14.0	16.3	10.3

In a flexible labour market, the majority of workers should have suitable education for their jobs where the job mismatch just explains the searching and matching situation [Borghans and Grip (2000)]. However, in Pakistan, the labour market is not flexible; the structural mismatch may exist also. Assuming that the JA and WSA truly measure the education-job mismatch, the respondents who are mismatched on the basis of JA, WSA, or RM are called frictional mismatched graduates, while who are mismatched on the basis of JA and WSA only are called structural mismatched graduates [Dieter and Omey (2006)]. Table 5 shows that over-education is mainly a structural phenomenon as it is about 16 percent, while frictional over-education ranges from 9 percent to 10 percent. However; under-education is a frictional phenomenon as it is more than structural under-education with a range from 4 percent to 8 percent. The structural over-education reflects that the education-job mismatch may not be a temporary phenomenon in Pakistan.

Table 5

The Level of Frictional and Structural Mismatch (% of total)

	Frictional Mismatch		Structural Mismatch	
Type of Mismatch	JA and RM	WSA and RM	JA and RM	WSA and RM
Under-educated	4.3	7.8	0.2	2.1
Over-educated	10.3	8.8	15.8	16.0

Contrary to existing empirical text [Pollet, *et al.* (1999); Dieter and Omey (2006)], the results of SEG dataset show higher level of qualification deflation (13 percent) than the qualification inflation (8 percent) in Pakistan where employees are reporting a higher educational requirement than the employer's requirement level. This points to the occurrence of up-gradation of educational requirements in the private sector in lower occupations as well as the need of revising the contents of jobs especially the professional jobs in the government sector.

To check out the significance of differences between JA, WSA and RM estimates on the required level of education, the parametric t-test shows that two theoretic build methods, the JA and WSA are consistent over the required level of education for a particular job; however, the third statistical method (RM) significantly differ over the measurement of required level of education as compared to the both WSA and JA measures. Regarding the estimation of education-job mismatch, there exist poor correlation between RM and JA (0.25), again a poor correlation between RM and WSA (0.26), while the high correlation between the JA and WSA (0.64) measure.

5.2. The Incidence of Qualification Mismatch

The representative datasets of the Pakistan labour market are unable to provide the relevant information regarding the attained and required skills of job holders; therefore, this study has measured the qualification mismatch from the SEG 2010 dataset. As discussed earlier, the nine skills possessed by the graduates and required in their current job have been measured at 5 point-likert scale and weights have been assigned to each attained and required skills on the basis of demanded skills. Taking the difference of attained and required skill index, the qualification mismatch has been measured after calculating the zero mean and 0.08 standard deviation and the results have been reported in Table 6 which shows that more than one-fourth of the graduates are mismatched in qualification either in terms of over-qualification or in terms of under-qualification. The phenomenon of 'matched graduates' is considerably higher among males (73 percent—74 percent) than among females (67 percent). A lesser proportion of female graduates are under-qualified (11 percent) as compared to the male graduates (13 percent—14 percent); however, there are more over-qualified female graduates (22 percent) as compared to the male graduates (12.7 percent—13.4 percent). It reflects the scenario of relatively more under-utilisation of females' skills in their jobs probably because of the concentration of female graduates in the lower occupations.

Table 6

The Distribution of Respondents by the Level of Qualification Mismatch (%)

	Matched Graduates	Under-qualified	Over-qualified
Weights Estimated by PCA			
Female	66.7	11.1	22.2
Male	72.8	13.9	13.4
Total	71.8	13.4	14.8

A recent debate exists whether the formal education should be used as a proxy of qualification or not. Green and McIntosh (2002) found a moderate correlation between over-education and over-qualification; whereas no relationship could be found between under-education and under-qualification. The majority of studies found poor correlation between the two by arguing that education and qualification mismatch are different aspects with respect to incidence and their consequences on the labour market [Jim and Egbert (2005); Lourdes, *et al.* (2005)]. Table 7 reports the marginal and joint distribution with poor level of association between education-job mismatch and qualification mismatch. Under the JA criteria by education-job mismatch, 59 percent of the graduate workers are consistent to qualification criteria also; whereas, under WSA criteria, 57 percent of the graduates are rightly classified to both education and qualification mismatch.

Table 7

Marginal and Joint Distribution of Education and Qualification Match (%)

	Matched	Under-qualified	Over-qualified	Education Match
Job Analyst Method (JA)				
Matched	52.0	10.3	7.2	69.5
Under-educated	3.5	0.4	0.6	4.5
Over-educated	16.3	2.7	7.0	26.1
Qualification Match	71.8	13.4	14.8	100
Worker Self Assessment Method (WSA)				
Matched	48.8	9.0	7.6	65.4
Under-educated	6.8	2.1	1.0	9.9
Over-educated	16.2	2.3	6.2	24.7
Qualification Match	71.8	13.4	14.8	100

To go one step further, the statistical association between education-job mismatch and qualification mismatch has been checked by non-parametric tests. Both the Spearman and Kendall tau rank correlation coefficients in Table 8 show the lower level of correlation between the two measures of education-job mismatch and qualification mismatch. Regarding the Kruskal Wallis Rank test, the estimated Chi-square tie values also show the poor association between the qualification mismatch and education-job mismatch, as the calculated values of Chi-square are less than the tabulated values (124.3 at 5 percent), thus supporting the null hypothesis that a significant difference exists between the education-job mismatch and qualification mismatch.

Table 8

The Level of Association between Education and Qualification Mismatch

	Qualification Mismatch			
	Spearman Correlation	Kendall tau rank Correlation		Kruskal Wallis
Education Mismatch	Coefficients	tau-a	tau-b	Chi-squared ties
JA	0.13	0.06	0.13	10.88
WSA	0.11	0.05	0.10	6.20

5.2. The Incidence of Field of Study and Job Mismatch

The existing studies on field of study and job mismatch, carried out in the US and Sweden have used the national survey datasets which provided them detailed information about the relevance of field of study to the contents of current job [Robst (2007); Martin, *et al.* (2008)]. But, the national datasets in Pakistan have no such information about this type of job mismatch. Following, Jim and Robert (2004) and Robst (2007), this study has measured the field of study and job mismatch by subjective approach from SEG 2010 dataset. Table 9 shows that 11 percent of the graduates consider that their current jobs are totally irrelevant to their studied field of discipline, while another 14 percent reported their jobs are slightly relevant, followed by the moderate relevant with 38 percent and complete relevant with 37 percent. An important information is that the female graduates are facing more field of study and job mismatch than the male graduates as one-third of the female graduates are mismatched either with irrelevant or weak relevant category; however, less than one-fourth of the male graduates are falling in these first two categories (Table 9).

Table 9

The % Distribution of the Respondents by Field of Study and Job Mismatch

Level of Mismatch	Female	Male	Total
Irrelevant	14.8	10.6	11.3
Slightly Relevant	18.5	12.9	13.8
Moderately Relevant	33.3	39.3	38.3
Completely Relevant	33.3	37.2	36.6

6. CONCLUSIONS AND POLICY IMPLICATIONS

The main focus of this study is to estimate the three types of job mismatch and the analysing the determinants of job mismatch. About one-third of the graduates are mismatched either in over-education or in under-education category. The over-educated graduates are further classified into *'apparent* over-educated *and 'genuine* over-educated categories. Approximately 60 percent of the graduates are in the former category while the rests are in later category. More than one-fourth of the graduates are mismatched in qualification; about half of them are over-qualified and the half are under-qualified. More than one-tenth of the graduates consider that their current jobs are totally irrelevant to their studied field of discipline, while 14 percent of the sampled graduates reported that their jobs are slightly relevant to the field of study. The female graduates are facing more field of study and job mismatch than the male graduates.

Overall, the incidences of job mismatch do not support the Human Capital Theory [Becker (1964); Schultz (1962)] which assumed the competitive labour market and in a pure human capital framework, the concept of job mismatch may be meaningless when wages are linked with the productivity. However, this study cannot necessarily reject the Human Capital Theory on the basis of cross-sectional dataset as the mismatch phenomenon might be temporary. Similarly, more qualification mismatch among female graduates support the theory of differential over-qualification. Additional research is required with a dynamic perspective to explore its length and the societal losses as well. In the present analysis, the incidences of job mismatch do not mean that the level of education should be lowered: it rather suggests the need for more quality of education and skills as well as reforms in the labour market. Our findings lead to the following policy implications and recommendations primarily in two areas; reforms in human resource development and labour market institutions;

- The phenomenon of job mismatch highlights the weak coordination among various demand and supply side stakeholders. A close coordination among these is prerequisite for better understanding of issues in order to formulate the right policies.
- The estimates of over-education and under-qualification suggest that the educational system is either providing inadequate skills or creating more graduates in those disciplines which have relatively less demanded in the labour market. A sound occupational-specific education would ensure the matching jobs. There is a need to strengthen the vocational education and training (TVET) policies at the province and district levels.
- The statistics of under-qualification and qualification inflation highlights that the education system is not coping with right demands of the labour market. There is a need to conduct some tracer type studies and/or occupational census (GED and DOT in US, SOC in UK, ARBI in Netherlands) to understand the employment patterns and skills demanded by the various sectors and occupations. It would not only guide the planners and enrolled youth about the labour market opportunities and type of skill needed, but also would help to project future educational needs.

- For females, the rapid rising enrolment with limited participation in the labour market and more job mismatch issues suggest to address the socio-cultural constraints and labour market discriminations. There is a need of policies and programs which would not only breach the ‘glass wall’ and ‘glass ceiling’ barriers, but also provide them the entrepreneur’s opportunities and caretaking skills.
- The estimates of job mismatch, especially the field of study and job mismatch highlights the labour market rigidities and imperfections. There is a need to design and promote policies which would ensure the six dimensions of decent work; opportunities of work, conditions of freedom, productive work, equity in work, security at work and dignity at work. The ‘merit’ norms and equal job opportunities should be ensured for the various segments of the society. There is a need of strategies and programmes to improve the social relations between the employers and employees to raise the level of job satisfaction and productivity. Further, the macroeconomic policies i.e. fiscal, monetary and trade policies can also be used to achieve the decent work objectives.
- The existing labour market information system is inadequate. It mainly depends on the Labour Force Survey (LFS) which is not sufficient to provide up-to-date and adequate information to job seekers. There is a need to improve the LFS questionnaire for skill assessment, labour market opportunities and job mismatches. A module about the history of employment may also be made part of the LFS.

Appendix Table 1

A Reviewed Summary of Incidence of Education-Job Mismatch with Variation in Estimates by Various Approaches

Author(s)	Country	Type of Definition	Estimated Results of Education-Job Mismatch
Hartog and Oosterbeek (1988)	Netherlands	Job Analyst Subjective (WSA)	**JA:** 7% OE, 35.6% UE for 1960; 13.6%OE, UE 27.1% UE for 1971 **WSA:** 17% OE, 30% UE for 1974
Hersch (1995)	US	Subjective and Job Analyst	**WSA:** 29% OE, 13% UE; **JA :** 33% OE, 20% UE
Cohn and Khan (1995)	US	Subjective and Realised Match (RM)	**WSA:** 33% OE, 20% UE; **RM:** 13% OE, 12% UE
Battu, *et al.* (2000)	UK	Subjective-satisfaction Job Analyst Subjective- degree requirement	**WSA-satisfaction:** 40.4% OE **JA:** 40.7% OE **WSA- degree requirement:** 21.75% OE
Chevalier and Walker (2001)	UK	Job Analyst Subjective	**JA:** 13% OE in 1985, 18.9% (Male): 14.7% OE in 1985, 21.6% (Female) **WSA** 33.8% OE in 1985, 33.8% (Male): 30.9% OE in 1985, 30.9% (Female)
Groot and Maassen (2000b)	Holland	Subjective Job Analyst Realised Match	**WSA** 8.7% OE, 3.8% UE (male), 13.6% OE, 2.1% UE (female) **JA** 12.3% OE, 13.3% UE (male), 19.5% OE, 5.7% UE (female) **RM** 11.5% OE, 16.7% UE (male), 12.2% OE, 14.2% UE (female)
Bauer (2002)	Germany	Realised Match using Mean and Modal Values	**Mean Index:** 12.3% OE, 10.4% UE (male), 10.7% OE, 15.6% UE (female) **Mode Index:** 30.8% OE, 20.6% UE (male), 29.9% OE, 37% UE (female)
Chevalier (2003)	UK	Job Analyst Subjective Subjective- Job requirements	**JA:** 17% OE **WSA:** 32.4% OE **WSA-Job requirements:** 16.2% OE
Kler (2005)	Australia	Realised Match Job Analyst	**RM:** 19% OE, 11% UE (male), 17% OE, 13% (female) **JA:** 7% OE, 45% UE (male), 10% OE, 50% UE (female)
Lourdes, *et al.* (2005)	Spain	Subjective approach to measure Education and Qualification Mismatch	**Education Mismatch:** 35% OE, 26% UE **Qualification Mismatch:** 34% OQ, 44% UQ
Dieter and Omey (2006)	Belgium	Subjective and Job Analyst	**WSA:** OE 39.2%, UE 3.4%; **JA:** OE 26.4%, UE 4.9%

Note: OE for over-education, UE for under-education, AE for adequate education, OQ for Over-qualification and UQ for under-qualification

Appendix Table 2

A Reviewed Summary of Studies Over the Incidence of Education-Job Mismatch

Author	Country	Time Frame	Definition Type	Estimates
Duncan and Hoffman (1981)	US	1976	Subjective	42.0% OE, 11.9% UE, 46.1%AE
Rumberger (1987)	US	1969, 1973 and 1977	Job Analyst	1969: 35% OE , 1973: 27% OE and 1977: 32% OE
Verdugo and Verdugo (1989)	US	1980	Realised Match	10.9% OE, 9.9% UE and 79.2% AE
Sicherman (1991)	US	1976, 1978	Subjective	40% OE, 16% UE, 44% AE
Alba-Ramirez (1993)	Spain	1985	Subjective	17% OE, 23% UE, 60% AE
Groot (1993)	Netherlands	1983	Realised Match	16.1% OE, 16.3% UE, 67.5% AE
Robest (1995)	US	1976, 1978 and 1985	Subjective	36% OE, 20% UE and 44% AE (Pooled estimates for 3 years)
Battu, *et al*. (1999)	UK	1986, 1991 and 1996	Degree required (yes/no)	For 1985: 37.6% OE (males), 46.4% (females) For 1991: OE 41.6% (male) 45.3% (female) For 1996: OE 41.3% (male) 39.3% (females)
Cohn and Ng (2000)	Hong Kong	1986 and 1991	Realised Match	For 1986: 38% OE (male) 32% OE (female); 28% UE (male) 24% OE (female) For 1991: 37% OE (male) 31% OE (female); 28% UE (male) 23% UE (female)
Dolton and Siles (2001)	UK	1998	Subjective	42% OE first job in terms of degree being 22% OE current job necessary to do the work 33% did not require a degree to get job
Jim and Velden (2001)	Holland	1998	Subjective	33% OE(male),10.7% OE(female),10.4% UE(male),15.6%UE(female)
McGuinness (2003)	Northern Ireland	1997-2000	Subjective	29% OE first job, 24% OE current job
Decker, *et al*. (2002)	Holland	1992	Subjective	For 15-19 age 41.7% OE; For 30.44 age 27.0% OE For 49-64 age 18.0% ; Overall 30.6% OE
Voon and Miller (2005)	Australia	1996	Realised Match	15.8% OE(male), 13.6% (female); UE 13.7% (male), 18.53% (female); AE 70.53%for male, 67.86% for female
Budria, *et al*. (2007)	12 European Countries	European Community Household Panel 2001	Subjective	In Europe 21.92% OE; In Australia 15.61% OE, 19.13 for Belgium, 19.33% for Denmark, 20.09% for Finland, 23.68% for France, 14.29% for Germany, 29.81% for Greece, 16.26% for Ireland, 30.35% for Itlay, 25.47% for Portugal, 25.01% for Spain, 19.42% for UK

Note: OE for over-education, UE for under-education, AE for adequate education.

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Schooling is Associated not only with Long-run Wages, but also with Wage Risks and Disability Risks: The Pakistani Experience

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1. INTRODUCTION

Many studies document significantly positive associations between schooling attainment and wages in developing countries [see the reviews in Psacharopoulos (1985, 1994); Psacharopoulos and Patrinos (2004)]. Based in part on these associations, there has been widespread advocacy for increasing schooling in developing countries to increase productivity and income and, if targeted towards poorer households, reduce poverty and inequality.

But when individuals enter occupations subsequent to completing their schooling, they not only face an expected work-life path of wages, but also other occupational characteristics, including wage risks and disability risks, for which there may be compensating wages differentials. This has been recognized in some of the recent (as well as older) literature on schooling and labour markets in developed economies. Christiansen, *et al.* (2006), for example, estimated the risk-return trade-off for different schooling attainment and types of schooling based on the Danish Labour Force Survey and identified "efficient" and "inefficient" (inferior based only on risks and returns) schooling combinations. Tuor and Backes-Gellner (2010) used the Swiss Labour Force Survey to estimate risk and returns for different types of schooling paths—all leading to a tertiary degree—by distinguishing among a purely academic path, a purely vocational path and a mixed path with loops through both systems, with entrepreneurs separated from employees in order to examine whether for the same schooling the labour market outcomes differ between these two groups. Their empirical results suggest that mixed schooling paths are well-rewarded in the Swiss labour market and for entrepreneurs high returns are associated with high income variance. Diaz-Serrano and Hartog (2006) used the 1995 Spanish Encuesta de Estructura Salarial (Salary Structure Survey) of 1995 to estimate the earnings variance and skewness and found compensating wage differentials for schooling as a risky investment. There are studies which have employed cross sectional data for finding risk as the dispersion of earnings [for instance McGoldrick

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(1995); McGoldrick and Robst (1996)]. Low, Meghir, and Pistaferri (2008) specify a structural life-cycle model of consumption, labour supply and job mobility in an economy with search frictions that allows them to distinguish among different sources of risks (shocks to productivity, job destruction, processes of job arrival when employed and unemployed and match level heterogeneity) and to estimate their effects and the impact of alternative governmental policies to mitigate risks.

However there is very little evidence in the literature on the associations between schooling attainment and these risks characteristics of occupational choices in developing country contexts, where labour markets may operate much differently than in more developed economies due to, for example, different degrees of mobility and labour market segmentation. The present paper contributes to the literature on developing country labour markets by estimating the associations between schooling and wage risks and between schooling and disability risks in addition to those between schooling and expected wages. These estimates are conditional on the maintained assumption that individuals enter broad occupational categories in specific geographical locations subsequent to their schooling and there is relatively little subsequent mobility. Data on workers in the most recently available six rounds of the Pakistan Labour Force Survey with 77,685 observations are used for the empirical analysis. The occupational and regional categories used are broad so that, in the context of Pakistan, the assumption of limited mobility seems warranted.

The rest of the paper is organized as follows. Section 2 describes the key data from the Labour Force Surveys used in this study. Section 3 discusses how wage risks and disability risks are defined. Section 4 presents the results. Section 5 concludes.

2. DATA

We use pooled data from the six most recent available cross-sectional nation-wide Labour Force Surveys of Pakistan for the years 2001-02, 2003-04, 2005-06, 2006-07, 2007-08 and 2008-09. The Labour Force Survey of Pakistan is conducted by the Federal Bureau of Statistics (FBS), Islamabad. The FBS[1] collects data throughout the country from all rural/urban localities in four provinces of Pakistan based on the 1998 Population Census, excluding the Federally Administered Tribal Areas (FATA) and the military restricted areas. The population of these excluded areas constitutes about 2 percent of the total population.

The analysis includes 77,685 observations on individuals of working-age (10-65 years)[2] involved in any economic activity in these six surveys for whom we have data on the critical variables for the analysis. The variables for each worker include wages, hours worked, work disability, occupation, residence (in urban or rural area and in one of the four provinces), schooling attainment, gender and age. Table 1 gives summary statistics

[1]The FBS uses a stratified two-stage random sample design for data collection. Each area is divided into urban and rural domains. The enumeration blocks for urban domains and village/mouzas/dehs for rural domains are considered as Primary Sampling Units (PSU). The listed households of sample PSUs are taken as Secondary Sampling Units (SSUs). A specified number of households (i.e., 12 from each urban sample PSU, 16 from each rural sample PSU) are selected with equal probability using a systematic sampling technique with a random start.

[2]The Labour Force Survey of Pakistan collects data on economic activity for those above 10 years of age. Only 1.4 percent of the observations in the data that we use for our analysis below is in the 10-14 age range. Our estimates do not change substantially if these individuals are excluded.

Table 1

Summary Statistics

Variables	Categories	Means/ (S.D)
Age (Years)		33.8
		(11.6)
Ln Monthly Wages		8.26
		(.78)
Ln Hourly Wage Rates		2.95
		(.85)
Hours Worked Per Week		49.4
		(12.2)
Disability Risks		1.3
		(11.9)
Male		89.6%
Rural		40.3%
Province	Punjab	44.3%
	Sindh	28.2%
	Khyber Pakhtunkhwa	14.7%
	Balochistan	12.8%
Schooling	Illiterate	22.0%
	Primary (7 grades)	15.7%
	Middle (9 grades)	11.3%
	Matric (11 grades)	19.5%
	Intermediate (13 grades)	11.3%
	Graduation (15-16 grades)	13.4%
	Above Graduation (more than 16 grades)	6.8%
Occupations	Managers	6.4%
	Professionals	6.4%
	Technicians and Associate Professionals	19.1%
	Clerical Support workers	7.2%
	Service and Sales Workers	15.4%
	Skilled, Agricultural, Forestry and Fishery Workers	1.5%
	Craft and Related Trade Workers	14.5%
	Plant and Machine Operators, Assemblers	9.7%
	Elementary Occupations	19.5%
Total Number of Observations=		77685

for these data. The mean age is 33.8 years. The sample is predominantly male (89.6 percent), reflecting the very limited female labour force participation rate in Pakistan. Durrant (2000) discuss that mostly females in Pakistan are not economically active and even if they are active their work is largely unpaid and hidden. Ahmed and Azim (2010) also conclude that probabilities of women in Pakistan to be economically active become low special after marriage and traditional culture is the main reason for low economic activity at women's part. Occupation is defined according to the International Standard Classification of Occupations

(ISCO) at the level of nine categories. The highest proportions of workers are in elementary/unskilled occupations (19.5 percent), technicians and associate professionals (19.1 percent), service and sales workers (15.4 percent) and craft and related trade occupations (14.5 percent). There are seven schooling categories, with 22 percent illiterate having less than primary education and 11.3-19.5 percent in the five categories ranging from completed primary education (seven years) to graduation (15-16 years) and a smaller proportion (6.8 percent) having attained the post-graduate level.[3]

3. MEASUREMENT OF WAGES RISKS AND DISABILITY RISKS

We assume that subsequent to schooling, working individuals enter into one of 144 labour market groups defined by occupation, gender, urban/rural, province and gender (144 = 9 occupational categories * 2 gender categories * 2 urban/rural categories * 4 provinces). We use these groups to define the wage risks and the disability risks that the individuals face upon entering into one of these groups subsequent to schooling. That is, we assume that the residuals in relations that we estimate below are, from the point of view of individuals, short-term random shocks, not persistent longer-run factors. To the extent that there are long-run persistent factors known by individuals, our procedures may result in overestimates of the actual risks, but with the time series of cross sections that we have we are not able to explore such a possibility.

Wage Risks: To estimate the wage risks we use the standard deviation of the residuals in a wages[4] (or earnings) equation for each of the 144 groups defined above. To do so, we first estimate *ln* wages relations with right-side variables for nine occupational dichotomous variables, one gender dichotomous variable, one urban/rural dichotomous variable, three provincial dichotomous variables, age, age-square[5] and

[3]According to the Pakistan Education Statistics Pakistan follows three tier education systems which include Elementary Education (8 years), Secondary Education (4 years) and Higher Education (4 years). There are two scenarios in case of higher education either go for two year graduation degree (BA/BSc) then later on two year masters degree (MA/MSc) or four year professional degree in Engineering, Computer sciences, Business Administration etc. In case of degree in Medical science there are 5 years. In case of PHD there are five more years of study after 4 years of higher education. According to the National Education Policy enrolment of students is the lowest in elementary level of education in Pakistan as compared to other reference countries including India, Bangladesh, Thailand, South Korea, Malaysia and Iran. Pakistan spends relatively less in education in terms of GDP (2.3 percent) as compared to the countries like Iran (4.7 percent), Malaysia (6.2), Thailand (4.2 percent), South Korea (4.6 percent), India (3.8 percent), and Bangladesh (2.5 percent). It further tells that on the Education Development Index, which combines all educational access measures Pakistan lies at the bottom with Bangladesh and is considerably below in comparison to Sri Lanka. A similar picture is presented by the gross enrolment ratios that combine all education sectors, and by the adult literacy rate measures. The overall Human Development Index (HDI) for Pakistan stands at 0.55, which is marginally better than for Bangladesh and Nepal but poorer than other countries in the region. Although Pakistan's HDI has improved over the years but the rate of progress in other countries has been higher. Bangladesh, starting at a lower base has caught up, while other countries have further improved upon their relative advantage. These developments do not augur well for Pakistan's competitive position in the international economy. As the Global Competitiveness Index (GCI) shows, Pakistan's performance is weak, on the health and education related elements of competitiveness, when compared with its major competitors like India, China, Bangladesh, Sri Lanka and Malaysia.

[4]Wages used in the paper are real wages. The nominal wages provided in the Labour Force Surveys are deflated by the consumer price index provided by the Ministry of Finance, Government of Pakistan (Economic Survey of Pakistan 2009-10, Chapter 10).

[5]Age-sqaure is used as a proxy for experience; this proxy has been widely used in literature. [For example: Serrano, *et al.* (2003); Danny and Harmon (2007), Harmon, *et al.* (2001)].

interactions of all the other variables with age and age-squared to allow life-cycle wages patterns to vary with occupation, gender, urban/rural and province: [6]

$$Ln\ (Wages) = \alpha + \beta_i X_i + \mu_i,\ \ \mu \sim (0, \sigma^2), \qquad \dots \qquad \dots \qquad \dots \qquad \dots \qquad (1)$$

where X is a vector with the right-side variables described above. We then calculate the standard deviations of the residuals from the estimated *ln* wages relation for each of the 144 groups defined above and refer to these standard deviations as the "wages risks." [7]

Because wages are the product of average hourly wage rates and hours worked, we also follow a similar procedure for wage rates and hours worked by estimating:

$$Ln(Wage\ Rate) = a + b_i X_i + u_i,\ \ u \sim (0, \sigma^2) \qquad \dots \qquad \dots \qquad \dots \qquad \dots \qquad (2)$$

$$Ln(Hours\ Worked) = \xi + \lambda_i X_i + v_i,\ \ v \sim (0, \sigma^2) \qquad \dots \qquad \dots \qquad \dots \qquad \dots \qquad (3)$$

We then define "wage rate risks" and "hours worked risks" parallel to "wages risks", defined above.

Table 2 presents OLS estimates of relations (1)-(3). The graphical presentation of life-time earnings profiles based on gender, provinces, urban/rural and occupations are presented in Figures 1–4. The estimated coefficients of occupational, regional, gender, provincial categories, age and age square confirm an inverted u-shaped life-time earning profile, as has usually been reported in the previous literature. The gender earning gap favoring males is evident from this regression analysis, with this gap increasing over the life cycle. Among the occupational categories, 'Managers, senior officials and legislators' remain the highest earnings category over the life cycle. The earnings of 'Professionals' increase sharply initially with age but there is steep decline as well for older ages. 'Clerks' is one occupational category whose mean earnings remain almost stable throughout the working life.

The first three columns of Table 3 present summaries of our estimated wages risks, wage rate risks, and hours worked risks by occupation, gender, urban/rural and province. The means for wages risks and wage rate risks are fairly stable for those with low levels of schooling but increase for those with the highest two or three schooling levels. In the case of gender, wages risks are very high for females as compared to their male counterparts, with both wage rates risks and hours worked risks higher. The higher wages risks for females may reflect that a large proportion of working women are in the informal sector without any legally-binding agreements between employers and employees.

[6]The extended form of this equation is:
$\ln(\text{Wage } s_i) = \alpha + \beta_{1j}\text{age} + \beta_{2j}\text{agesq} + \beta_{3j}\text{gender} + \beta_{4j}\text{gender} * \text{age} + \beta_{5j}\text{gender} * \text{agesq} + \beta_{1j}\text{region} + \beta_{7j}\text{region} * \text{age} + \beta_{8j}\text{region} * \text{agesq} + \beta_{9ij}\text{age} \sum^4_{j=1} \text{province} + \beta_{1Dij} \sum^4_{j=1}\text{province} * \text{age} + \beta_{11ij} \sum^4_{j=1}\text{province} * \text{age sq} + \beta_{12ij} \sum^9_{j=1}\text{occupation} + \beta_{13ij} \sum^9_{j=1}\text{occupation} * \text{age} + \beta_{13ij} \sum^9_{j=1} \text{occupation} * \text{agesq} + \mu_j$

[7]Wages risks $= \sqrt{\frac{1}{n-1}\sum^{n_j}_{i=1}(\mu_{ij} - \bar{\mu}_{ij})^2}$, where *i* refers to the *i*th individual in the *j*th group and n is number of observations in each group.

Table 2

Regression Results for ln Monthly Wages, ln Hourly Wage Rate and ln Hours Worked per Week

Variables	*ln* Monthly Wages Coefficient Estimate	*ln* Monthly Wages Standard Error	*ln* Hourly Wage Rate Coefficient Estimate	*ln* Hourly Wage Rate Standard Error	ln Hours Worked per Week Coefficient Estimate	ln Hours Worked per Week Standard Error
Age	0.14***	0.005	0.15***	0.006	–0.01***	0.002
Age^2	–0.001***	0.00007	–0.001***	0.00007	0.0001***	0.00002
Occupation						
Professionals	–0.34*	0.14	0.05	0.16	–0.39***	0.05
Technicians	–0.06	0.11	0.09	0.12	–0.15***	0.04
Clerks	1.42***	0.14	1.58***	0.15	–0.15**	0.05
Services	0.177	0.11	0.20	0.12	–0.02	0.04
Skilled_Agri	0.45*	0.19	0.55**	0.20	–0.10	0.07
Craft	0.66***	0.11	0.87***	0.12	–0.21***	0.04
Plant and Machine	1.54***	0.13	1.81***	0.13	–0.25***	0.04
Elementary/Unskilled	0.77***	0.11	0.83***	0.11	–0.06	0.04
Occupations*Age						
Professionals*Age	0.02*	0.008	0.003	0.008	0.01***	0.003
Technicians*Age	–0.02**	0.006	–0.01*	0.007	–0.0005	0.002
Clerks*Age	–0.09***	0.008	–0.09***	0.008	0.003	0.003
Services *Age	–0.03***	0.006	–0.04***	0.006	0.005**	0.002
Skilled_Agri*Age	–0.05***	0.010	–0.06***	0.01	0.005	0.003
Craft*age	–0.06***	0.006	–0.07***	0.006	0.011***	0.002
Plant & Machine*Age	–0.11***	0.007	–0.13***	0.007	0.02***	0.002
Elementary*Age	–0.07***	0.006	–0.08***	0.006	0.003	0.002
Occupation*Age^2						
Professionals*Age^2	–0.0003**	0.0001	–0.0001	0.0001	–0.0001***	0.00003
Technicians*Age^2	0.0001*	0.0001	0.0001	0.00009	0.00003	0.00003
Clerks*Age^2	0.0009***	0.0001	0.001***	0.0001	–0.00001	0.00003
Services*Age^2	0.0002*	0.0001	0.0002*	0.00008	–0.00003	0.00003
Skilled_Agri*Age^2	0.0005***	0.0001	0.0005***	0.0001	–0.00005	0.00005
Craft*Age^2	0.0006***	0.0001	0.0007***	0.00008	–0.0001***	0.00003
Plant and Machine*Age^2	0.001***	0.0001	0.001***	0.00009	–0.0002***	0.00003
Elementary*Age^2	0.0007***	0.0001	0.0007***	0.00008	–3.65E-06	0.00002
Region						
Rural	0.006	0.04	0.007	0.04	0.0008	0.01
Rural*Age	–0.006*	0.002	–0.006*	0.002	–0.0002	0.0008
Rural*Age^2	0.00004	0.00003	0.00004	0.00003	3.64E-06	0.00001
Gender						
Female	–0.752***	0.06	–0.50***	0.07	–0.2***	0.02
Female*Age	0.022***	0.004	0.02***	0.004	0.005***	0.001
Female*Age^2	–0.0003***	0.00005	–0.0002***	0.00006	–0.00007***	0.00002
Province						
Sindh	0.045	0.045	0.02	0.05	0.02	0.02
KPK	–0.032	0.062	–0.09	0.06	0.06*	0.02
Balochistan	0.41***	0.069	0.4***	0.07	–0.03	0.02
Province*Age						
Sindh*Age	0.0026	0.0028	0.004	0.003	–0.001	0.001
KPK*Age	0.0011	0.0035	0.007*	0.004	–0.006***	0.001
Balochistan*Age	–0.011*	0.004	–0.01*	0.005	–0.001	0.001
Province*Age^2						
Sindh*Age^2	–0.00002	0.00003	–0.00004	0.00004	0.00002*	0.00001
KPK*Age^2	0.00001	0.00005	–0.00008	0.00005	0.00009***	0.00001
Balochistan*Age^2	0.0001**	0.00005	0.0001	0.00006	0.00002	0.00002
Constant	5.87***	0.11	0.26***	0.11	4.16***	0.03
F(41, 77643)	1142.92		1215.54		491.51	
Prob > F	0.0000		0.0000		0.0000	
R-squared	.3764		.3909		.2061	
Adj R-squared	.3760		.3907		.2056	
N	77685		77685		77685	

Notes: *t significant at p<.05.
**t significant at p<.01.
***t significant at p<.001.

Fig. 1. Male- Female Life-Time Wage Earnings Profiles

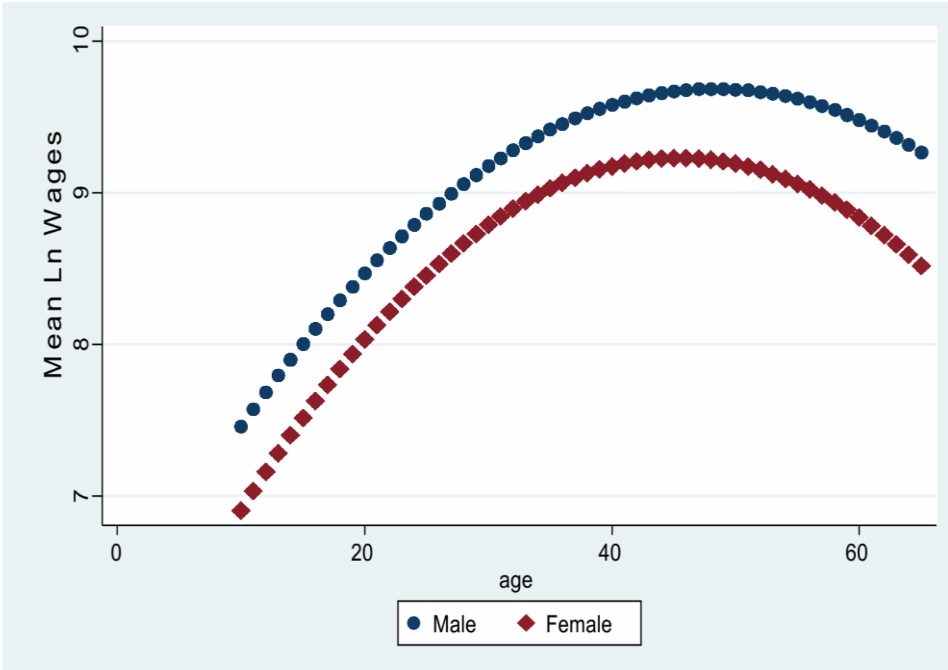


Fig. 2. Urban-Rural Life Time Wage Earnings Profiles

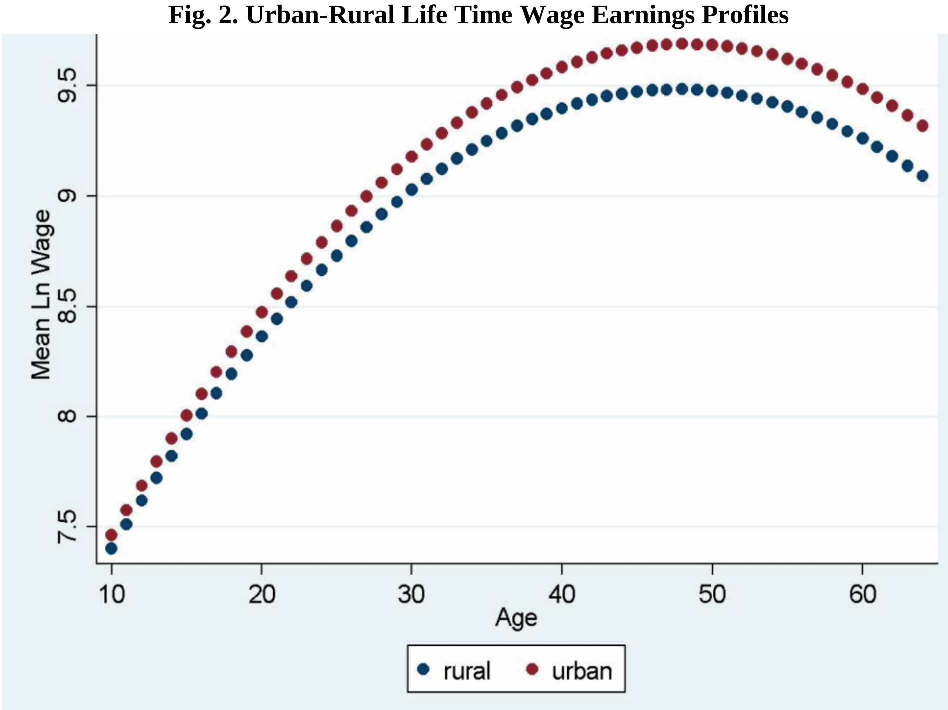


Fig. 3. Life Time Wage Earnings Profiles in Different Provinces

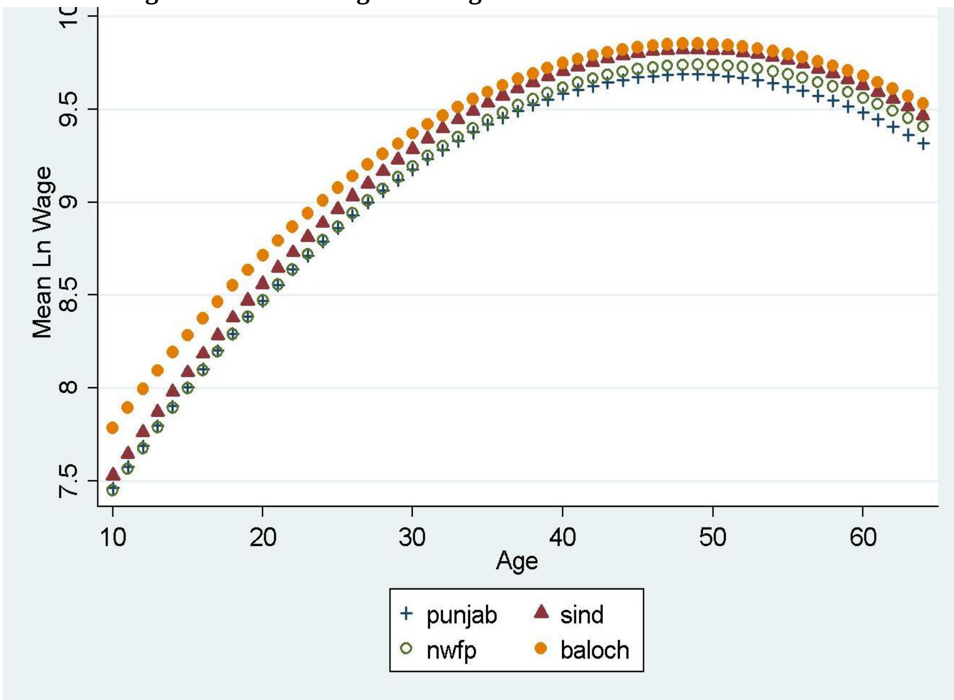


Fig. 4. Life-Time Wage Earnings Profiles in Different Occupations

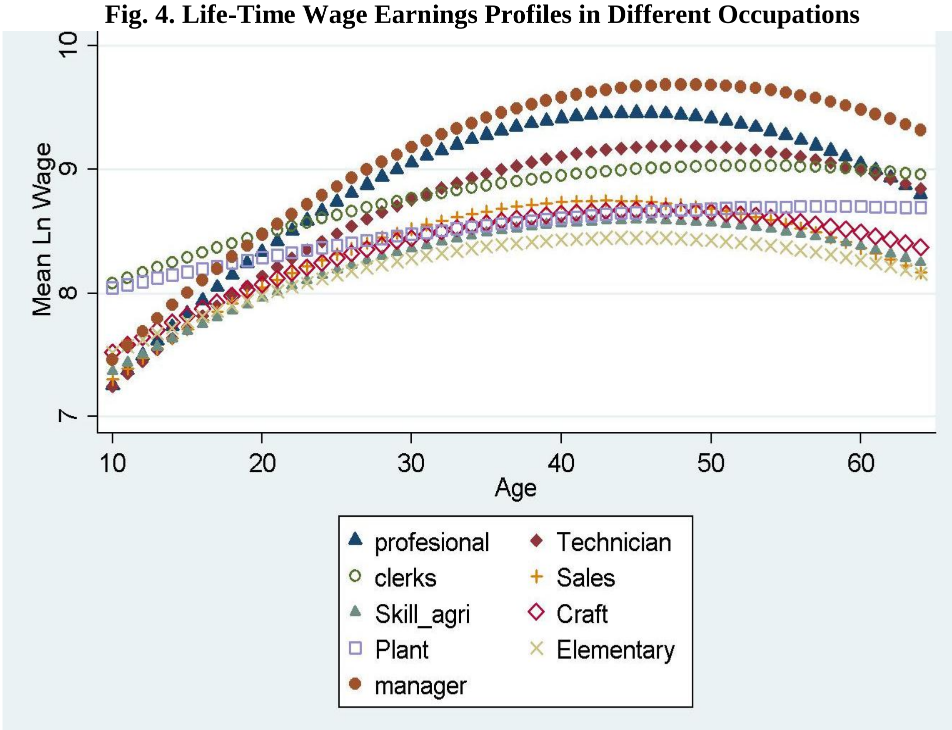


Table 3

Summary Statistics for Wages Risks, Wage Rate Risks, Hours Worked Risks and Disability Risks

Variable	Wages Risks	Wage Rate Risks	Hours Worked Risks	Disability Risks[8]
Gender				
Male	.57	.63	.22	1.4
	(.09)	(.09)	(.04)	(12.3)
Female	.77	.76	.27	.45
	(.10)	(.08)	(.05)	(7.05)
Region				
Rural	.58	.65	.23	1.7
	(.09)	(.08)	(.04)	(14.8)
Urban	.60	.65	.22	1.02
	(.12)	(.11)	(.04)	(9.3)
Province				
Punjab	.63	.67	.24	1.6
	(.11)	(.09)	(.04)	(12.0)
Sindh	.59	.64	.21	1.17
	(.11)	(.11)	(.04)	(11.0)
KPK	.58	.64	.26	.96
	(.11)	(.10)	(.04)	(9.29)
Balochistan	.52	.57	.20	0.93
	(.08)	(.08)	(.04)	(15.4)
Schooling				
Illiterate	.57	.62	.24	1.78
	(.10)	(.08)	(.05)	(12.4)
Primary (5 grades)	.57	.62	.23	2.12
	(.09)	(.08)	(.04)	(18.7)
Middle (8 grades)	.56	.61	.22	1.56
	(.08)	(.07)	(.04)	(11.0)
Matric (10 grades)	.58	.63	.22	.97
	(.10)	(.09)	(.04)	(8.96)
Intermediate (12 grades)	.59	.64	.22	0.83
	(.11)	(.11)	(.04)	(10.4)
Graduation (14-16 grades)	.67	.71	.23	0.63
	(.13)	(.13)	(.04)	(7.64)
Above Graduation (more than 16 grades)	.71	.75	.23	0.45
	(.13)	(.13)	(.05)	(6.49)
Occupations				
Managers	.79	.84	.19	0.69
	(.04)	(.05)	(.02)	(7.4)
Professionals	.82	.87	.26	0.55
	(.06)	(.06)	(.04)	(7.44)
Technicians and Associate Professionals	.61	.67	.25	0.63
	(.10)	(.08)	(.03	(7.95)
Clerical Support Workers	.51	.55	.17	0.86
	(.05)	(.05)	(.03)	(11.29)
Service and Sales Workers	.56	.62	.22	.80
	(.05)	(.04)	(.02)	(8.27)
Skilled, Agricultural, Forestry and Fishery	.52	.62	.23	2.55
Workers	(.09)	(.07)	(.04)	(14.7)
Craft and Related Trade Workers	.58	.61	.19	2.44
	(.08)	(.06)	(.04)	(13.84)
Plant and Machine Operators, Assemblers	.50	.56	.23	2.48
	(.03)	(.03)	(.02)	(20.13)
Elementary Occupations	.56	.63	.26	1.41
	(.08)	(.06)	(.03)	(12.68)
Number of Observations=77685				

[8]The labour market diability risk rate is calculated as: number of injuries faced by every individual during one year/Total number of hours worked by every worker during one year*200,000; where 200,000 = base for 100 full-time equivalent workers (40 hours per week, 50 weeks per year).

Disability Risks: Work accidents are widespread. According to the International Labour Organisation (ILO, 2010),[9] there are 340 million occupational accidents and 160 million victims of work-related illnesses annually, overall in the world. Moreover in the Middle East and Asia ILO region that includes Pakistan (but excludes China and India), work-related accident fatality rates are four-fold more than those observed in industrialized countries.

For our empirical work we define “disability risks” to be the incidence of injuries or illness at the work-place for the same 144 groups defined above.[10] The fourth column of Table 3 presents summaries of the estimated disability risks by occupation, schooling, gender, urban/rural and province. The disability risks tend to have patterns opposite to the wage risks for schooling, occupations and gender. Occupational disability rates are highest in ‘Skilled, Agricultural, Forestry and Fishery Workers’, ‘Craft and Related Trade Workers’ and ‘Plant/Machine Operators and Assemblers.’

Correlations Among Risks Measures: The more correlated are the risks measures, of course, the less is gained by including multiple risks measures in our analysis. On the other hand, the more correlated are the risks the harder it would be to identify the associations of schooling with any one particular type of risks rather than other highly-correlated types. Table 4 gives the correlations among our measures. Note that the wages risks measure and the wage rate risks measure are highly correlated, but—though both are significantly correlated with the hours worked risks—for neither of the two are the correlations with hours worked risks all that high. On the other hand disability risks are negatively and significantly correlated with both the wages risks and wage rate risks, though the absolute magnitudes of these correlations are small and the correlation with hours worked risks is insignificant.

Table 4

Correlations among Wages Risks and Disability Risks

Type of Risk	Wages Risks	Wage Rate Risks	Hours Worked Risks	Disability Risks
Wages Risks	1	–	–	–
Wage Rate Risks	0.96*	1	–	–
	(0.00)			
Hours Worked Risks	0.32*	0.38*	1	–
	(0.00)	(0.00)		
Disability Risks	–.025*	–.025*	–.008	1
	(.00)	(0.00)	(.014)	

Note: *Significant at .01 level.

4. RESULTS

The primary results of interest for this study are estimates of associations between schooling attainment and wages, wage risks and disability risks. Therefore we estimate relations of the form of

[9]International Labour Organisation (2010), World Statistics: The Enormous Burden of Poor Working Condition. http://www.ilo.org/public/english/region/eurpro/moscow/areas/safety/statistic.htm Accessed on April, 8th 2011.

[10]Hersch (1998) used the same measure of disability risks for different industries.

$$Y_i = \alpha + \beta_i Z_i + \mu_i, \qquad \mu \sim (0, \sigma^2) \qquad \ldots \qquad (4)$$

Where Y_i is a seven-element vector of labour market outcomes (mean wages, mean wage rates, mean hours worked, wages risks, wage rate risks, hours worked risks, and disability risks) for each individual based on his/her being in one of the 144 labour market categories as a function of the vector Z, which includes three dichotomous variables for provinces (with Punjab the omitted category), a dichotomous variable for female, a dichotomous variable for rural and seven dichotomous variables for different schooling levels.

The first three variables in Y_i —mean wages, mean wage rates, and mean hours worked—have been included because these are the work life-cycle equivalents of the variables that are the outcomes of usual emphasis in studies on associations between schooling and labour market outcomes. In addition we include various risks variables that have been defined and described above.

Table 5 presents estimates for the first three variables in Y_i. *Ln* mean wages are lower in Punjab than in the other three provinces, particularly than in Balochistan. This reflects that *ln* mean wage rates are higher in the three other provinces than in Punjab, indeed enough higher in Balochistan and in the Khyber Pakhtunkhwa to more than offset the significantly lower *ln* mean hours worked in these two provinces. The mean *ln* wages are 0.17 *ln* points lower in rural than in urban areas, primarily reflecting that the significantly lower *ln* wage rates are reinforced slightly by lower *ln* hours worked. The mean *ln* wages are 0.52 *ln* points lower for females than for males, reflecting a combination of 0.32 *ln* points lower *ln* wage rates and 0.20 lower *ln* points hours worked.[11] The coefficient estimates for the schooling levels indicate significant positive

Table 5

Regressions for Mean ln Wages, Mean ln Wage Rates and Mean ln Hours Worked

	Mean *ln* Wages		Mean *ln* Wage Rate		Mean *ln* Hours Worked	
	Coefficient Estimate	Standard Error	Coefficient Estimate	Standard Error	Coefficient Estimate	Standard Error
Province						
Sindh	0.12***	0.002	0.12***	0.002	0.006***	0.0007
KPK	0.06***	0.003	0.10***	0.003	–0.03***	0.0009
Balochistan	0.27***	0.003	0.34***	0.003	–0.06***	0.0009
Region						
Rural	–0.17***	0.002	–0.15***	0.002	–0.01***	0.0006
Gender						
Female	–0.52***	0.004	–0.32***	0.004	–0.20***	0.001
Schooling						
Primary	0.06***	0.003	0.07***	0.002	–0.005***	0.0009
Middle	0.10***	0.003	0.11***	0.004	–0.01***	0.001
Matriculation	0.25***	0.003	0.31***	0.003	–0.06***	0.0009
Intermediate	0.39***	0.003	0.51***	0.004	–0.11***	0.001
Degree	0.60***	0.004	0.74***	0.004	–0.13***	0.001
Above Degree	0.72***	0.005	0.87***	0.005	–0.14***	0.001
Constant	8.06***	0.002	2.65***	0.002	3.96***	0.0007
F(11, 77673)	7566.36		8579.84		8350.88	
Prob > F	0.0000		0.0000		0.0000	
Adj R-squared	0.56		0.53		0.54	
N	77685		77685		77685	

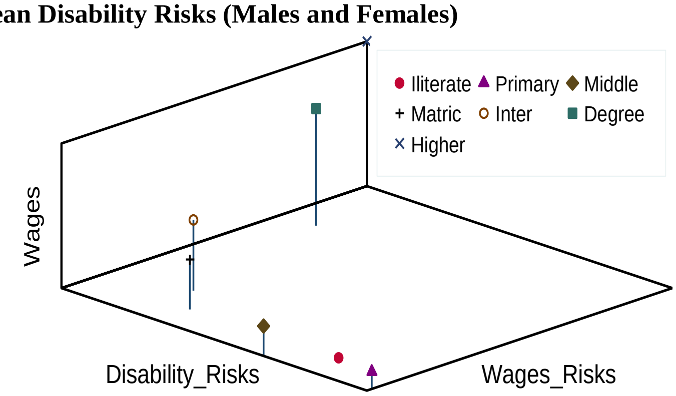
[11]Khan and Irfan (1985), Shabbir (1993, 1994) and Nasir (1999) present similar findings.

associations between schooling and ln wages and more strongly with ln wage rates. The latter more than offset the increasing significantly negative association between schooling levels and mean ln hours worked, perhaps because those with higher full incomes use part of their incomes to purchase more leisure. The patterns in the coefficient estimates for schooling attainment, thus, are consistent with the usual emphasis on positive associations of schooling with wages and wage rates, with the latter more than offsetting possibly negative associations with hours worked.

Table 6 presents the estimates for the last four components of Y_i, those related to wages risks (including the two components of wage rate risks and hours worked risks) and disability risks. For almost all of the alternative risks variables, risks are significantly greater in the Punjab than in the other three provinces, and least of all in Balochistan.[12] The single exception to this statement is that the hours worked risks are greatest in the Khyber Pakhtunkhwa. The risks are significantly less in rural than in urban areas for wages, but are significantly greater in rural areas than in urban areas for wage rates, hours worked and disabilities. Thus in terms of geography, both with reference to provinces and rural/urban areas, there is a tendency ceteris paribus for lower wages to be associated with greater risks—the opposite of what one might expect if wages included compensating differentials for risks. Females experience significantly higher wages risks than males by about 0.16 ln points, reflecting primarily higher wage rate risks but also significantly higher hours worked risks. But females experience significantly lower disability risks.

Of central interest for this paper are the associations between schooling and wages risks and disability risks, the estimated values of which are plotted in Figure 5. As compared with no schooling, having primary school does not significantly change the risk experience except for significantly slightly less hours worked risks. Having middle schooling, however, significantly reduces both wages risks (and both of its components)

Fig. 5. Schooling Levels and Associated Mean *ln* Wages, Mean *ln* Wage Risks and Mean Disability Risks (Males and Females)



[12]Punjab is the largest province of Pakistan, both in terms of population and economic activity, with a large proportion of the workforce engaged in agriculture-based employment. During the period under study there were considerable fluctuations in agricultural production (*Economic Survey of Pakistan 2006-07*), consistent with relatively high risks in this province. Siddiqui and Siddiqui (1998) and Ashraf and Ashraf (1993) present related results for earning equations.

Table 6

Estimates of Associations of Schooling with Wages Risks and Disability Risks

	Wages Risks		Wage Rate Risks		Hours Worked Risks		Disability Risks	
	Coefficient Estimate	Standard Error	Coefficient Estimate	Standard Error	Coefficient Estimate	Standard Error	Coefficient Estimate	Standard Error
Province								
Sindh	–0.03***	0.0007	–0.03***	0.0007	–0.02***	0.0003	–0.31***	0.10
KPK	–0.04***	0.0009	–0.04***	0.0009	0.02***	0.0004	–0.57***	0.13
Balochistan	–0.09***	0.0009	–0.09***	0.001	–0.04***	0.0004	–0.73***	0.14
Region								
Rural	–0.0001*	0.0006	0.01***	0.0006	0.01***	0.0002	0.53***	0.09
Gender								
Female	0.16***	0.001	0.10***	0.0009	0.04***	0.0004	–0.81***	0.14
Schooling								
Primary	–0.0001	0.0008	–0.0007	0.0007	–0.009***	0.0004	0.27*	0.14
Middle	–0.003***	0.0009	–0.003***	0.001	–0.01***	0.0005	–0.28*	0.16
Matriculation	0.006***	0.0008	0.007***	0.001	–0.01***	0.0004	–0.77***	0.13
Intermediate	0.02***	0.001	0.02***	0.001	–0.01***	0.0005	–0.83***	0.16
Degree	0.09***	0.001	0.09***	0.001	–0.01***	0.0004	–0.96***	0.15
Above Degree	0.12***	0.001	0.12***	0.001	–0.01***	0.0006	–1.08***	0.19
Constant	0.58***	0.0007	0.64***	0.0007	0.24***	0.0003	1.88***	0.11
F(11, 77673)	5506.27		4190.13		3102.92		25.13	
Prob > F	0.0000		0.0000		0.0000		0.0000	
R–squared	0.4262		0.3330		0.3053		0.0035	
Adj.R-Squared	0.4261		0.3330		0.3053		0.0035	
N	77685		77685		77685		77685	

Table 7

Estimates of Association of Schooling with Mean ln Wage, Mean ln Wage Rate, Mean ln Hrs Worked, Mean ln Wage Risks), Mean ln Wage Rate Risks, Mean ln Hours Worked Risks, Mean Disability Risks [Note: Standard Errors in Parenthesis]

	Mean *ln* Wages	Mean *ln* Wage Rate	Mean *ln* Hrs Worked	Mean *ln* Wages Risks	Mean *ln* Wage Rate Risks	Mean *ln* Hours Worked Risks	Mean Disability Risks
Province							
Sindh	0.14***	0.09**	0.06**	–0.04	–0.05**	–0.03*	–0.20
	(0.05)	(0.05)	(0.02)	(0.03)	(0.03)	(0.02)	(0.32)
KPK	0.04	0.04	0.0001	–0.07**	–0.07***	0.01	–0.38
	(0.05)	(0.05)	(0.02)	(0.03)	(0.03)	(0.01)	(0.30)
Balochistan	0.32***	0.33***	–0.01	–0.13***	–0.12***	–0.06***	–0.39
	(0.05)	(0.05)	(0.02)	(0.03)	(0.03)	(0.02)	(0.32)
Region							
Rural	–0.10***	–0.08**	–0.02	0.07**	0.07***	0.02	0.69*
	(0.04)	(0.04)	(0.02)	(0.02)	(0.02)	(0.01)	(0.25)
Gender							
Female	–0.46***	–0.40***	–0.08***	0.12***	0.05*	0.01	–0.49
	(0.05)	(0.05)	(0.02)	(0.03)	(0.03)	(0.02)	(0.31)
Schooling							
Primary	–0.21	–0.16	–0.05	–0.35	–0.11	–0.28**	–2.78
	(0.43)	(0.38)	(0.19)	(0.27)	(0.24)	(0.13)	(2.65)
Middle	1.6**	0.89	0.72**	–0.24	–0.32	–0.17	6.35*
	(0.61)	(0.55)	(0.26)	(0.37)	(0.34)	(0.18)	(3.69)
Matric	0.22	0.18	0.04	0.13	0.14	–0.12	–2.36
	(0.30)	(0.27)	(0.13)	(0.18)	(0.16)	(0.09)	(1.79)
Intermediate	0.65*	0.92***	–0.28*	–0.83***	–0.72***	–0.23**	–1.63
	(0.37)	(0.32)	(0.15)	(0.22)	(0.20)	(0.11)	(2.18)
Graduate	1.08***	1.14***	–0.07	0.39**	0.48***	–0.06	–0.76
	(0.27)	(0.23)	(0.11)	(0.16)	(0.14)	(0.08)	(1.58)
Above Degree	2.21***	2.36***	–0.15	–0.08	–0.03	–0.19***	–0.76
	(0.21)	(0.18)	(0.09)	(0.12)	(0.11)	(0.06)	(1.22)
Constant	7.17***	1.98***	3.84***	0.89***	0.83***	0.37***	1.81**
	(0.09)	(0.08)	(0.05)	(0.06)	0.05	(90.03)	(0.72)
N	106	106	106	106	106	106	106
F(11, 94)	69.30	103.65	15.55	11.29	9.60	6.34	3.84
Prob>F	0.00	0.00	0.00	0.00	0.00	0.00	0.00
R-Square	0.89	0.92	.645	0.56	0.52	0.43	0.31
Adj. R-Square	0.87	0.91	.603	0.51	0.47	0.36	0.23

Table 6

and disability risks. Having still higher levels of schooling increasingly reduces disability risks, but increases wages risks (and even more wage rate risks that offsets slight declines in hours worked risks). Therefore the increased average wages and wage rates with more schooling noted in Table 5 may in part be due to compensating differentials for increased wages risks and wage rate risks—but there certainly is not evidence of compensating differentials for disability risks, which are negatively associated with schooling.

Figures 6 and 7 show how the mean return and risks estimates vary for male and female workers. Female workers are more exposed than male workers to disability risks and wage risks at the three lower levels of schooling and still have relatively low mean wages.

Fig. 6: Schooling Levels and Associated Mean *ln* Wages, Mean *ln* Wage Risks and Mean Disability Risks (Males Only)

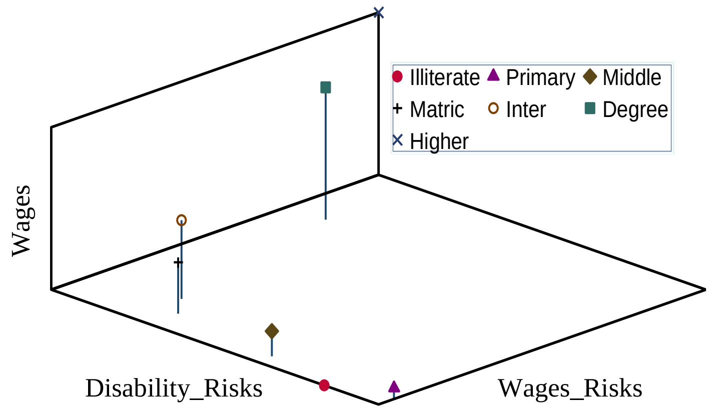


Fig. 7. Schooling Levels and Associated Mean *ln* Wages, Mean *ln* Wage Risks and Mean Disability Risks (Females Only)

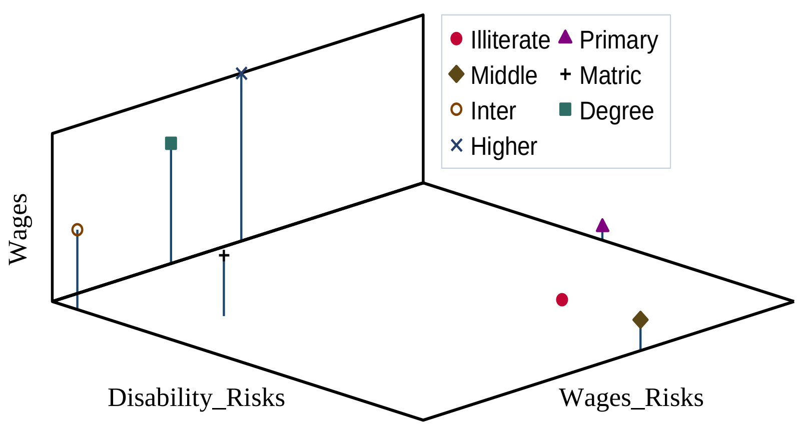


Table 7 presents alternative estimates in which the observations are the mean values for the subset of 106 of the 144 labour market categories for which there are sufficient numbers of observations (minimum number of observations in each category is

Table 7

at least 15), rather than the individuals, for the same specifications as in Tables 5 and 6. The estimates in Table 7 generally are consistent with the results in Tables 5 and 6 (i.e., positive associations of schooling with wages risks but negative association of schooling with disability risks), though with some minor differences and a tendency towards less precision.

5. CONCLUSION

Schooling is widely associated with wages in developing country labour markets. However other characteristics of these markets also may be importantly associated with schooling. Subject to the caveats about our assumptions above, we have examined what are the associations between schooling attainment and "wages risks" and "disability risks" in Pakistani labour markets. Our estimates suggest that more schooling is not only significantly positively associated with higher work life-cycle mean wages and wage rates, but also with higher wages risks and lower disability risks. These patterns also differ significantly by gender, moreover, with women with low schooling facing higher wages risks and lower disability risks than men with low schooling. Considering the wage level-schooling association alone, therefore, may be misleading regarding the associations of schooling with labour market outcomes and gender differentials in those associations.

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The Impact of Trade Liberalisation on Wage Inequality: Case of Pakistan

ZARA SALMAN and MARIAM JAVED

1. INTRODUCTION

While an increasing number of developing economies are engaging in trade liberalisation, its impact on wage inequality is not quite understood. Trade liberalisation is defined as the removal or reduction of restrictions or barriers on the free exchange of goods between nations. This includes the removal or reduction of both tariff (duties and surcharges) and non-tariff obstacles (like licensing rules, quotas and other requirements) [Investopedia].[1] This phenomenon is seen to impact wages for various skill levels differently and therefore, is likely to have consequences on wage inequality as well. Even though various studies have focused on how economic growth and various demographic factors affect wage inequality, few studies examine the impact on it as a result of policy changes such as, trade liberalisation [Kassa (2003)]. Given Pakistan's slashing reforms towards liberalisation of trade in the 1990s especially after its membership of the WTO in 1995, the impact of this policy on wage inequality is equally important as other determinants.

The Heckscher-Ohlin model and the Stolper-Sameulson Theorem provide the necessary theoretical underpinning to explain how free-trade impacts wages in different sectors of the economy. According to the H-O model, countries specialise in the production of those goods which intensively use the factors of production in which they are abundantly endowed. Consequently, this model predicts that while developed countries specialise in the production of goods that intensively use skilled labour, developing countries like Pakistan, specialise in goods that intensively use unskilled labour [Giliani, *et al.* (2003)]. Under this approach, international competition in developed countries will only increase wages of high-skilled labour, if and only if there is an increase in the relative prices of goods they specialise in. This result is presented by the Stolper-Sameulson Theorem. This theorem, in the developing country context, would imply that trade liberalisation increases the relative prices of industries that employ unskilled labour, and therefore, increasing their wages would consequently reduce wage inequality within the country.

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[1]http://www.investopedia.com/

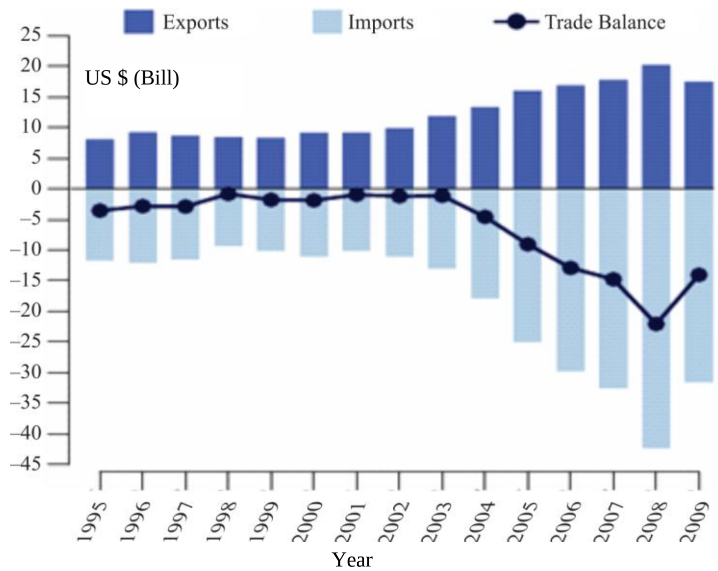
In this paper, the effect of trade liberalisation policies on wage inequality in Pakistan in 1990s and early 2000 is investigated. Firstly, the paper aims to investigate whether trade liberalisation played any role in influencing the Pakistani wage structure, during this ten year period after joining the WTO. Secondly, if it did have any impact, it seeks to examine whether it is in accordance with the result expected by the Stolper-Sameulson Theorem. The results demonstrate that an increase in trade liberalisation, measured through import penetration, export penetration and relative prices of each industry, has increased wage inequality for different skill levels; a result contrary to that predicted by the Stolper-Sameulson Theorem.

The rest of this section provides a background on Pakistan's trade liberalisation and wage inequality, the consequent objectives of the research and the relevant review of the literature. Section 2 outlines the empirical model while Section 3 describes the data and data sources. Section 4 then presents the estimation results, while Section 5 provides a discussion of these findings in light of other research. Concluding comments and recommendations are in Section 6.

1.2. Background of Pakistan's Trade Liberalisation and Wage Inequality

Trade liberalisation in Pakistan was introduced to strengthen its industrial base. Till the sixties, Pakistan had a very restricted trade policy of import substitution in order to protect its weak manufacturing sector. This was because Pakistan had always focused on its agricultural sector and combined with a lack of well organised infrastructure and political instability, trade policy was characterised with high tariff and non-tariff barriers. However, in the seventies the beginning of an open trade policy was seen. Yet the most substantial change occurred in the late eighties and early nineties when tariff slabs were reduced from 17 to 10 and a uniform tax was introduced instead of a commodity based sales taxes. Moreover, the maximum tariff was decreased from 225 percent in 1986-87 to 70 percent in 1994-95, whereas non-tariff barriers were mostly removed as well. Through various tax holidays and tariff cuts like the decline in average tariff rate from 77 percent to about 17 percent, the government of Pakistan aimed to provide incentives to improve the efficiency of its manufacturing sector. Moreover, measures to encourage exports were introduced, which included the removal of all export duties except for 251 items for which Pakistan has a comparative advantage in the international market. Also included in these measures was entering into Free trade Agreements with mutual agreements on easy access to markets for countries like Malaysia and Sri Lanka [Bashir (2003)]. Pakistan also became member of the World Trade Organisation in 1995 which lead to further openness through steps like signing the Agreement on Textile and Clothing [Industrial Information Network].[2] Moreover, the implementation of a Structural Adjustment and Stabilisation Program led to further trade reforms as they were an integral part of the development process introduced by them [Hyder, *et al.* (2011)]. These measures resulted in a positive effect which was seen in the trade-to-GDP ratio. The ratio increased by 0.4 percentage points per annum in Pakistan since 1990 [Civil Service of Pakistan].[3] The result of these measures can also be seen in the rising trend of exports and imports as depicted by Figure 1.

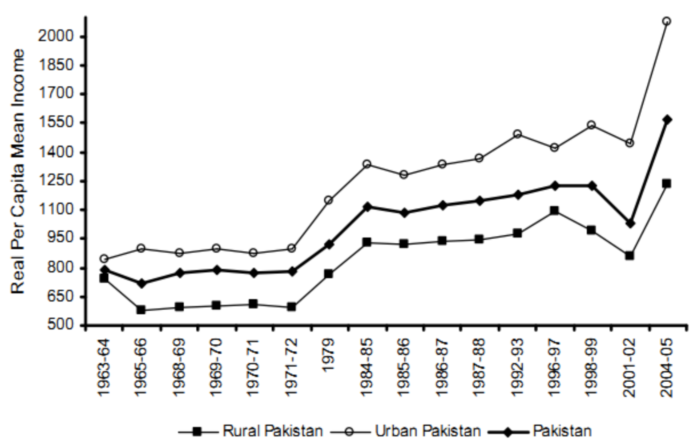
[2] http://www.iin.com.pk/
[3] http://www.cssforum.com.pk/



Source: UN Comtrade.

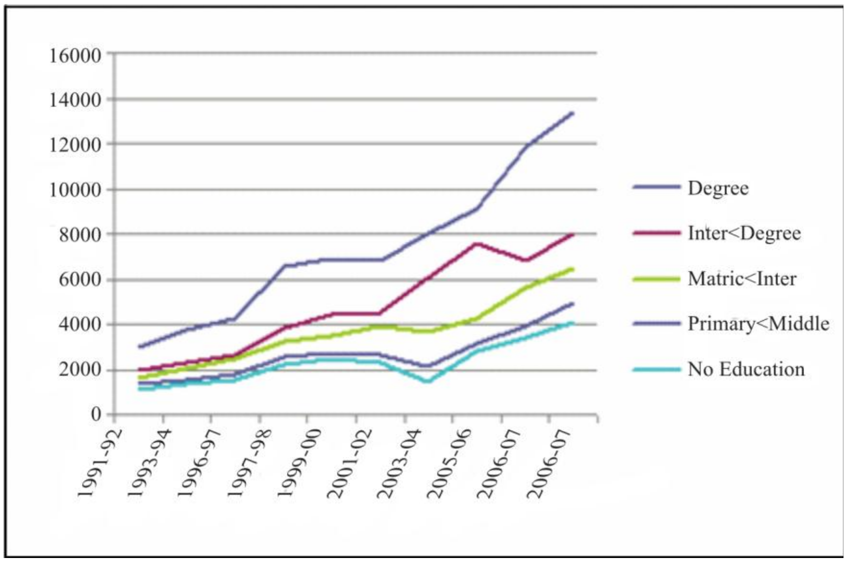
Fig. 1. Total Imports, Exports and Trade Balance

While the volume of trade has increased in Pakistan, the trend for wages has changed as well. Figure 2 shows an upward trend of real per capita mean incomes over time for both rural and urban areas of Pakistan. Furthermore, real and money wages in Pakistan have shown a positive trend from year 1995 till 2005 with a growth rate lower than GDP per capita growth rate in the nineties but higher than GDP per capita from the year 2000 onwards [Irfan (2008)]. Moreover, the trend of wages based on educational categories shows a positive movement over the period 1995-2006 with the greatest improvement seen for workers with higher degrees. This can be seen in Figure 3.



Source: M. Irfan (2008) Pakistan's Wage Structure. PIDE, pp. 15-18.

Fig. 2. Mean Income Trend



Source: M. Irfan (2008) Pakistan's Wage Structure.PIDE, pp. 15-18.

Fig. 3. Wage Trend Based on Educational Category

Moreover, Pakistan's wage data demonstrates the existence of inter-industry wage premiums, as emphasised in Table 1. This elicits that wages for workers with the same degree of skill do not equalise across all industries.

Table 1

Inter-Industry Premiums for Three Skill Groups

	Skilled Premium	Semi-Skilled Premium	Unskilled Premium
Food, Beverage and Tobacco	135.0	59.9	44.2
Textile Wearing Apparel, Leather Industry	153.5	64.8	44.1
Paper, Paper Products, Printing, Publishing	155.4	64.4	48.8
Chemical, Petroleum, Coal, Rubber and Plastic	162.1	93.3	52.7
Basic Metal Industries	145.7	80.1	62.4
Fabricated Metal, Machinery and Equipment	176.5	67.2	49.9
Other Industries	172.6	66.7	50.3

Note: Data for Mean of Yearly Real Wage (1996-97). Real Wages in (000) Rupees.

1.3. Objectives of the Research

The variation in wage premiums across industries for workers with the same skills, paves the way for researching the impact of trade liberalisation on wage inequality. This paper aims to use inter-sector and time variability from years, 1996 to 2005 in trade liberalisation as well as skill premiums to explore the role played by the former in influencing the wage structure of Pakistan in late 1990s and early 2000. Furthermore, it aims to establish the degree to which the Stolper-Sameulson Theorem can explain

Pakistan's wage structure by mid-2000. However, based on the background of trade liberalisation in Pakistan, this paper solely focuses at the effect of the manufacturing sector wages, since the prime objective of trade liberalisation policies has been to improve the industrial sector. Additionally, this research departs from H-O model to a degree. This is because the H-O model enforces perfect inter-sector mobility of labour, assuming wages for workers with the same degree of skill to equalise across all industries, a result inconsistent with the wage data of Pakistan (Table 1).

Since no similar study has been conducted for Pakistan, our paper will serve as an important tool for policy-makers, to draw lessons from existing policy measures which effect the development and growth of the economy. Moreover, the conclusions drawn from this research can also be used as a reference and an evaluation tool for future policy changes as Pakistan enters into new trade relations with various countries.

1.4. Literature Review

Current research indicates that the impact of trade liberalisation on wage inequality is highly debatable. The East Asian countries experienced a positive effect of trade liberalisation i.e., a decline in wage inequality, in accordance to the Stolper-Samuelson theorem. Yet some Latin American countries seem to have experienced the reverse of what the theorem predicted; a liberal trade policy seems to have increased wage inequality. Beyer, *et al.* (1999), while conducting a study on Chile, found that liberalisation had a substantial effect on wage inequality. They provided two reasons for the increase in inequality i.e., transformation in the productive structure of the economy and technological change which was skill biased. These changes resulted in an improvement in wages for skilled labour.

Furthermore, according to Galiani, *et al.* (2003), the trade liberalisation reforms introduced in the nineties in Argentina demonstrate that wage inequality widened in those manufacturing industries where import penetration deepened. In their empirical analysis, the impact of import penetration on college wage premium was studied. By controlling for both individual and industry specific characteristics, it was discovered that there is a positive and significant correlation between both variables. This clearly indicated that while trade liberalisation increases wage inequality in Argentina, it does not completely explain this rise. Therefore other factors must be taken into account as well.

Moreover, some research has led to results that indicate no relation in the empirical analysis of the impact of trade openness on wage inequality. According to Munshi, *et al.* (2006) who studied this relationship for the cotton textile industry of Bangladesh, liberal trade reforms do not increase wage inequality. Four measures were used to estimate this relationship i.e., the ratio of USA to Bangladeshi manufacturing prices, the ratio of exports plus imports to GDP, the ratio of aggregate exports to GDP, and the ratio of imports of consumer goods to aggregate consumption. All measures show an increase in both the wages of skilled and unskilled workers, implying that trade liberalisation has lead to a positive technical change which is skill neutral but that it does not affect wage inequality.

On the other hand, while the above studies go against the predictions of Stolper-Samuelson theorem, those done by Bigsten, *et al.* (2006), Goh, *et al.* (2005) and Kumar, *et al.* (2005) seem to reinforce the predictions of the Stolper-Samuelson theorem. Kumar, *et al.* (2005) use tariff reductions to study the impact of trade liberalisation on wage inequality in India, implying that productivity increases are passed on to industry wages. As those manufacturing industries with higher proportion of unskilled labour had greater tariff reductions, the increase in their wages was also greater relative to skilled labour.

2. ECONOMETRIC METHODOLOGY

2.1. Basic Model

In this section, the estimation strategy used in this study is presented. It commences by introducing the basic model that is frequently used in human capital literature in order to determine differences in wages across skill levels, which includes individual, yearly, industrial and regional control variables. This is followed by an introduction of the augmented empirical specifications.

In the basic model, skill dummies are included in order to see the differences in wage premiums between skilled, semi-skilled and unskilled workers across different industries.

$$Wage_i = \alpha_1 + \alpha_2 age + \alpha_3 age^2 + \delta_1 married + \delta_2 male + \delta_3 urban + \delta_4 training + \delta_5 Y + \gamma P + \lambda I + \varphi_1 S + \varepsilon_i \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (2.1)$$

An OLS model is used to estimate the Equation 2.1. In the above Model 1, *Y* represents the year dummy, *P* represents provinces dummies, *I* represents industry dummies while *S* represents skill dummies. Two variations of Model 1 are run, one for each year, 1996 and 2006 respectively.

Moreover, there is a need to control for clustering in this model since this paper has used aggregate level data for imports, exports and prices at industry level and combined it with micro level data for workers with respect to their industries. If clustering at industry level is not controlled for, the estimated standard errors from OLS estimates on the aggregate data will be too small while their respective *t*-values will be very large, resulting in rejection of the null hypothesis of no significance [Cheah (2009)].

2.2. Introducing Trade Variables

Basing the analysis on Giliani and Sanguinetti's paper (2003), interaction terms between trade and skill variables are introduced in order to evaluate how trade liberalisation impacts wage premiums. Trade liberalisation is measured through import and export penetration ratios and relative prices for each industry.[4] In Model 2, only interactions between skill dummies and import penetration are introduced to see the impact of reduction in tariffs and quotas on the skill premiums. Furthermore, in Model 3, interaction terms between skill dummies and export penetration are added to Model 2, in order to assess the significance of trade liberalisation, encompassing both exports and imports in influencing wages premiums. Then, relative prices are added to Model 3, by including its interactions with the skill dummies of industries in order to decipher how their inclusion further affects the impact of our variables of interest on disparity in wages across varied skill levels. This is done in Model 4.

[4]When we introduce these interactions we remove the skill dummies from the equation.

3. DATA AND CONSTRUCTION OF VARIABLES

3.1. Data Sources

In this section, the data sources used in this study are discussed and the construction of different variables used in the empirical models is highlighted. Furthermore, a brief description of these variables, followed by summary statistics is also provided.

The data used in this study is obtained from a nationally representative cross-sectional data set named as the *Labour Force Survey of Pakistan*. The LFS is an annual survey, carried about by the Federal Bureau of Statistics. The major aim of the survey is to collect a set of comprehensive statistics on the various dimensions of country's civilian labour force. The number of sample households in the survey is 32,778 (99.7 percent of the total sample). Furthermore, it uses a Multi-stage stratified random sample [International Household Survey Network].[5]

The surveys for the year 1996-97 and 2005-06 are obtained and merged in order to carry out the analysis. Since trade liberalisation policies gained tremendous momentum in the early nineties and moreover, Pakistan became a member of the World Trade Organisation at this time, 1996-97 is an ideal time period to be taken as the base period to which trade liberalisation effects of wages can be compared. Secondly, a nine to ten year gap between the two data points is ample time for the trade liberalisation policies to have any effect and thus 2005-06 is taken as the second data point.

Furthermore, since this survey does not provide data on imports, exports or their respective prices, which is necessary for the analysis, this information is obtained from the *Federal Bureau of Statistics Yearbook 2006*, Section 9. Moreover, as this research is interested in evaluating the effects of trade liberalisation on wage inequality in the manufacturing sector, the sample is restricted to the Two Digit Standard Industrial Classification (SIC). The description is given in Table 2.

Table 2

Two Digit (SIC) for Manufacturing Industries

Code	Description
31	Manuf. of Food Beverage and Tobacco
32	Manuf. of Textile Wearing Apparel and Leather Industry
33	Manuf. of Wood or Wood Product or Furniture
34	Manuf. of Paper, Paper Product, Printing, Publishing
35	Manuf. of Chemical Petroleum, Coal Rubber and Plastic Prod.
36	Manuf. Non-metallic Product Except Petroleum and Coal
37	Basic Metal Industries
38	Manuf. Fabricated Metal Products, Machinery and Equipment
39	Other Manuf. Industries and Handicraft

Source: Code Book, Labour Force Survey, 1996-97.

[5]http://surveynetwork.org/

While, the LFS provides data about all industries, the Statistical Yearbook, 2006 is unable to supply us with trade data for Industries 33 and 36. Therefore, as key information on imports and exports is missing for these industries, their respective observations are dropped from the sample.

3.2. Definition and Construction of Variables

Basing our model on Giliani and Sanguinetti's paper, 'The impact of trade liberalisation on wage inequality: evidence from Argentina' (2003), the extent of trade liberalisation is measured through import penetration, export ratio and relative prices. Import penetration is the logarithm of the ratio of imports to the gross value added for each industry in the manufacturing sector, whereas export ratio is defined as the logarithm of the ratio of exports to the gross value added for each industry in the manufacturing sector. These variables have been adjusted for inflation using GDP deflator, where the base year is 2000-01.[6]

To gather data on relative prices for each industry, the production value of each industry was divided by the quantity produced for it, to get market prices. This method was used as no data was available for individual industry prices. Real prices for years 1996-97 and 2005-6 were firstly obtained by dividing each price by the year's Consumer Price Index (CPI)[7] and secondly by the Wholesale Price Index (WPI).[8] However, since these prices were not in the same unit, due to each industry having a different quantity unit, the prices were converted into index numbers by taking 2005-2006 as the base year. These index numbers for relative prices were obtained by dividing the real prices of both 1996-97 and 2005-6 by the real prices of base year, 2005-6. By this method, comparison of the prices of 1996-1997 with 2005-2006 as base year could be undertaken.

Table 3

Periodic Changes in Trade Variables

	Import Penetration		Export Ratio		Relative Prices	
Industries	1996-1997	2005-2006	1996-1997	2005-2006	1996-1997	2005-2006
Food, Beverage and Tobacco	0.81	1.58	0.07	0.07	1.11	0.73
Textile, Wearing, Apparel and Leather	0.04	0.04	3.60	1.29	1.22	0.73
Paper, Paper Products, Printing, Publishing	0.67	0.62	0.00	0.00	1.64	0.73
Chemical, Petroleum, Coal, Rubber and Plastic	3.81	1.90	0.11	0.22	0.88	0.73
Basic Metal Industries	3.23	2.63	0.00	0.00	2.15	0.73
Fabricated Metal, Machinery and Equipment	4.03	6.91	0.17	0.14	2.75	0.73
Other Manufacturing Industries and Handicraft	40.67	53.01	45.93	59.50	4.82	0.73

Source: Federal Bureau of Statistics Yearbook 1996 and 2006.

Furthermore, in order to see the effect of trade liberalisation on wage inequality among labour of different skill levels in the manufacturing sector, variables were defined for wage and the three skill categories. The variable for wage is an annual estimate calculated by translating weekly or monthly earnings (whichever is available for a

[6]GDP Deflator: 1996= 62.04, 2006=147.07.
[7]CPI: 1996=81.11, 2006=131.64 (Base Year 2000-01).
[8]WPI: 1996=81.62, 2006=136.68 (Base Year 2000-01).

particular cross-section), into yearly income. However, since there was still a constraint of missing wages for certain observations (3381 observations) that needed to be addressed, observations from the working sample were used, to estimate by OLS, a typical wage determination (2.1). Parameter estimates from this equation and values of all right hand-side variables for non-workers were used to generate the predicted or fitted wage for the non-workers.

The level of skill premiums were analysed by educational level of workers. Therefore, three skill groups were defined: unskilled (those individuals who have at most attended primary school but have not finished it), semi-skilled (those that have at most attended Intermediate level of schooling but have not finished it) and skilled group (those who have finished a tertiary degree). Dummies are generated for each skill level and are equal to 1, corresponding to the worker's respective skill. The reason why only education and not training is used as proxy for skill is because most workers are trained in the informal sector so the data available for formal training is scarce. Moreover, this data cannot account for the differences in the skills required for white collar jobs and blue collar jobs.

Age and age^2 have been used as a proxy for experience and experience^2 respectively. Mincer's method is not used because it requires completed years of schooling which is missing in our data. The available data fails to differentiate between attended years of schooling and completed years of schooling. Furthermore, the dummies for gender, marital status, training and rural-urban origin are used as right hand side variables for the wage equation. Dummies are also generated for 7 industries and 4 provinces in order to control time-invariant industries and province specific effects. Since, this study is interested in evaluating the impact of trade liberalisation on wage inequality across two periods, a further dummy is generated for year 1996 equal to 1 if year is 1996-97 and year 1996 equal to 0 if year is 2005-06.

Interaction terms are also incorporated in the study. These include interactions between different levels of skill and import penetration, export ratio and relative prices. The variables are defined in Table 4 while summary statistics for all these variables are given in Table 5.

Table 4

Definition of Variables Used in the Regression Analysis

Variables	Description
Wage (I**nwage**)	Yearly wages of all workers in the manufacturing sector excluding industry 33 and 36
Age **(age)**	Age in years
Age^2 **(age2)**	Quadratic term for age
Male (male)	=1if worker is male
Married **(mar)**	=1 if worker is married
Urban **(urban)**	=1 if worker works in an urban area
Year 1996 **(yr1996)**	=1 if year is 1996
Training **(train)**	=1 if worker has training

Continued—

Table 4—(*Continued*)

Punjab **(Punjab)**	=1 if worker is in Punjab
Sindh **(Sindh)**	=1 if worker is in Sindh
KPK **(KPK)**	=1 if worker is in KPK
Balochistan **(Baloch)**	=1 if worker is in Balochistan
Manuf. of food, beverage and tobacco **(in31)**	=1 if worker works in the food, beverage and tobacco industry
Manuf. of textile, wearing, apparel and leather industry **(in32)**	=1 if worker works in the textile, wearing, apparel and leather industry
Manuf. of paper, paper product, printing, publishing **(in34)**	=1 if worker works in the paper, paper product, printing, publishing industry
Manuf of Chemical, petroleum, coal ,rubber and plastic **(in35)**	=1 if worker works in the chemical, petroleum, coal, rubber and plastic industry
Basic metal industries **(in37)**	=1 if worker works in the basic metal industry
Manuf. Fabricated metal, machinery and equipment **(in38)**	=1 if worker works in the fabricated metal, machinery and equipment industry
Other manuf. Industries and handicraft **(in39)**	=1 if worker works in other manufacturing industries and handicrafts
Import Penetration (**inimp)**	Ratio of imports to value added
Export Penetration (**inexp)**	Ratio of exports to value added
Relative Prices **(price)**	Ratio of real prices to Wholesale Price Index
Skilled **(skilled)**	=1 if worker has at most attended primary school but has not finished it
Semi-skilled **(semiskilled)**	=1 if worker has at most attended Intermediate level of schooling but has not finished it
Unskilled **(unskilled)**	=1 if worker has finished a tertiary degree
Skilled Dummy * Import Penetration **(impskilled)**	Interaction term of skilled with import penetration
Semi-skilled Dummy * Import Penetration **(impsemi)**	Interaction term of semi-skilled with import penetration
Unskilled Dummy * Import Penetration **(impunskill)**	Interaction term of unskilled with import penetration
Skilled Dummy * Export Penetration **(expskilled**)	Interaction term of skilled with export penetration
Semi-skilled Dummy * Export Penetration **(expsemi)**	Interaction term of semi-skilled with export penetration
Unskilled Dummy * Export Penetration **(expunskill)**	Interaction term of unskilled with export penetration
Skilled Dummy * Relative Prices **(pskill**)	Interaction term of skilled with relative prices
Semi-skilled Dummy * Relative Prices **(psemi)**	Interaction term of semi-skilled with relative prices
Unskilled Dummy * Relative Prices **(punskill)**	Interaction term of unskilled with relative prices

Table 5

Summary Statistics of the Variables Employed in the Wage Equation

Variables	Mean	Std. Dev.	Min.	Max.
Wage	10.343	1.130	0	13.693
Age	29.901	12.869	10	85
Age^2	1059.707	936.506	100	7225
Male	0.611	0.487	0	1
Female	0.389	0.487	0	1
Married	0.520	0.499	0	1
Unmarried	0.478	0.499	0	1
Urban	0.660	0.474	0	1
Rural	0.312	0.474	0	1
Year 1996	0.312	0.463	0	1
Year 2006	0.688	0.463	0	1
Training	0.078	0.268	0	1
Punjab	0.66	0.482	0	1
Sindh	0.248	0.432	0	1
KPK	0.089	0.285	0	1
Balochistan	0.022	0.145	0	1
Manuf. of Food Beverage and Tobacco	0.107	0.309	0	1
Manuf. of Textile Wearing Apparel and Leather Industry	0.577	0.494	0	1
Manuf. of Paper, Paper Product, Printing, Publishing	0.034	0.182	0	1
Manuf. of Chemical Petroleum, Coal Rubber and Plastic Prod.	0.054	0.227	0	1
Basic Metal Industries	0.021	0.144	0	1
Manuf. Fabricated Metal Products, Machinery and Equipment	0.104	0.305	0	1
Other manuf. Industries and Handicraft	0.102	0.303	0	1
Import Penetration	0.804	1.233	0.026	4.198
Export Penetration	0.998	1.196	0	4.318
Relative Prices	1.160	1.027	0.732	4.819
Skilled	0.059	0.235	0	1
Semi-skilled	0.335	0.472	0	1
Unskilled	0.606	0.489	0	1
Skilled Dummy * Import Penetration	0.056	0.341	0	4.198
Semi-skilled Dummy * Import Penetration	0.267	0.777	0	4.198
Unskilled Dummy * Import Penetration	0.481	1.068	0	4.198
Skilled Dummy * Export Penetration	0.043	0.313	0	4.318
Semi-skilled Dummy * Export Penetration	0.307	0.791	0	4.318
Unskilled Dummy * Export Penetration	0.648	1.089	0	4.318
Skilled Dummy * Relative Prices	0.063	0.319	0	4.819
Semi-skilled Dummy * Relative Prices	0.370	0.751	0	4.819
Unskilled Dummy * Relative Prices	0.727	1.031	0	4.819

4. EMPIRICAL FINDINGS

In this section, the findings of the empirical model will be presented and discussed. This section begins with the basic model, and moves on to the modifications made to the basic model. Furthermore, the effect of the three measures of trade liberalisation on wage inequality in Pakistan is investigated collectively as well as separately.

Table 6 presents a pair of typical estimated coefficients for variables that control for individual characteristics for the year 1996 and 2006 [Equation (2.1)]. The estimated coefficients are close to expected. Wages increase with education and age. Urban workers earn more than rural workers in both years, as is expected. Marital status and Gender are insignificant. Wages do not vary by gender as the females included in this sample are mostly involved in white-collared jobs rather than blue-collared jobs. In 1996, there is no significant difference in wages across provinces; however, in 2006 the wages in Sindh are

Table 6

Individual Control Variables: Estimates for Selected Years

Variables	1996-97	2005-06
Skilled Labour	0.938***	1.062***
	(0.123)	(0.054)
Semi-skilled Labour	0.374***	0.327***
	(0.027)	(0.007)
Age	0.063***	0.045***
	(0.009)	(0.005)
Age2	–0.001***	–0.000***
	(0.009)	(0.000)
Married	0.065	0.033
	(0.049)	(0.038)
Male	0.058	–0.018
	(0.047)	(0.008)
Urban	0.142***	0.133***
	(0.02)	(0.029)
Training	0.036	0.045
	(0.045)	(0.045)
Sindh	0.043	0.049**
	(0.062)	(0.015)
KPK	–0.126	–0.178***
	(0.076)	(0.042)
Balochistan	0.100	0.022
	(0.066)	(0.101)
Food, Beverage and Tobacco	–0.222***	–0.060***
	(0.017)	(0.003)
Textile Wearing Apparel, Leather Industry	–0.143***	–0.164***
	(0.017)	(0.003)
Paper, Paper Products, Printing, Publishing	–0.024	–0.044***
	(0.335)	(0.009)
Chemical, Petroleum, Coal, Rubber and Plastic Products	–0.131**	–0.045***
	(0.052)	(0.012)
Basic Metal Industries	–0.052**	0.189***
	(0.015)	(0.015)
Fabricated Metal Product, Machinery and Equipment	–0.126***	0.019***
	(0.009)	(0.005)
R-squared	0.234	0.146
Number of Observations	3220	7117

Notes: *** and** indicate significance at 1 percent and 5 percent respectively.
Standard errors are written in parenthesis.
The robust standard errors are corrected for clustering at the industry level.

significantly higher than Punjab, while the wages in KPK are significantly lower than Punjab. Furthermore, wages on average have increased in the Food, Chemical, Metal and Fabricated Metal industries (compared to the base category, which is Other Manufacturing Industries and Handicrafts) over the ten year period. However, wages on average declined in the Textile and Paper industry over this period. The skilled premium also increased on average during this period.

Model 2 details the introduction of interaction terms between import penetration and skill levels to the original model, to see the impact of trade liberalisation on wage inequality. The results of the regression are given in Table 7. The estimated impact of import penetration on the wages of skilled workers is positive and highly significant, while its impact on the wages of unskilled workers is negative and also statistically significant. Since, the coefficient for Import Penetration* Semi-skilled is statistically insignificant, we observe no change in the wages of semi-skilled workers with an increase in import penetration. Overall this result implies that as import penetration increases by 1 percent, wage premiums of skilled workers increase by 0.212 percent while the wages of the unskilled workers decrease by 0.199 percent.

Moving on, further interactions are added between export penetration ratio and skill dummies (Model 3), it is observed that some of the earlier coefficients change drastically, as shown in Table 7. The coefficient for the year dummy increases substantially. The industries which had significant coefficients in Model 2, become statistically insignificant in Model 3, and vice versa. This Model also makes the effect of our import penetration interaction insignificant, implying that there is no change in wage premiums as a result of higher import penetration. Furthermore, the interactions between export penetration and skilled dummy, and export penetration and unskilled dummy, are statistically insignificant, there is no impact of higher export penetration on the wage premiums of the skilled and unskilled categories and no substantial effect of wage inequality. However, higher export penetration leads to an increase in wage premiums for the semi-skilled. As export penetration increases by 1 percent, the wage premium for the semi-skilled increases by 0.221 percent.

Proceeding to Model 4, relative prices of industries are now interacted with the skill dummies and added to Model 3. The results of this model, as shown in Table 7, are quite consistent with that of Model 3 and thus quite contradictory to Model 2. All import penetration interactions with skill dummies are still insignificant and there is still no impact of export penetration on skilled wage premium. The interactions with relative prices also come out as insignificant. However, unlike Model 3, Model 4 shows that not only semi-skilled but also unskilled wage premium is increasing with an increase in export penetration. Here a 1 percent increase in export penetration leads to a 0.191 percent and 0.136 percent increase in wage premiums for semi-skilled and unskilled labour respectively. This result shows that while with respect to import penetration and relative prices, there is no impact on wage inequality, wage inequality is decreasing with respect to export penetration.

Table 7

Parameter Estimates for Model 2, 3, 4

Variables	Model 2	Model 3	Model 4
Skilled Dummy * Import Penetration	0.213**	0.276	0.065
	(0.079)	(0.154)	(0.170)
Semi-skilled Dummy * Import Penetration	–0.090	0.054	0.023
	(0.073)	(0.056)	(0.065)
Unskilled Dummy * Import Penetration	–0.199*	0.051	0.092
	(0.092)	(0.124)	(.106)
Skilled Dummy * Export Penetration		0.371	0.218
		(0.267)	(0.226)
Semi-skilled Dummy * Export Penetration		0.221***	0.191***
		(0.062)	(0.047)
Unskilled Dummy * Export Penetration		0.086	0.136***
		(0.060)	(0.035)
Skilled Dummy * Relative Prices			0.456
			(0.250)
Semi-skilled Dummy * Relative Prices			0.106
			(0.058)
Unskilled Dummy * Relative Prices			–0.062
			(0.056)
Age	0.063***	0.061***	0.058***
	(0.008)	(0.004)	(0.004)
Age2	–0.0006***	–0.001***	–0.001***
	(0.000)	(0.000)	(0.000)
Married	0.009	0.015	0.025
	(0.046)	(0.034)	(0.033)
Male	0.002	0.005	0.005
	(0.016)	(0.014)	(0.016)
Urban	0.182***	0.174***	0.165***
	(0.025)	(0.014)	(0.013)
Training	0.081*	0.080*	0.067
	(0.040)	(0.034)	(0.038)
Year 1996	0.479***	0.326***	0.294***
	(0.037)	(0.031)	(0.039)
Sindh	0.112**	0.104**	0.087**
	(0.045)	(0.029)	(0.027)
KPK	–0.162**	–0.158**	–0.171**
	(0.049)	(0.053)	(0.050)
Balochistan	0.034	0.039	0.042
	(0.72)	(0.079)	(0.076)
Food, Beverage and Tobacco	–0.578*	0.613	0.699**
	(0.269)	(0.322)	(0.275)
Textile Wearing Apparel, Leather Industry	–0.750*	0.454	0.532
	(0.330)	(0.366)	(0.308)
Paper, Paper Products, Printing, Publishing	–0.473	0.800*	0.844**
	(0.304)	(0.352)	(0.288)
Chemical, Petroleum, Coal, Rubber and Plastic	–0.394	0.745*	0.819**
	(0.264)	(0.331)	(0.256)
Basic Metal Industries	–0.252	0.897**	0.929***
	(0.235)	(0.302)	(0.243)
Fabricated Metal, Machinery and Equipment	–0.336	0.635**	0.701**
	(0.186)	(0.244)	(0.202)
R-Squared	0.174	0.180	0.188
Number of Observations	10337	10337	10337

Notes: ***,**,* indicate significance at 1 percent,5 percent, 10 percent respectively.
Standard errors are written in parenthesis.
The robust standard errors are corrected for clustering at the industry level.

Since the introductions of these export penetration interactions and price interactions have caused significant changes in our coefficients of Model 2, we expect these to be highly correlated with other variables in the regression. We confirm this assertion by reporting the correlation matrix. Table 8 shows that interaction terms between skill and export penetration are highly correlated with the interaction terms between skill and import penetration, and therefore their inclusion in Model 3 gives divergent results. Furthermore, the interaction terms between skill and relative prices are also highly correlated with interactions between export penetration and skill dummy, as well as with the interactions between import penetration and skill dummy.

Table 8

Correlation Matrix

	Price* Skilled	Price* Semi-skilled	Price* Unskilled	Import* Skilled	Import * Semi-skilled	Import* Unskilled
Import-Penetration* Skilled	**0.78**	–0.08	–0.12	1.00	–0.06	–0.07
Import-Penetration* Semi-skilled	–0.07	**0.75**	–0.24	–0.06	1.00	–0.15
Import-Penetration* Unskilled	–0.09	–0.22	**0.78**	–0.07	–0.15	1.00
Export-Penetration* Skilled	**0.71**	-0.07	–0.10	**0.64**	–0.05	–0.06
Export-Penetration* Semi-skilled	–0.08	**0.75**	–0.27	–0.06	**0.69**	–0.18
Export-Penetration* Unskilled	–0.12	–0.29	**0.78**	–0.10	–0.20	**0.72**

Since, there exists significantly high correlations between our key variables, separate models for each of these set of interactions are run. Table 9 reports their results. Model 2, here only includes the interactions between import penetration and skill dummies. Its results have been interpreted earlier which show that as import penetration increases in different industries, the skilled premium increases, while the unskilled premium decreases; therefore, causing wage inequality to increase substantially.

Model 5 only includes the interactions between export penetration and skill dummies. This estimation elicits that as export penetration increases by 1 percent, the wage premium for the skilled and the semi-skilled increases by 0.48 percent and 0.181 percent respectively. From this model, it can be interpreted that skilled and semi-skilled premiums increase while there is no significant change in wage premium for the unskilled, as export penetration of different industries increases. Therefore, rise in export penetration, similar to import penetration, has resulted in increasing wage inequality in Pakistan.

Model 6, also reiterates previous results that an increase in relative prices of industries is likely to increase wage inequality. As a result of an increase in relative prices, there is no significant change in the wage premium for the unskilled worker. However, the skill and semi-skilled wage premium show a substantial growth with respect to rising relative industry prices. If relative prices in any industry increase by 1 percent, the skilled and semi-skilled wage premium increases by 0.483 percent and 0.086 percent respectively.

Table 9

Parameter Estimates for Model 2, 5, 6

Variables	Model 2	Model 5	Model 6
Skilled Dummy * Import Penetration	0.213**		
	(0.079)		
Semi-skilled Dummy * Import Penetration	–0.090		
	(0.073)		
Unskilled Dummy * Import Penetration	–0.199*		
	(0.092)		
Skilled Dummy * Export Penetration		0.485**	
		(0.136)	
Semi-skilled Dummy * Export Penetration		0.181***	
		(0.045)	
Unskilled Dummy * Export Penetration		0.044	
		(0.041)	
Skilled Dummy * Relative Prices			0.483**
			(0.153)
Semi-skilled Dummy * Relative Prices			0.086*
			(0.036)
Unskilled Dummy * Relative Prices			–0.074
			(0.044)
Age	0.063***	0.061***	0.058***
	(0.008)	(0.004)	(0.005)
Age2	–0.0006***	–0.001***	–0.001***
	(0.000)	(0.000)	(0.000)
Married	0.009	0.015	0.026
	(0.046)	(0.031)	(0.037)
Male	0.002	0.007	0.003
	(0.016)	(0.016)	(0.014)
Urban	0.182***	0.179***	0.167***
	(0.025)	(0.017)	(0.014)
Training	0.081*	0.090	0.074
	(0.040)	(0.048)	(0.046)
Year 1996	0.479***	0.367***	0.445***
	(0.037)	(0.038)	(0.052)
Sindh	0.112**	0.109***	0.089**
	(0.045)	(0.024)	(0.031)
KPK	–0.162**	–0.160**	–0.174***
	(0.049)	(0.054)	(0.047)
Balochistan	0.034	0.036	0.039
	(0.72)	(0.072)	(0.072)
Food, beverage and tobacco	–0.578*	–0.291**	–0.142**
	(0.269)	(0.105)	(0.051)
Textile wearing apparel, leather industry	–0.750*	0.118	–0.208***
	(0.330)	(0.082)	(0.049)
Paper, paper products, printing, publishing	–0.473	0.463***	–0.034
	(0.304)	(0.111)	(0.071)
Chemical, petroleum, coal, rubber & plastic	–0.394	0.500***	0.008
	(0.264)	(0.103)	(0.081)
Basic metal industries	–0.252	0.607***	0.092
	(0.235)	(0.111)	(0.068)
Fabricated metal, machinery & equipment	–0.336	0.387***	–0.054
	(0.186)	(0.102)	(0.050)
R- Squared	0.174	0.177	0.186
Number of Observations	10337	10337	10337

Notes: ***,**,* indicate significance at 1 percent,5 percent, 10 percent respectively.
Standard errors are written in parenthesis.
The robust standard errors are corrected for clustering at the industry level.

To test the validity of Models 2, 5 and 6, an F-test was carried out by comparing each with a restricted model which had no interaction term. The F-test showed that for *H0*: no significant difference between the two models, the null hypothesis was rejected for all three models. Moreover, this test is confirmed by the *p*-values of each model. For Model 2, the *p* value (0.0378) is significant at 5 percent level. For Models 5 and 6, the p values 0.0015 and 0.0031 respectively are significant at 1 percent level. Table 10 shows these results. These results confirm that the three separate models with import penetration, export ratio and relative prices as indicators for trade openness are valid and therefore, more suitable to study the impact on wage inequality than Model 4 which has all three indicators together.

Table 10

F-Test

Import Penetration* Skilled= Import Penetration* Semi-skilled= Import Penetration* Unskilled
$F(3,6) = 5.45$
Prob > F = 0.0378
Export Penetration* Skilled= Export Penetration* Semi-skilled= Export Penetration* Unskilled
$F(3,6) = 20.20$
Prob > F = 0.0015
Price*Skilled= Price*Semi-skilled= Price*Unskilled
$F(3,6) = 15.50$
Prob > F = 0.0031

5. DISCUSSION

In the empirical analysis, as stated earlier, three indicators of trade liberalisation i.e. import penetration, export ratio and relative prices were used together in one model, (Model 4) to study the effect on wage premiums based on skill. However, this model produced insignificant results for the indicators of import penetration and relative prices for all skill types. A significant impact on wage inequality was only seen with respect to export penetration for the semi-skilled and unskilled labour, which showed that wage inequality decreases as the ratio of exports with respect to the value added increases, leading to a rise in wage premiums. If this model was to be considered, then it would signify that the reduction in tariffs and non-tariff barriers, for import competing industries, does not lead to a change in wages for any skill. Neither does the increase in relative prices of each industry. However, if trade openness as indicated by research, has lead to a significant positive change in the composition of production towards manufacturing in Pakistan and also to a reduction in labour force participation inequality based on gender [Hyder, *et al.* (2011)], then the possibility of trade's impact on wage inequality is not far-fetched.

In addition, the interaction terms of the three variables turned out to be correlated with each other, casting doubt on the validity of the results of the first model. Therefore, the effect of the three indicators was investigated separately. When Model 2 was estimated with only import penetration dummies, the corresponding results regarding increasing wage inequality matched those of Galiani, *et al*. (2003). Their results depicted that an increase in import penetration ratio in the country leads to higher wage premiums of skilled workers relative to other skill based labour. This revealed a significant widening of the wage gap. While the results of Model 2 also show a similar increase in the premium for skilled labour, it also shows significant decrease in skill premium for unskilled labour, significantly widening the wage gap in Pakistan's case as well.

Moreover, results of this paper oppose the findings of Goh, *et al.* (2005), who conducted a study for Poland. They find wage premiums to have increased for unskilled labour, while there being no impact on the skilled premium, with the reduction in tariffs. Their results support the findings of Stolper-Sameulson. The difference from this study's results can be attributed to the fact that Poland carried out trade liberalisation while being in the transitioning stage, and thus the increase in wages for the unskilled is likely to be influenced by greater efficiency that usually follows the transition from a planned to a market economy.

It is also relevant to compare these findings with that of India and Bangladesh, since they are quite similar to Pakistan, in terms of wage structures and trade reforms. According to Mishra (2005), the impact of tariffs and non-tariff barriers on wages in India is such that, sectors with a higher proportion of unskilled labour and higher reductions in protectionist measures will experience an increase in relative wages, relative to those sectors with skilled labour. One reason for the differences between our results could be attributed to the fact that this paper does not look at the skill based impact of trade reforms for each sector. Moreover, the trade reforms in India were much more drastic than those in Pakistan so that might have led to a variation in results.

Furthermore, in model 5 only the effect of export penetration ratios on wages was studied. This model supports the results of Model 2 by also depicting increasing wage inequality. This model predicts increases in the wages for skilled and semi-skilled workers, while there being no significant effect on wages of the unskilled. This result, along with that of the previous model is somewhat similar to the case of Bangladesh. Munshi, *et al*. (2006) use four measures of trade openness. With respect to their results on trade liberalisation through measure of exports and imports, our results are quite consistent. Their coefficient is lower for unskilled and higher for skilled, leading to greater wage inequality. However, with respect to their relative price measure, their results diverge from the results of our model 6, where we find that relative price interaction terms depict a rising wage inequality due to relatively high premiums for skilled and semi-skilled labour. According to Munshi, *et al*. (2006), changes in prices due to openness have an insignificant effect on wages. In their analysis different measures give quite contradictory results on the effect of trade liberalisation on wage inequality. Therefore, in their final analysis, they conclude that due to overlapping standard errors of estimated coefficients, there is no statistically significant difference between the effect of the above measures of liberalisation on wages for unskilled and skilled workers. Though their overall result conflicts with the results of this paper, it must be considered that similar to the case of India, the case of Bangladesh also looks at sector specific data.

6. CONCLUSION

This paper examined the role of trade liberalisation on wage inequality for the period 1996-2005, by combining micro level data from the Labour Force Survey of Pakistan with national data on trade variables from the Federal Bureau of Statistics. Three measures representing the introduction of trade reforms were introduced that is, import penetration, export penetration and relative prices for the manufacturing sector, in order to study the effect on wage premiums based on different levels of skill and by using inter-sector and time variability. The findings indicate that while it is difficult to study the effects of trade liberalisation by using all the measures together, but by analysing them separately, Pakistan's wage premiums for the skilled rise relatively to those for the unskilled. It also predicts that a 10 percent increase in import penetration, increases the wage premiums for the skilled workers by 2.12 percent, while it reduces the wages premiums of the unskilled workers by nearly 2 percent. Furthermore, it can be observed that a 10 percent increase in export penetration increases premiums of the skilled and the semi-skilled workers by 4.8 percent and 1.8 percent respectively, while having no impact on the wages of the unskilled worker. This implies that wage inequality has risen in Pakistan due to the effects of trade openness; a result contrary to the predictions of the Stolper-Samuelson Theorem as well as to the experience of countries like India and Bangladesh.

This contradiction can be explained by the fact that Pakistan aimed to protect non-skill intensive firms in favour of skill intensive firms during its policy of trade liberalisation, similar to the case of Mexico [Robertson (2000)]. This eventually led to the rise in relative prices of skill intensive goods and consequently, the transfer of resources from firms that employed unskilled labour to those that employed skilled labour. This shift not only increased the demand for skilled labour, increasing their wages but also decreased the demand for unskilled labour, causing a fall in their respective wages. Therefore, Pakistan's inconsistent and discriminatory trade liberalisation policy contributed to its widening of the wage differential between the skilled and the unskilled worker, and consequently to the failure of the Stolper-Sameulson Theorem.

However, these results must be considered keeping in mind some shortcomings. Most of the empirical research about the trade liberalisation impacts on wages has been done using Panel data for industries, which is not available in case of Pakistan. This allows researchers to control for sector and time fixed effects and can be used to evaluate how trade liberalisation impacts wages for different skill levels across different industries. Furthermore, the availability of industry specific trade data in case of Pakistan is also a shortcoming, in estimating such a model. Another limitation of our analysis is that, our model considers two surveys for the ten year period, and therefore, more accurate results could have been obtained using yearly surveys for all these ten years.

Despite these shortcomings, the paper enriches the line of studies in the international trade literature that could assist policy makers in developing countries engage in an informed decision-making concerning whether trade liberalisation is best to reduce wage inequality. Empirically, it would further be useful to investigate how trade liberalisation impacts wage inequality for workers at three-digit industry level, to provide a deeper analysis. Furthermore, effects of trade liberalisation on wage inequality across skill levels could be seen controlling for other events like recession, devaluation and oil boom. These may be lines of enquiry for the future research.

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Impact of Public Debt on the Economic Growth of Pakistan

NAEEM AKRAM

1. INTRODUCTION

Heavy indebtedness of the developing countries is one of the major challenges at the beginning of 21st century. Needless to point out that government can finance its budget and development efforts by borrowing or taxing the output. However, taxes tend to distort the structure of relative prices, borrowing, if pushed beyond the carrying capacity of an economy, creates problems of intergenerational equity, and it can cause a transfer of resources that tends to be undermining growth. Yet borrowing has to be done to finance the public expenditure in order to increase social welfare and promote economic growth.

Public debt can be classified as sum of external debt and domestic debt. As far as the relationship between external debt and economic growth is concerned, a reasonable level of borrowing is likely to enhance economic growth, through capital accumulation and productivity growth [Chowdhury (2001)]. Because at early stages of development, countries have small stocks of capital and they have limited investment opportunities. External borrowing for productive investment creates macroeconomic stability [Burnside (2000)]. It is also been seen as capital inflow having positive effect on domestic savings, investment and economic growth; it implies that foreign savings complement domestic savings to cater for investment demand [Eaton (1993)]. However, high level of accumulated debt has an adverse effect on rate of investment and economic growth. Most broad rationalisation of the adverse effect of debt is "debt overhang" effect. If there is likelihood that in future, debt will be larger than the country's repayment ability then anticipated debt-service costs will depress the domestic and foreign investment [Krugman (1988); Sachs (1990); Karagol (2002)]. The other channel through which debt obligations affect economic growth is known as "crowding out" effect. If greater portion of foreign capital is used to service external debt, very little remains available for investment and growth. Debt-servicing cost of public debt can crowd out public investment expenditure, by reducing total investment directly and complementary private expenditures indirectly [Karagol (2002); Diaz-Alejandro (1981)]. However, various authors [Pattillo, *et al.* (2002, 2004)] are unable

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to find evidence of a significant crowding out effect, while others [i.e., Chowdhury (2004); Clements (2003); Elbadawi, *et al.* (1999)] finds that both debt burden and debt service obligations have reduced the investment and economic performance.

In developing countries, policy makers and international organisations have given domestic debt far less attention as compared with external indebtedness. Issuing domestic debt, whether to finance fiscal deficit or to mop up monetary liquidity, involves a complex assessment of the costs and benefits to the economy. The justification behind creation of domestic debt in poor countries is that it kindles development of deep and liquid internal financial markets, protect countries from unfavourable external shocks, and mitigate foreign exchange risk [Del (2003); Aizenman, *et al.* (2004); Kumhof (2005)]. Domestic debt can crowd in risky private sector investment by protecting bank balance sheets and profitability [Barajas Salazar (1999, 2000)]. As such, investments are more proficient than investment that is associated with low risk. Most important concern about domestic debt is crowding out effects on private investment. When governments borrow domestically, they use domestic private savings, otherwise that may have been on hand for private sector lending. In turn, smaller residual pool of loan able funds was available in market to elevate the cost of capital for private borrowers. It results in dropping private investment demand, and therefore capital accumulation, growth and welfare [Diamond (1965)]. Domestic debt is also viewed as more expensive in comparison to concessionary external financing [Burguet and Ruiz (1998)]. As a result, interest load of domestic debt may absorb important government revenues and thus crowd-out pro-poor and growth enhancing expenditures. High-yielding government domestic debt held by banks can make them self-satisfied about costs and decrease their efforts to mobilise deposits and fund private sector projects [Hauner (2006)].

The present study will explore the impacts of public debt on economic growth in Pakistan. Furthermore, as investment is the basic channel through which public debt affects growth. Therefore, it becomes very important that the relationship between debt and investment is also explored, which is what this study also seeks to do.

The organisation of the paper will as follows; after the brief introduction in Section 2 a brief review of the literature is presented, Section 3 presents a brief scenario of public debt, and economic growth in Pakistan, whereas the Section 4 provide a detailed discussion on theoretical model, data and estimation methodology. Section 5 and 6 are devoted for discussion of the results of growth and investment models respectively. The last section presents the conclusions emerged from the study and policy implications.

2. LITERATURE REVIEW

Numerous studies have dealt with the debt-economic growth relationship over the last two decades. After the second oil crisis in 1979, all countries were affected by the worldwide recession of 1980-83. Due to low goods prices, high real rates of interest and slow growth in the industrial countries, some debtor countries have experienced debt servicing problems. Therefore, the period since 1982 has been portrayed as a period of debt overhang. An overview of literature is summarised as under.

Levy and Chowdhury (1993) has concluded that an increase in the public and publicly guaranteed external debt may indirectly depress the level of GNP by discouraging capital formation and encouraging capital flight due to tax increase expectations. Cunningham (1993) found that debt burden has a negative effect on economic growth because of the impact on the productivity of labour and capital. In another study Sawada (1994), finds that heavily indebted countries (HICs) have debt overhang problems. Since their current external debts are above the expected present value of the future returns. Many other studies; Chowdhury (2001), Siddiqui and Malik (2001), Easterly (1999, 2001 and 2002) and Sen, *et al.* (2007) comes to the same conclusion that external debt negatively affects economic growth. Impact of high debt on growth appears to operate through both a strong negative effect on physical-capital accumulation and on total factor productivity (TFP) growth. In addition, neither TFP nor private savings rates are affected by external debt levels [Patillio, *et al.* (2004)]. Fosu (1996) argued that GDP growth is negatively influenced via diminishing marginal productivity of capital. It was also estimated that on average a high debt country faces about one percentage reductions in GDP growth rate annually. Latter on Fosu (1999), comes to the conclusion that negative relationship between economic growth and debt might be due to a poor performance of recipient country.

Smyth and Hsing (1995) find that in early 1980, debt ratios rose but it was below 38.4, and debt-financing have stimulated the economic growth. On the other hand, during 1986-93, debt ratio rose from 40.7 percent to 50.9 percent. This ratio is above the (38.4) optimal debt ratio and it is expected to adversely affect the economic growth. In another very comprehensive study Patillo (2002) indicated that on average, external debt is growth-enhancing up to about 160 percent of export to debt level, and growth-reducing thereafter (i.e. the debt overhang range). Furthermore study suggests that the debt overhang mechanism works through the productivity of investment as much as it does through the volume of investment. However, Maghyereh, *et al.* (2002) comes to the conclusion that in Jordon, external debt below the threshold level of 53 percent of GDP has a positive relationship with GDP and thereafter the relationship turns to be negative. Blavy (2006) finds that 'threshold level of debt' is 21 percent of GDP, below that level, debt is positively associated with productivity, but the coefficient for the "above threshold debt" becomes negative and significant. The total effect of high debt is significantly negative. It found that doubling of public debt would reduce productivity growth of about 1.5 percent.

As mentioned earlier investment is very important channel through which economic growth is affected. Cohen (1993) found that the level of debt does not explain the slowdown of investment in highly indebted developing countries. Warner (1992) suggests that the reasons behind the decline of investment in many of the heavily indebted countries are declining exports prices, high world interest rates, and sluggish growth. These shocks could have directly caused investment to decline. It was argued that debt failed to have a negative coefficient as the debt theories predict. These finding were criticised by Rockerbie (1994) and it was argued that these shortcomings may have caused investment to be biased and unreliable testing method. Deshpande (1997) also comes to the conclusion that relationship between external debt and investment is negative.

Metwally (1994) found that capital inflows have a significant impact on the growth in Algeria, Egypt and Morocco. In a study on Kenyan economy, Maureen (2001) finds that current debt flows, stimulate investment while past debt accumulation discourages investment. This confirms the existence of a debt overhang problem in Kenya. It has also been found that 'crowding out' of current investment as a result of servicing relatively large amounts of external debt so debt servicing does not appear to affect growth adversely but has some crowding out effects on private investment.

Abbas (2004) finds that there was a significant positive growth payoff to debt, even at the very high levels, 93 percent of GDP. Analysis presented quite a complex picture of the relationship between debt and growth, and domestic debt and growth. On one hand, the results seemed to affirm conventional wisdom that the decision to switch the source of budgetary finance from external to domestic debt would be fraught with difficulties. On the other, the study obtained quite robust results on the growth payoff of domestic debt issuance in more developed financial systems. However the overall relationship remained negative. Abbas (2007) has extended its previous work; and finds the evidence that above a ratio of 35 percent of bank deposits domestic debt undermines economic growth.

Anwar (2002) concluded that if exports remain stagnant, then devaluation has directly increased foreign debt in rupee and results in dramatic increase in debt service burden, lower economic growth and higher poverty level. Study argues that it is crucial to address basic reasons that caused debt build-up and subsequent adverse effects on economic growth and poverty levels while designing a debt reduction strategy. Policy of tax reforms, expanding the production and export base and creating diversification in exports can be handy in tackling debt problem.

In another study, Waheed (2006) concluded that there is primary deficit so it has to be filled out by domestic debt. The only way to stop the process of debt accumulation is to reduce the primary deficit by continued fiscal adjustment. This adjustment should not be achieved on the cost of cut in development expenditure rather there is need for serious efforts to increase domestic tax revenue.

From the review of literature it can be broadly surmised that divergent opinions exist on practically every aspect of the relationship of debt with key economic variables. Firstly, most of the studies on the subject focus on the relationship between external debt and economic growth, neglecting domestic debt entirely or mentioning it in the passing. The reason is the understanding that, unlike domestic debt, external debt is more difficult to service and repay. But this is true only when the domestic debt is moderate and not when it is large and growing. Secondly, most of these studies have been conducted by using panel data. There is very limited studies on Pakistan on the impacts of public debt on economic growth.

3. SITUATION OF PUBLIC DEBT IN PAKISTAN[1]

At the time of independence Pakistan was a poor and underdeveloped country. In order to stimulate economic growth, adequate revenues are a prerequisite but since its independence, Pakistan is facing financial crunch. Confined revenues and savings coupled with rising expenditures have caused situation of persistent fiscal deficit over the years. Similarly, situation of balance of payment is also not satisfactory and Pakistan is facing current account deficit. These deficits are filled by public debt and Pakistan has to spend considerable portion of its GDP on interest payments of the loans. The need to service debt obligation is undermining economic performance and resulting in collapse of development planning. Because debt obligations and expenditure on debt servicing become a resource drain for already limited revenues and is halting economic growth and poverty reduction efforts. Decade of 1990s is a typical example of this situation, during

[1]For detailed discussion, see Akram (2010) and Akram, *et al*. (2011).

1990s Pakistan is facing severe fiscal deficit, elevated public debt and near to the ground economic growth and rising incidence of poverty. Developing countries with higher incidence of public debt have to cope up with the same situation.

Several points can be concluded after examining Public debt scenario in Pakistan. Firstly, debt problem has been in making for a long time. Inability of successive governments to reduce fiscal deficit significantly, unproductive use of debt and stagnant growth in real revenues has fuelled the debt problem. Secondly, rising public debt in Pakistan is largely contributed by factors like stagnant government revenues and high real cost of borrowing. Resultantly, sharp fluctuation in real cost of borrowing, dynamics of the growth in public debt also changed over time. Thirdly, debt problem cannot be detached from broader issues of economic strategy and management especially policies regarding savings, exports, and revenue, expenditure etc. Lastly, due to rising expenditure on debt servicing governments have always reduced development expenditure instead of reducing the current expenditure. Pakistan's increasing debt servicing requirements during 1990s exerted significant strain on fiscal management. To meet the commitments under IMF's structural adjustment programme, Pakistan had to reduce size of the budget deficit to less than 5 percent of GDP during 1990s. As revenue generation efforts are only partially successful and Pakistan is unable to generate adequate revenues to meet expenditure. Consequently, successive governments have tried to reduce deficit by reducing development expenditure that has hampered economic growth process and resulted in decline in human development indicators and it has raised incidence of poverty. Moreover, public debt servicing placed serious constraints for priorities of government's budgetary allocations, leaving very limited resources available for development expenditure. However, improved situation of Debt obligations aftermath of 9/11, Pakistan got considerable fiscal space to increase expenditure on development projects especially in social sector and infrastructure development, extremely vital for pro poor and sustainable economic growth. Pakistan got much needed fiscal space but it is debatable whether Pakistan has developed a sound fiscal policy to get long-term benefits from it or not. Debt explosion coupled with higher fiscal and current account deficit resurfaced in 2008 and is a major threatening syndrome for economic management, it depicts that Pakistan has wasted the opportunity for sustainable growth.

4. DATA AND METHODOLOGY

The model used in the present study is borrowed from Cunningham (1993), wherein debt burden has been introduced into the production function. This is because debt burden has important implications for the capital and labour productivity. Nations that carries a significant debt burden required to spend portion of its resources to service its debt liabilities having significant implications on decisions regarding the employment of labour and capital in the production function. The growth equation[2] in the reduced vector form can be written as under:

$$y_t = \alpha + \beta y_{t-1} + \sum_{j=1}^{k} \delta x_{tj} + \sum_{m=1}^{p} \pi Debt_{tm} + \varepsilon_t \qquad \ldots \qquad \ldots \qquad \ldots \qquad (1)$$

Where y_t is log of per capita GDP at t time and y_{t-1} is lagged value of GDP. x_{tj} is a vector of control variables, x_{tm} is the vector of various public debt indicators, and ε_t is the classical error term.

[2]For the detailed derivation of the model, see Cunningham (1993).

Keeping in view the importance of investment, Presbitero (2005) is of the view that it is better to disentangle the analysis of public debt and economic growth in a two-step relationship. Firstly, the direct links between public debt and economic growth are explored then relationship between public debt and Investment is also analysed. Following the analogy that investment is the basic channel through which debt affects economic growth. The vector form equation for the investment can be written as under:

$$Inv_t = \alpha + \sum_{j=1}^{k} \delta x_{tj} + \sum_{m=1}^{p} \pi Debt_{tm} + \varepsilon_t \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (2)$$

Where inv_t is log of investment at t time and x_{tj} is a vector of control variables, x_{tm} is the vector of various public debt indicators, and ε_t is the classical error term.

To empirically test, the relationship between public debt and economic growth, time series data of Pakistan for the period of 1972-2009 has been used. Different variables have been used in various studies to analyse the impact of public debt on economic growth. A brief description and some background of the variables used is summarised in Table 1 below:

Table 1

Data Source

Sr. No.	Name of Variable	Data Source	Description
1.	Per Capita GDP (Yt)	WDI [3]	Different measures of GDP growth have been used in literature e.g. Per capita GDP, GDP growth rate, Real GDP, Real GNP etc. In the present study, we have used per capita GDP because it captures the perspective of economic growth and welfare.
2.	Investment (Kt)	WDI	For capital stock the main variables used in the literature are gross domestic investment (Gross capital or gross fixed capital formation), Investment/output ratio, (Capital stock is calculated by using hedonic valuation method and by using the perpetual inventory method). The present study uses gross capital formation as a ratio to GDP.
3.	External debt (ED_Y)	GDF [4]	The indicators of public debt are categorised as:
4.	Domestic Debt (dd_y)	IFS [5]	**Stock Variables:** The stock variables relates to value of the debt burden to different key economic indicators e.g. debt/exports ratio, debt/GDP ratio, domestic debt/GDP ratio. The most widely used indicator to judge stock of public debt (including external debt) is its ratio to GDP.
6	Debt Servicing (DS_X)	GDF	**Flow Variables:** Flow variables focus on debt service payment. Public debt consists of two parts i.e. external debt and domestic debt. In the study, we have used Public External Debt/GDP, Domestic Debt/GDP and Debt Servicing/Exports ratios.
7.	Exports	WDI	
8.	Imports	WDI	
9.	Openness (op)	WDI	The variables used to measure openness includes tariffs and quotas, real exports, real imports, balance of trade and the ratio of exports and imports as percentage of GDP. The present study uses the (Exports + Imports)/GDP*100 as a proxy for openness.
11.	Inflation (inf)	WDI	In order to capture the impact of uncertainty created by debt/debt servicing, inflation becomes very crucial as a control variable. There exist different indicators to measure inflation. Consumer price index and GDP deflator are most widely used indicators of inflation. In this study, we have used CPI as an indicator of inflation.

[3]*World Development Indicators* (World Bank).
[4]*Global Development Finance* (World Bank).
[5]*International Financial Statistics* (IMF).

Estimation Methodology

For the time series, in order to guard against spurious regression, the first step is to see whether the series is stationary or non-stationary; to ensure that unit root tests are used. The time-series method used has the problem of settling at the very outset the issue of the stationarity of the data. If some variables are I(I) then standard regression analysis may yield spurious results.[6] To tackle that issue the latest approach is the cointegration analysis. In the present study, ADF unit root test has been applied. The detailed results of unit root test are summarised in Table 2 below:

Table 2

Results of Unit Root Test

	Level			1st Difference		
Name of Variable	Intercept	Trend and Intercept	None	Intercept	Trend and Intercept	None
Yt	–1.3058	–3.1201	–3.1851	–3.9636*	–	–
OP	–2.3112	0.2769	–5.6354*	–	–	–
INF	–3.2371**	–	–	–	–	–
KT	–2.3304	–2.2869	–5.0182*	–	–	–
ED_Y	–1.0071	–1.1647	–1.2025	–4.5151*	–	–
DD_Y	–2.8093	–2.6208	–0.1687	–5.1595*	–	–
DS_X	–2.0982	–2.9363	–0.7879	–7.9247*	–	–

Null Hypothesis: Existence of unit root. *, **denotes the rejection of Null at 5 percent and 10 percent level respectively.

The results of unit root test reveal that the model is a mixture of I(0) and I(I) variables, so most appropriate method for estimation in these circumstances is Autoregressive Distributed Lags Model (ARDL) Cointegration technique proposed by Pesran, *et al.* (2001).

The basic conditional VECM equation for the relationship between public debt and economic growth Equation 2 can be written as under.

$$\Delta y_t = \alpha + \gamma_1 y_{t-1} + \gamma_2 op_{t-1} + \gamma_3 k_{t-1} + \gamma_4 ed\_y_{t-1} + \gamma_5 ds\_x_{t-1} + \gamma_6 dd\_y_{t-1} + \gamma_7 inf_{t-1} + \sum_{i=1}^{\rho} \omega_i \Delta y_{t-i} + \sum_{i=0}^{\rho} \tau_i \Delta op_{t-i} + \sum_{i=0}^{\rho} \sigma_i \Delta k_{t-i} + \sum_{i=0}^{\rho} \beta_i \Delta ed\_y_{t-i} + \sum_{i=0}^{\rho} \varphi_i \Delta ds\_x_{t-i} + \sum_{i=0}^{\rho} \theta_i \Delta dd\_y_{t-i} \sum_{i=0}^{\rho} \pi_i \Delta inf_{t-i} + \varepsilon_t \quad \ldots \quad \ldots \quad \ldots \quad (A)$$

Where γ_i the long run multipliers are α is the intercept and ϵ_t is the error term. Similarly, the ARDL specifications for investment is presented in equation B:

$$\Delta k_t = \alpha + \gamma_1 k_{t-1} + \gamma_2 inf_{t-1} + \gamma_3 yt_{t-1} + \gamma_4 ed\_y_{t-1} + \gamma_5 ds\_x_{t-1} + \gamma_6 \mathrm{dd\_y}_{t-1} + \sum_{i=1}^{\rho} \omega_i \Delta k_{t-i} + \sum_{i=0}^{\rho} \tau_i \Delta inf_{t-i} + \sum_{i=0}^{\rho} \sigma_i \Delta y_{t-i} + \sum_{i=0}^{\rho} \beta_i \Delta ed\_y_{t-i} + \sum_{i=0}^{\rho} \varphi_i \Delta ds\_x_{t-i} + \sum_{i=0}^{\rho} \theta_i \Delta dd\_y_{t-i} + \varepsilon_t \quad \ldots \quad \ldots. \quad \ldots. \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (B)$$

Where α is intercept, ε_t is the error term, similarly $\gamma_1 \ldots\ldots \gamma_6$ are the long run coefficients and ω, τ, σ, π, β, φ and θ are the short run dynamic coefficients. It is also worthwhile to define the variables here *y*, *k*, *op* and *inf* denote per capita GDP, investment openness and inflation respectively. Similarly, *ed_y* (external debt as percentage of GDP), *ds_x*

[6]Newbold (1974).

(debt servicing as percentage of exports) and *dd_y* (domestic debt as percentage of GDP) are the major indicators of public debt used in the analysis. From these equations long run and short run relationships can be derived.

5. GROWTH EQUATION RESULTS

As mentioned above, Equation **A** has been estimated for cointegration. The ARDL cointegration procedure begins with conducting the bound test for the null hypothesis of no Co-integration—i.e.

Ho: $\gamma_1 = \gamma_2 = \gamma_3 = \gamma_4 = \gamma_5 = \gamma_6 = \gamma_7 = 0$ against the alternative hypothesis of
H1: $\gamma_1 \neq \gamma_2 \neq \gamma_3 \neq \gamma_4 \neq \gamma_5 \neq \gamma_6 \neq \gamma_7 \neq 0$

For F-test, the selection of maximum lag length is very important. The observations in the study are annual and we have only 36 observations with seven parameters. For such short observations, as suggested by Pesaran, *et al.* (2001), we have selected a maximum lag length of 2. The estimation results of F-test for the level of significance are summarised in Table 3.

Table 3

Bound F Test Results

Country	F-Statistic Value	Lag Length	Significance Level	Bound Critical Values	
				I(0)	I(I)
			1%	2.96	4.26
Pakistan	5.547	2	5%	2.32	3.50
			10%	2.03	3.13

The results reveal that the F-statistic is greater than the upper bound critical values. It depicts that there exists a co-integrating relationship among the variables. After determination of the existence of cointegration among the variables, the next step in the ARDL approach is to determine the long-run coefficients for equation A. To find out the optimal length for the long-run coefficients of Equation (A), Schwarz Bayesian criterion (SBC) of the lag selection is utilised. The long-run results are summarised in Table 4.

Table 4

Long Run Estimation Results (1,1,0,0,1,2,0)

Variable	Coefficient	Std. Error	t-Statistic
Constant	0.817945	0.199972	4.090287
KT	0.015222	0.006844	2.224182
OP	0.078454	0.040259	1.948709
ED_Y	–0.161078	0.026391	–6.103601
DS_X	–0.002903	0.014712	–0.197318
DD_Y	–0.017687	0.017090	–1.034935
INF	0.004254	0.002469	1.723192
R-squared		0.995548	
Adjusted R-squared		0.994131	
F-statistic		702.7534	
Prob(F-statistic)		0.000000	
Serial Correlation LM Test		0.864945	
P value of LM Test		0.44101	

*and ** represent significance at 5 percent and 10 percent level respectively.

Long-run Relationships

The results confirm the negative relationship between external debt indicators and economic growth. External debt as percentage of GDP has significant and negative relationship with per capita GDP in Pakistan. Debt servicing as percentage of exports has insignificant relationship in Pakistan. It reveals that in Pakistan, debt overhang hypothesis seem to have played a significant role while the crowding out effect of external debt is not significant. The effects of domestic debt are negative and insignificant relationship with per capita GDP. Domestic debt has both positive and negative effects on economic growth. However, financial markets liberalisation and macroeconomic stability is a necessary condition for the domination of positive effects [Del (2003)]. Pakistan is lacking on these grounds so negative impacts of domestic debt are dominating.

The conventional wisdom is that investment enhances economic growth. This proposition has received support from various studies—e.g. Barro (1991), Pattillo, *et al.* (2002) and Abbas (2007)—which say that investment has had a positive relationship with per capita GDP. Openness is found to have positive and significant relationship with per capita GDP. It also supports the conventional wisdom that globalisation and free trade promotes economic growth. It is supported by various earlier studies including Naqvi (2010). Similarly, inflation is also have a positive and significant relationship with economic growth, supporting the view that reasonable level of inflation (by giving incentive to the investors) enhance the economic growth. This result is further confirmed by the analysis of investment. It is noteworthy that during the selected time period in Pakistan (except for few years) inflation remained in single digit.

Diagnostic tests results suggest a high value of R^2 revealing that overall goodness of fit of the model is satisfactory considering the number of variables. The F-Statistic measuring the joint significance of all the regressors in the model is also statistically significant. Serial correlation LM test indicates that there exists no serial correlation.

Short-run Relationships

After estimating long run coefficients, the final step in ARDL approach is the analysis of Error correction and estimation of short run coefficients. According to the relevant theory if there is cointegration among the variables then in the short-run error correction will also happen. The results of Error Correction Model are summarised in Table 5.

According to the results given in the table above, the existence of a stable long-run relationship among the variables is further confirmed by the significant error correction term [Bannerjee and Mestre (1998)]. The coefficient of the error correction term also represents the speed of adjustment. That is following a disturbance in the unrestricted model how quickly the variables returned backs to their long-run values. The results suggests that following a shock, approximately 72 percent, adjustment towards the long-run equilibrium is completed after one year.

The results reveal that external debt as percentage of GDP has negative and significant relationship in the short run. As far as debt servicing as percentage of exports, it also has a negative and significant relationship in the short run with per capita GDP. However, domestic debt does not have a significant effect on per capita GDP in the short run. Similar to the long run investment has a positive and significant effect on per capita GDP in the short run. However in the short run openness and inflation has insignificant relationship with per capita GDP.

Table 5

Error Correction Representation of the Selected ARDL Model (1,1,0,0,1,2,0)

Variable	Coefficient	Std. Error	t-Statistic
Constant	0.00612	0.01592	0.38472
D(YT(–1))	0.166321	0.178915	0.929612
D(KT)	0.02280	0.07367	0.30953
D(KT(–1))	0.03135*	0.01189	2.63618
D(OP)	0.04721	0.03158	1.49520
D(ED_Y)	–0.18881*	0.03404	–5.54650
D(DS_X)	–0.01345	0.00962	–1.39762
D(DS_X(–1))	–0.02680*	0.00666	–4.02185
D(DD_Y)	0.02363	0.01561	1.51414
D(DD_Y(–1))	–0.00722	0.00949	–0.76047
D(DD_Y(–2))	0.02138**	0.01208	1.76959
D(INF)	–0.00300	0.00913	–0.32865
ECT(-1)	–0.68722	0.19955	–3.44384
R-squared	0.734593		
Adjusted R-squared	0.504573		
F-statistic	3.193611		
Prob(F-statistic)	0.017272		

*, and ** denote significance at 5 percent and 10 percent level respectively.

The cumulative sum (CUSUM) graphs show that coefficient of the short run lies within the critical limits and indicate stability in the coefficients over the sample period.

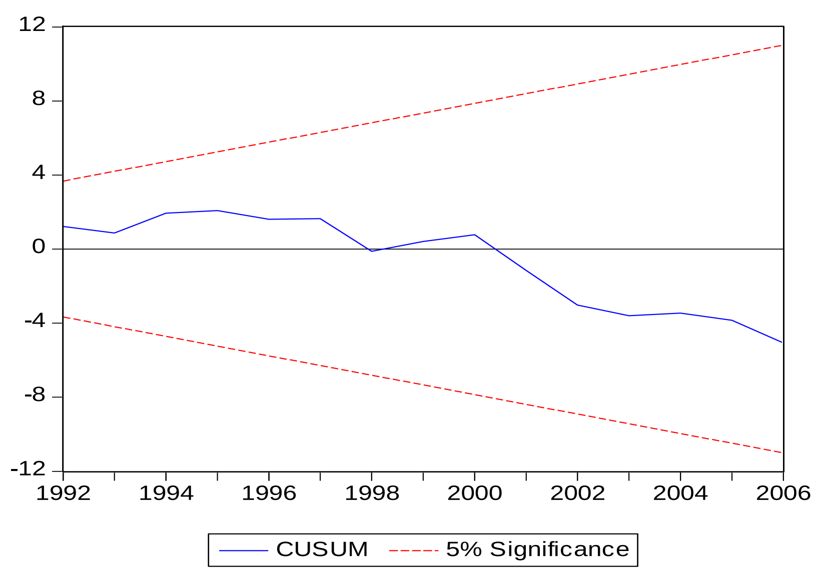

Fig. 1. CUMSUM Test

6. INVESTMENT EQUATION RESULTS

To analyse the impact of debt on investment Equation B will be used and following test of cointegration performed:

Ho: $\gamma_1 = \gamma_2 = \gamma_3 = \gamma_4 = \gamma_5 = \gamma_6 = 0$ against the alternative hypothesis of
H1: $\gamma_1 \neq \gamma_2 \neq \gamma_3 \neq \gamma_4 \neq \gamma_5 \neq \gamma_6 \neq 0$

Similar to the estimation reported above, maximum lag length of 2 has been selected. The results of F-test for the significance of are summarised in Table 6.

Table 6

Bound F-test Results

Country	F-Statistic Value	Lag Length	Significance Level	Bound Critical Values I(0)	I(I)
			1%	3.15	4.43
Pakistan	2.18	2	5%	2.45	3.61
			10%	2.12	3.23

The table shows that calculated F-statistics value lie within the bound limits at 10 percent level of significance. Therefore, these results are inconclusive and from the results of error correction model we will decide about the existence of the cointegration. After determination of cointegration among the variables, long run relationship is determined and long run coefficients are estimated for Equation B. The optimal length of the long-run coefficients is found by using the lag selection criterion of SBC. The long-run results of Equation (B) are summarised in Table 7.

Table 7

Long Run Estimation Results (1,0,1,1,1,2)

Variable	Coefficient	Std. Error	t-Statistic
INF	0.082148*	0.022979	3.574845
ED_Y	–0.164481*	0.073332	–2.242953
DS_X	–0.010207	0.038837	–0.262823
DD_Y	–0.095909*	0.048019	–1.997317
YT	0.080666**	0.04478	1.801379
Constant	2.117185	0.666954	3.174409
R-squared	0.645456		
Adjusted R-squared	0.552966		
F-statistic	6.978675		
Prob(F-statistic)	0.000254		
Serial Correlation LM Test	2.004280		
P value of LM Test	0.1597		

*, ** and *** denotes significance at 1 percent , 5 percent and 10 percent level respectively.

The Table 7 above reveals that in the long-run external debt as percentage of GDP has a negative and significant relationship with investment. It suggests that for Pakistan debt overhang hypothesis has a role in curtailing investment. However, debt servicing as percentage of exports has a negative but significant relationship with investment. Combined results of the impacts of public external debt and debt servicing show that in Pakistan, debt overhang is the major channel curtailing investment and per capita GDP.

The domestic debt also seems to have a negative and significant relationship with investment. This situation is well explained by Hauner (2006). He points out that government domestic debt held by banks results in making banks self-satisfied with their costs and makes them reduce their efforts to mobilise deposits to fund private sector projects. Hence, domestic debt reduces investment to some extent. In Pakistan, inflation, perhaps due to its mild nature has helped investment. It is also evident from the results that per capita GDP has a positive and significant relationship with investment.

The diagnostic tests show that there exists no serial autocorrelation and satisfactory goodness of fit. In the last step of ARDL the short run coefficient of the model are estimated and results are presented in Table 8.

Table 8

Error Correction Representation of the Selected ARDL Model (1,0,1,1,1,2)

Variable	Coefficient	Std. Error	t-Statistic
Constant	–0.02953	0.01504	–1.96324
D(KT(-1))	0.247017	0.15417	1.602239
D(INF)	0.034109	0.021647	1.575683
D(ED_Y)	–0.41422*	0.203461	–2.03586
D(ED_Y(-1))	–0.24726*	0.124859	–1.98033
D(DS_X)	–0.05105	0.036778	–1.38795
D(DS_X(-1))	–0.02393	0.027757	–0.86224
D(DD_Y)	0.033382	0.033803	0.987534
D(DD_Y(-1))	–0.04228	0.050002	–0.84557
D(YT)	–0.47572	0.560392	–0.8489
D(YT(-1))	0.538052*	0.285887	1.882046
D(YT(-2))	0.992588**	0.561617	1.767375
ECTK(-1)	–0.85042*	0.265804	–3.19944
R-squared	0.74623		
Adjusted R-squared	0.555902		
F-statistic	3.920766		
Prob(F-statistic)	0.006235		

* and ** denotes significance at 5 percent and 10 percent level respectively.

According to the results given in the table above, the existence of a stable long-run relationship among the variables is confirmed by the significant error correction term [Bannerjee and Mestre (1998)]. The results suggests that following a shock, after one year, about 85 percent adjustment back towards the long-run equilibrium is completed.

In the short run, public external debt has a negative and significant relationship with investment. It is also evident from the results that per capita GDP has a positive and significant relationship with investment in Pakistan. From the above results it can be concluded that debt variables have an insignificant relationship in the short run but a significant one in the long run.

The cumulative sum (CUSUM) graphs, indicate the stability in the coefficients over the sample period.

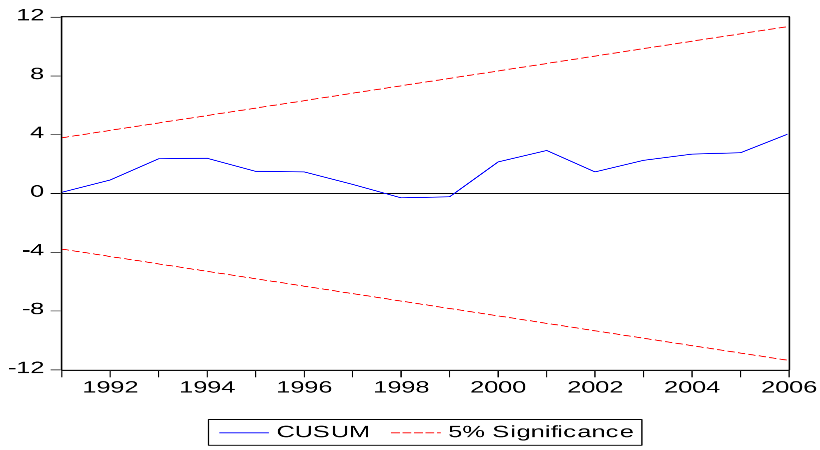

Fig. 2. CUMSUM Test

7. CONCLUSIONS AND POLICY IMPLICATIONS

The present study examines consequence of public debt for economic growth and investment regarding Pakistan. Furthermore, study has also investigated impacts of certain other variables on economic growth.

In Pakistan, public external debt has a negative and significant relationship with per capita GDP and investment, both in the short run and in the long run. Therefore, the results strongly confirm the existence of "Debt Overhang effects". On the other hand, only in the short run debt servicing has a negative and significant relationship with per capita GDP. But from this evidence we cannot infer the existence of the "crowding out effect" because debt servicing does not seem to significantly affect investment. Domestic debt has a negative and significant relationship with investment, suggesting that it has tended to crowd out private investment. However, domestic debt does not have significant relationship with per capita GDP; and that investment has a positive and significant relationship with per capita GDP. Keeping in view the findings of the study, first and foremost implication emerges that heavy reliance on external and domestic debt must be discouraged. Therefore, the policy makers should not use the debt to finance the deficits rather there is a dire need to enhance efforts to stimulate the revenue or reduce the current expenditures. The present study also shows that openness is growth enhancing; hence there is need that Pakistan may extend its efforts to increase the exports.

It may be interesting to highlight new areas of research that the present study suggests. In line with Pattilo, *et al.* (2002) and various others, this study is also unable to find out the full significance of "crowding out effect" of debt servicing, but there is consensus that debt servicing results in reducing the development expenditure. To test this argument further it is suggested that an empirical study may be conducted that explores the relationship between 3D's of public expenditure i.e. Development Expenditure, Defence Expenditure and Debt Servicing Expenditure. In that study by analysing the interlink-ages between 3D's, the government preferences for the development expenditure may be further explored. Furthermore, it is also suggested that a study may be conducted that may try to find out the optimal level of debt.

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Argentina: Economic Recovery and Tax Improvement after a Decade of Double Crisis

MIGUEL ANGEL ASENSIO

1. INTRODUCTION

During the last decade, Argentina was exposed to two main crises. The first one, was in the beginning of the initial decade of this century, the second one, during the years 2008 and 2009, as a consequence of the financial turbulence, still in course in the World.[1]

As it is well known, the first crisis concluded in a dramatic situation in terms of economic activity and in both, internal and external indebtedness. The default was a consequence of the crisis, in one hand, and the devaluation of the currency, in the other.

Since the year 2002, however, the signs of the recovery of the economy crisis began, and continue throughout the decade, ending in 2010 and in the course of the first months of 2011. Weighing the pros, the main indicators of level of activity showed positive results.

Also, during the same period, the primary balance of the national budget showed a favourable surplus, while the Taxes/GDP ratio increased continuously, getting a dramatic improvement that positions the country, together with Brazil, within the highest level of taxation in Latin America.

In what follows, I will try to expose briefly some of the indicators showing such evolution in economic and fiscal terms. In the end, I will essay some preliminary conclusions about this process, its weaknesses and virtues.

Given that the economic experiences could sometimes shed light on other scenarios, one particular aim will be to imagine particular reflections that would be useful in relationship for further comparative analysis and with the evolution of the economy in countries like Pakistan.

2. A BRIEF PRESENTATION

In times of Bicentennial of the Independence and in demographic terms, Argentina's present range of population is more than 40 million people, multiplying various times the human contingent in the years of the First Centennial. Anyhow, within the Latin American context, today, such population is behind the ones of Brazil, México and Colombia.

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[1]In the moment of closing this essay, the European countries are trying to reach an agreement for solving the situation on the Euro Area, because of the sequence of facts that followed the Greek debt.

Considering the total surface area, Argentina ranks among the ten biggest countries in the world, with 2.8 million square kilometers. Connected with the surface of the country, its population is of a moderate size, strongly concentrated in the Province of Buenos Aires and the Capital City. By contrast and in comparative terms, there is a low density population rate in huge extensions like Patagonia.

Located in the temperate region, the climate not always must be recognized with that of the Pampas, which is very friendly in terms of agricultural production. Dry climate and different soils are found in different parts of the country, like in the North, the West and the South.

Argentina has natural borders with Brazil, Paraguay, Uruguay, Bolivia and Chile. The Mercado Común del Sur (MERCOSUR) is an experience of integration which joins Argentina, Brazil, Paraguay and Uruguay, thus consolidating a potential huge market.

The trend in the population growth rate of the country is lower than in the other countries before mentioned. In the past, such characteristic has contributed to get acceptable rates in *per capita* terms[2] combined with not always good records of growth.

3. SHORT HISTORICAL NOTE

Initially, the Argentinean case, like others, is in essence a particular one. It is normal to remember that the country occupied a privileged position in terms of per capita GDP during the last part of the Nineteenth Century and the first part of the Twentieth Century.

The economic outcomes reached were visible. Following Maddison's data, it is possible to assert that just before the beginning of the First World War (1913), Argentina occupied the tenth place in the context of nations[3] because of the level of its GDP per capita.

It is widely accepted that such process was linked to a very generous endowment of natural resources in relation to a low population. It is also important to mention that during that time there was in advantageous coincidence with a growing demand of international products from temperate climate originating in Europe and other countries.

The usual comparison fostered for such evolution was with countries placed in a similar position like Canada, Australia and New Zealand bringing into being the so called "regions of recent settlement". One specific attribute of such countries was the relationship with Great Britain, the leading force in such "world of commerce".

The process was so intense that the rate of economic growth and development was clearly higher than in other countries. In spite of some allegation about a lowered growth after the First World War,[4] the evolution proved to be more successful in the countries of Oceania than in the Canadian one.[5]

However, such global behavior of the economy was strongly linked to the international demand that diminished after the Ottawa Agreements,[6] generating a less beneficial position of Argentina in relation with the "white dominions".

[2]See Ferreres, *et al.* (2005), for such data.

[3]See Madison (1995).

[4]We refer to the allegation from Di Tella-Zymmelman (1967), maintaining that in spite of having the conditions for industrial development around 1913, Argentina suffered a "phase of delay" in its pace and rhythm of economic growth.

[5]See Díaz Alejandro (1971).

[6]We refer to the Conference maintained in the year 1932 for Great Britain and nations of the British Commonwealth, getting a new arrangement for their reciprocal trade,

In a different way, Australia and Canada developed a wider scope of resources, including energy and the mineral ones, which conditioned Argentina's further development in the rest of the last century.[7]

The following history is well known too. After the 1930 economic crisis the country did not recover its privileged position in connection with the international trade and markets. In particular after the Second World War and along the second part of the past century, Argentina's evolution was one of permanent degradation regarding its international comparative position, showing occasional ups and downs during such evolution.[8]

The commercial partners were important, situation which is also relevant in Canada and Australia. The later substitution of the "British Connection" for those countries was very dynamic in a comparative perspective: for them, United States and Japan were actual locomotives.

There are plenty of explanations for Argentina's failure, ranging from some political interpretations, to sole economic reasons. We know a very celebrated and widely accepted comment by Simon Kuznets, who said that "there are four kinds of countries: developed, underdeveloped, Japan and Argentina".[9]

The last essay on economic policy under the logics of the Washington Consensus, implementing a system of currency board and an extensive programme of reform were based on the reduction of the state intervention and was initiated in the mid 1940's. Indeed, the liberalisation, privatisation of state companies and assets, opening of the economy as well as the pension sector and the fiscal regime ended with the hard conclusion of the whole regime in the turbulence generated by the 2001Crisis.

4. THE ARGENTINEAN ECONOMY IN THE 2001-2011 DECADE

From a simplistic point of view, one could begin saying that betterment in the situation was apparent during the years after the "big bang" Argentina suffered in the last days of 2001, after the collapse of the *currency board* system. As it is possible to imagine, it was a very strong change in flows and assets given such astonishing and enormous explosion.

However, progressively, a recovery was being apparent, quite dubiously at first and more strongly afterwards, given the floating and depreciation of the currency, the improvement of the external sector and the protective effects of such measure on the internal one, producing a progressive movement of economic upturn.

These results occurred initially without the presence of inflationary pressures, given the high level of unemployed factors in the origin, letting operate the expansionary forces positively and not eroding the low level of incomes then existing.

In the other way, it was possible to get a primary surplus in the public sector budget, in connection with the similar excess in the foreign trade. The economy followed for some years a virtuous path of "double surplus", the one corresponding to the public sector and the other to the commercial one.[10]

[7]See Asensio (1996).

[8]For some comparative insights, see Asensio (1996).

[9]See Asensio (1988, 1995). Curiously, it is famous an assert from Professor Paul Samuelson who affirmed that in the 1940's he would maintained that then "Argentina was the prospect" in terms of development.

[10]The opposite to other scenarios, were the result is one of "double deficit".

The trend observed in the GDP was one of positive annual rates maintained at an outstanding level. So, in recent times, it was possible to discover that Argentina was the third country in the last decade for the fast growing rhythm.[11] The indicator behaved positively, not only in global terms, but also in the *per capita* one too. The economic growth has been founded in the country, and not only was it *extensive*, but also *intensive*.[12]

This trajectory was continued without the presence of new international credit, except institutional creditors like the World Bank and the IADB, given the absence of private supporters in connection with the position of the country linked to the global market for bonds. Meanwhile, an important reconstruction of the debt was sorted out with a preponderant volume of those creditors, although a portion of them was not covered for the said agreements.

In such general scenario, it is not possible to omit the situation of the international markets for tradable goods. So, the soaring prices for commodities and agricultural products underlie the successful evolution of the Argentinean economy in these years. In particular, the level reached for the prices of soybean and soy oil produced by the country played a main role in this short story of particular “recovery from the ground”.

5. PRESENCE, EFFECTS AND ANSWERS TO THE RECENT INTERNATIONAL CRISIS

Given that the structure of international economic relations shows a strong influence from that of Asia and MERCOSUR, on first instance and at the official level, it was considered that the effects of the recession with a financial base would not be that important in Argentina.

The former assert obeys to the strong relationship standing with China–soy and soy related products- and with Brazil-mainly automotive industry which dominates the figures of the Chart below. In spite of that, the economic retraction was finally evident.

C-1

Argentina’s Foreign Trade (2010)

Order	Continent	Exports	%	Imports	%
1	Africa	4.002.331	5.9	336.998	0.6
2	America	33.683,4	49.4	30.023.358	53.1
3	Asia	15.680.146	23.0	13.018.393	23.0
4	Europa	13.191.721	19.4	12.387.358	21.9
5	Oceania	340.865	0.5	338.617	0.6
6	Various	1.235.602	1.8	396.820	0.7

[11] See *The Economist Online*, September 2011.

[12] Fort he notion of extensive and intensive economic growth, see among others, Marr-Paterson (1981).

At the best, since the last 2008-four-month-period, and during an important part of 2009, Argentina's GDP level was held back in its growing tendency, worsening also the employment statistics, inflation and credits to the private sector, situation that started from a decline generated in the external sector, with less imports and exports.[13]

In an economy where the foreign trade had a traditional relevance, the distortion of its magnitude, as a consequence of the worldwide situation already mentioned, would be the clear expression of a reversion in the favourable afore-mentioned tendencies. The commercial balance registered noticeably the bad news.

The "inward" spreading of the crisis in Argentina's economy made the deteriorations be verified in the labour market instance, people's falling in poverty, unregistered employment situations, and people's inequality, situations that, on the contrary, had been improving in countries that were included in the so called "rebirth of Latin America".[14]

C-2

Quarterly Economic Evolution in Argentina (2008/2011)[15]

Index	1/08	2/08	3/08	4/08	1/09	2/09	3/09	4/09	1/10	2/10	3/10	4/10	1/11
GDP	8.5	7.8	6.9	4.1	2.0	–0.8	–0.3	2.6	6.8	11.8	8.6	9.2	9.9
Employment	8.4	8.0	7.8	7.3	8.4	8.8	9.1	8.4	8.3	7.9	7.5	7.3	7.4
M	22.1	24.6	13.4	–0.9	–24.2	–26.3	–20.7	–4.1	30.1	35.6	37.4	32.7	20.4
X	6.1	–1.6	12.2	–11.2	–11.8	3.5	–17.4	2.5	4.2	18.2	27.8	7.4	7.1

In the previous graph it is possible to see that, from the first quarter in 2009, the deterioration effect in unemployment was verified, as well as the 2008-foreign trade brought forward, while the general economic reversal expressed by the GDP was explicit during the second and third quarter in 2009.

In such a context, it is quite surprising, nonetheless, that the time of the retraction reached a few quarters, situation that was quite clear when considering the after recuperation of the indicators showing the economic situation during 2010 and 2011.[16]

The 2008-2009 crisis moderate impact did not prevent to develop several measures to counteract it, fact which denied the previous assumptions of immunity before the phenomenon. Such answers could be identified with two important categories: (a) general procedures in economic politics, and (b) procedures with regard the federal system and federal-fiscal.

[13]There are discrepancies regarding the economic deterioration before mentioned. While there are provisional official numbers that identify it as a close to 1 percent growth, private estimations pointed out a recession higher than the 2 percent GDP. As we shall see, unemployment raised 8 percent and in 2009. The commercial balance between 2008 and 2009 showed a strong decline in exports and imports. In 2009, inflation was above 1 percent per month. Credit to the private sector, though it rose in nominal terms, it stopped its growth in real terms. In 2010 the improvement would be evident.

[14]See Special Reports on Latin America, *The Economist* (2010), page 13 and pages 1-18 of the Special Report.

[15]Acronyms used in the indexes are: GDP: quarterly Annual variations in the Gross Domestic Product; Employment: quarterly unemployment rate; M: quarterly imports annual variation, and X: quarterly export annual variation.

[16]Even when considering figures by inhabitants there was an expressed and notorious recuperation. According to *The Economist*, and considering provisional estimates in the Second quarter of 2011, Argentina was the third country, after China and India, in its GDP growth *per capita* since the fourth quarter in 2007 [*The Economist* online (2011)].

Among the firsts ones, it is possible to distinguish those that mean (i) to smooth and stimulate the fiscal and financing situation of the two taxpayers, like a moratorium and tax-amnesty, a programme to support declared work and the granting of loans with reduced interest rates for small companies; (ii) to back-up an aggressive programme for public works to encourage the global demand by means of investment, holding at the same time the stimulus to support the acquisition of new capital assets by the private sector, partially financed by the reprogramming by means of a bond exchange of the State owned debts, and (c) to strengthen the international reserves available to the Central Bank.

The second type of measures, in reference to the federal system, includes the consolidation of the national government's position on the one hand, as well as the assistance and support to the subnational governments before the crisis. These measures include a relief to the situation of high provincial indebtedness rate on one side, and the creation of conditioned assignments by retention on the exports, on the other hand. I shall mention them next when we deal with the federal financing outline within the crisis framework.

6. ECONOMIC STRUCTURE AND CHANGES IN THE STRUCTURE

After a long time leadership by the export sector, the Argentina's economy became further sealed as regards the "inward looking" strategy which was forced, at least partially, by the new international conditions as well as new considerations in terms of principles of economic policy. The years of the "Lost Decade" of the 80s and very clearly the 90s show the abandonment of this approach and the entrance in a period of economic openness, less interventions from the state and more market-friendly approach.

In the long term, it is interesting to see the evolution of the structure of the economy, which was related both with international and internal forces. As it is possible to remember, the focus in the economic structure is an old perspective in such classical essays like the Clark's or Kuznets's ones[17] to evaluate their changes along time.

In such perspective, the share of the different sectors in Argentina's economy was an interesting indicator. So, coming from an increase in the weight of the secondary sector which was evident at the beginning of the second part of the 20th C, and increased afterwards, it was apparent during the last decade of such Century and indisputable in the initial years of the 21st C, a coming back in that previous trend.

In more direct terms, the share of the manufacturing sector (industry) in GDP diminished strongly. In the same way, it was possible to speak about a "des-industrialization era", or, by opposite, remark the "re-primarisation" of the country, given the recovered place of some primary activities, to the interior of the aggregate mass of goods production.

C-3

Argentina: Economic Structure in Brief

Periods	Agriculture	Manufactures	Goods Production	Services
Mid 80s	8.8	25.3	46.7	53.3
Mid 90s	6.3	17.2	31.8	68.2
Mid 10s	5.7	17.5	34.2	65.8

[17]See Clark (1963) and Kuznets (1981), among others.

7. ECONOMIC GROWTH, POVERTY AND EQUALITY

Of course, this overview forgets, in a certain sense, the important role of services. The increasing weight of the tertiary sector was in the scenario in a very visible manner. Probably, in the long run, what it could be agreed on is discovering a move from agriculture not only to industry but to services in the end, or, to services, but passing through manufacturing also**.**

In parallel with the exploding situation represented by the 2001 Crisis, expressed in an epochal fall of the GDP's levels (global and *per capita*),[18] jumped in an impressive way the ratios of social exclusion and poverty and worsened dramatically the inequality indexes of the country.[19]

Thus, people in conditions of risk increased in parallel with the sinking of the economy, situation which was apparent in the streets of the main cities of the country. The concentration in the distribution of national income followed this trend, widening the gap among the poorest and the riches in the society.

These aspects were linked intimately with the precarisation or elimination of a myriad of employment positions in the whole of the economy. Thus, the fall in the economy correlated itself with a fall in the level of unemployed.

This beginning was followed by a slow but consistent process of improvement along the decade. Considering the bad results derived for the worsening during the 2008-2009 turbulence, the comparison between extremes (2001-2011) shows an improvement very clear in the rate of unemployment level, which was reduced in quantitative terms.

The poverty index and the Gini's Coefficient showed also the improvement of the economic conjuncture along the decade. Although better indicators have been signaled as a characteristic of various countries of Latin America, the reduction of inequality is one of the outcomes after the 2001 very deep socio-economic crisis.

C-4

Poverty, Extreme Poverty, Income Gap and Gini's Coefficient in Argentina

Years	Poor	Poorest	Income-Gap	Gini's Coefficient
2000	33.4	9.0	14.4	0.479
2001	35.9	11.6	17.3	0.503
2002	53.0	24.8	23.1	0.526
2003	47.8	20.5	17.4	0.517
2004	40.2	15.0	15.4	0.495
2005	33.8	12.2	14.6	0.490
2006	26.9	8.7	14.3	0.478
2007	20.6	5.9	13.8	0.465
2008	15.3	4.4	13.6	0.454
2009	13.2	3.5	13.2	0.441

[18]The global GDP decreased by15 percent. This was historical in perspective.

[19]Until today it is possible to remember some images in the media of such days, showing a lot of people try to get food and other basic goods in the streets of the main cities.

As it appears in the chart above, not only was poverty reduced but extreme poverty as well.[20] The Gini's Coefficient, after reaching a peak in 2002, dropped consistently afterwards until descending to a better position. In comparative terms it looks now as a moderate index for a medium income level country.[21]

7. TAX REVENUES: LEVEL AND STRUCTURE

One of the peculiarities of the last years was the new level reached by tax revenues. The main requirement imposed for a particular time without additional possibilities for increasing the existing public debt was the need to obtain as a result, clear and permanent primary surpluses in the public budget.[22]

Such framework for the fiscal stance was not a question of economic taste. Indeed, it was an imposition of the circumstances. It meant control of the expenditure level and success in the corresponding ability to collect taxes for the financing of the government. It was the framework for the fiscal policy along the decade. Argentina, one big debtor, should save money for getting enough funds for the repayment of such debt.[23]

However, the history of global collection of taxes in Argentina showed a preliminary situation where the tax share of GDP was not particularly important, at least in comparative terms, in relation to developed countries and other countries of Latin America. Years ago, the weak ratios Taxes/GDP have been mentioned as a logic and direct cause of inflation.

Such strong assert keeps its own logic applied to the case of Argentina. The relationship among low taxation, fiscal deficits and higher inflation looked consistent with the volatility of prices and long inflationary tradition of the country. So, the improvement of the tax collection had a structural importance.

The results obtained during the last decade looks outstanding. The tax revenues reached a high volume in relation to GDP. In few years, the global collection, after increases obtained year by year, reached a peak close to 34 percent of GDP. It is a remarkable outcome equating the Brazilian one, which until recently was the higher in the Latin American region and among the MERCOSUR's countries.[24]

C-5

Tax Revenue and GDP Structure of Fiscal System

Main Taxes	2001	2010
Value Added Tax	5.71	8.07
Income Tax	3.99	5.44
Taxes on Property	0.31	0.40
Financial Transactions Tax	1.09	1.86
Foreign Trade	0.64	3.98
Gasoline Tax	1.27	1.01
Social Security Taxes	3.23	7.10
Provincial Taxes	3.64	4.76
Total	21.14	33.69

[20]Extreme poverty is called "indigence" in the statistical system of Argentina.

[21]The Gini's Coefficient for Argentina shows a position quite far from the best but very far from the worst in international terms. Is better than the Brazilian one and better than the USA indicators, in spite of that it is far from the outstanding levels such the Scandinavian ones or other countries in Asia, like Pakistan.

[22]The average rate was usually of 2.5 percent of the GDP.

[23]It was similar to "living from its own".

[24]It is remarkable if compared with other important countries in Latin America, in particular México and Colombia.

Considering the existence of various levels of government and given the federal character of the country, such result was obtained mainly through strong variation in the levies which compose the national or central taxation. So, if the consolidated or global tax pressure increased, the national tax coefficient increased strongly and faster. The consequence is a structure of tax collections with a higher weight of the national ones with respect of the provincial ones.

C-6

Tax Revenue/GDP Relation

Resources	2001	2002	2005	2008	2009	2010	Change 2001/10
National	17.50	16.91	23.10	26.63	27.10	28.93	11.43
Provincial	3.64	3.39	4.12	4.40	4.63	4.76	1.12
Total	21.14	20.30	27.22	31.03	31.73	33.69	12.55

The table above indicates that more than 80 percent of the joint tax collection is generated by national taxes. Likewise, dynamically speaking and in the long term, from 2001 to 2010, the increase between extremes of national collection almost double that of the provinces, 65 percent against 30.8 percent. In other terms, the result just mentioned before shows that in the same period national or central taxes increased 11.43 percent of the GDP *vis a vis* the provincial ones which increased 1.12 percent of GDP. Jointly, they increased 12.55 percent of GDP. In the end, it implies also more budgetary power for the central government.[25]

We need now turn to the global structure of the taxation.[26] Observing such structure we can see that the central changes produced in it explains the commented outcome. So, the creation of two new particular taxes and the favourable evolution of others had a bearing on those figures.

First of all, the taxation on financial transactions, well known as *the tax on the checks*, in one side, and the *retentions on exports,* in the other, explained a big part of the increase, particularly the latter, given the boom in commodity exports which benefited the country.

Additionally, the maintenance of a very low level for the amount not subject to taxation (nontaxable minimum) in the personal income tax and in the wealth tax applied on property—in spite of an increasing inflation—generated important revenue yields to the government, persistently maintained.

Besides, the behaviour of the external sector played again a role with respect to the indirect taxes. So, the growing tendency exhibited by the imports, permitted also a higher amount for the Value Added Tax collected from such significant source.

However, the new composition of revenues was a major cause for the increasing of the tax revenues along the period. Although the economic buoyancy after the worst peak of the crisis fostered the growth of the tax collection from all sources, it was evident that the new members of the family, the taxation on financial transactions and the new tax on exports were responsible for a big part of the increment.

[25]We should mention that there were some additional changes in the legal budgetary framework, strengthening the position of the national government [Asensio (2009)].

[26]It is necessary to distinguish structure of taxation or structure of the collection of taxes, from the structure of individual taxes. The latter alludes to the elements considered in the legal system for each tax, for determining and assessing the amount to be paid for an individual taxpayer.

Some voices of criticism reasonably argued that instead of using the export tax, exclusive revenue of the national Government, the income tax could reap the good circumstances of the economy, letting the provinces to share it with the national government given the character of shareable revenue of that tax. Provinces do not get it at all.

Anyway, it should be mentioned for practical reasons. The option for the export tax came from its minor risk of tax evasion and consequently major fiscal productivity, and its alluded quality of non-shareable resources given that the Constitution leaves the tax on foreign trade as exclusive revenues of the central government.[27]

Such outcomes were reached in spite of some other factors included in the individual structure of the taxes. Those factors are in the base of a measurable size for the tax expenditures, which ranges for more than 1 percent of the GDP. Consequently, the important amount of tax expenditures could not impede the aggregate growth of tax collection in the country.[28]

In the end, high levels of tax collection in the decade was one of success, but mainly a national success, as it was previously mentioned, given that the concentration of revenues in the national level leave the subnational governments less endowed and more dependent from the national one.

C-7

Evolution of the Fiscal Revenues in the Short Term (GDP %)

Revenues[29]	2007 (1)	2008 (2)	2009 (3)	2010 (4)	(2):(1)	(3):(2)	(4):(3)	% 09/08	% 10/09
RN	25.13	26.63	27.10	28.93	1.50	0.47	+1.83	+ 3.60	+6.75
RP	4.22	4.39	4.63	4.76	0.17	0.24	+0.13	+ 6.38	+2.80
RN-RE	22.61	23.14	24.30	25.77	0.53	1.16	+1.47	+ 6.91	+6.04
RN-SS	20.62	21.54	20.36	21.83	0.92	–1.18	+1.47	– 3.85	+7.22

The chart above indicates a better behaviour for the national taxes (RN) with respect the provincial ones (RP). However, the outcome does not avoid variations if retention on exports (RE) or social security contributions (SS) are considered.

The federal-fiscal scenario is not absent in the picture. The story of collection success is always one of big centralisation, because it was achieved essentially across national resources which were also non-shareable resources. If it were a profile admitted when the crisis was very deep, it is not a profile needed for the future.

[27]The income tax, as well as the VAT, being the main taxes in the fiscal structure of the nation, has a tradition of difficult control and difficult collection. The export tax was an easier way of covering the expenses without need of sharing the subnational governments.

[28]It implies to accept that there exist exemptions and deductions that reduce the tax yields, included in the general concept of tax expenditures. Legislation in Argentina disposes that an assessment in tax expenditures be published for the government. See DNAF (2010).

[29]RN: National Resources; RP: Provincial Resources; RE: Export Retentions; SS: Social Security.

8. CONCLUDING REMARKS AND LESSONS FOR OTHER COUNTRIES

The case that we have presented quite briefly, corresponding to an economy in evolution after a major breakdown, involves various aspects and extremes. It is well know that each economy and society owns particular profiles which in turn generate quite different ways for their advance and recovery.

Argentina's economic development has suffered major interruptions during the second part of the 20th Century and in the beginning of the present one. In the long term, the country has lost very important positions in a comparative analysis, not to speak if we compare its international situation in the Bicentennial with respect the First Centennial. In such a way, in 1913, the country was among the first ten considering its *per capita* GDP .At present it is close to the sixtieth position.[30]

During the last decade, the trend of the Argentine economy showed that it is possible to improve some variables when the general conditions move in the positive directions. Real and financial sectors where benefitted for the international scenario.

The weight of the external sector was overwhelming. In such a way, the "commodity surplus" helped for arriving to the fiscal surplus. Also, the flow of trade linked to the "Brazilian connection. Nevertheless, the real increase of tax revenues itself was relevant and impressive.

However, it is necessary to reach a deepening of the research for determining if all the results depend from external factors, administrative improvements, changes in legislation or the achieving of an increase in the tax effort.[31] We are sure of tax booming in the period, yet it is not equally sure that it was a direct consequence of more tax effort.

Likely, the way was the reverse: the economic growth fostered the tax collection and the tax structure improved tax productivity. Changes in the tax structure geared by new levies were present too. It indicates that such particular comments should be quite inconclusive and not definitive.

What it is indisputable is that the tax yields increased clearly in a short time. Of course, still remains open questions like the duration and consolidation of that trend that assures a healthy and sustainable macro-fiscal scenario in the long term.

In any case, it could generate some new inquiries for countries, like Pakistan, that have been fighting many years to improve tax effort and collections, as well as maintaining and increasing their rates and pace of economic growth and development.

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[30]Of course, the map of the World has suffered major changes, including some fragmentation of empires and countries, comparing one situation and another, which has it influence in the result.

[31]See Asensio and Asensio, Alejandro (2008).

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Is Consumption Pattern Homogeneous in Pakistan? Evidence from PSLM 2007-08

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I. INTRODUCTION

The analysis and examination of household consumption patterns made possible by the pioneering work of Ernest Engel, in the form of the Engel curve,[1] is a critical element for the formulation of various aspects of economic policy. This information is essential for macroeconomic planning purposes, as accurate projections of demand for various commodities are critical for efficient allocation of scarce productive resources across the different sectors of the economy. Knowledge of consumer behavior is also important for evaluating the impact of tax proposals on household welfare, as taxes imposed on commodities having an income elasticity greater than one are likely to effect rich households, while taxing necessities (with elasticity below one) will have a disproportionately adverse effect on low income households.

A vast empirical literature has examined household consumption patterns, using the Engel curve framework for both the developed and developing countries. Noteworthy studies in this regard include Stigler (1954), Houthakker (1957), Giles and Hampton (1985) and Tansel (1986). In case of Pakistan, household consumption patterns have been analysed by a large number of studies, which includes Ranis (1961), Rahman (1963), Bussink (1970), Ali (1981), Malik (1982), Cheema and Malik (1985), Malik and Ahmad (1985), Ahmed and Ludhow (1987), Alderman (1988), Burney and Khan (1991, 1992) and more recently Shamim and Ahmad (2007) and Ahmad and Arshad (2007). The major limitation of the existing literature, apart from being based mainly on datasets which are over two decades old, is that the household consumption patterns have been analysed only for Pakistan as a whole or by its urban-rural regions. To our knowledge, no study has examined the consumption behavior of households across the four provinces of the country.

A provincial level analysis of household budgets is necessary as the socio-economic and cultural conditions differ considerably across the federating units of the country, which is likely to give rise to heterogeneous consumption patterns across the

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[1]The Engel curve shows the relationship between a household's expenditure on a particular good and total household income, holding prices constant.

four provinces. A provincial analysis of household budgets has taken on an increased importance in the post 18th Amendment period, with more responsibilities being devolved to provinces. This increased level of decentralisation is also likely to have major consequences for macro-economic management in the country. The present study will attempt to empirically test for the homogeneity of household consumption patterns across the provinces of the country as well as explore the urban-rural variations within each province. The paper will estimate marginal expenditure shares and expenditure elasticities at the provincial level as well as by urban/rural areas, using recent household level micro data from PSLM 2007-08. The study would make use of the 12 broad commodity groupings employed by Burney and Khan (1991),[2] to examine the inter-provincial and intra-provincial differences in consumption behaviour.

Another objective of this study is to look at the role of remittances in determining the level and distribution of household expenditures across the four provinces, with respect to the 12 expenditure groups. With remittances emerging as a major source of liquidity to recipient households in recent years, it would be worthwhile to examine how the inflow of remittances has changed consumption of those households who are receiving them versus households not receiving them and how the impact differs across provinces.

The layout of the paper is as follows: Section II presents the methodology and theoretical framework used in the analysis, while Section III discusses the data. Results are reported and discussed in Section IV and the impact of remittances on provincial consumption patterns is examined in Section V. The final section ends the paper with some concluding remarks.

II. THEORETICAL FRAMEWORK

The Engel curve is a demand function derived from a constrained utility maximisation problem, which can be specified as follows:

$$x_i = a_i + b_i(p_j/p_i) + c_i(Y/p_i) + e_i \qquad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \qquad (1)$$

where x_i is the demand for commodity i, p_j/p_i represents the relative price ratio , Y/p_i is the real income and e_i is the random error term. Consequently, the relationship between expenditure on commodity i and income can be derived as:

$$p_i\, x_i = a_i\, p_i + b_i\, p_j + c_iY + e_i\, p_i \qquad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \qquad (2)$$

Empirical studies on household consumption patterns, which are mainly based on single year cross section data, generally assume that all the sample households face the same prices for every commodity. There is however evidence to suggest that this assumption is not likely to be true.[3] This stems from the fact that household income and expenditure surveys typically collect data from clusters of households that live in the same village or urban block. Market prices within a cluster are likely to be same, but may differ across clusters due to a variety of reasons. As household budget surveys do not collect information on market prices, it is difficult to account for price variations on household consumption patterns, using such datasets.

[2] The study used micro data from the 1984-85 round of the Household Income and Expenditure Survey (HIES).

[3] For example, see, Alderman (1986), Deaton (1988, 1997) and Behrman and Deolalikar (1990).

If we assume that all households face the same price for every commodity, then equation (2) can be expressed as:

$$E_i = \alpha_i + \beta_i Y + u_i \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (3)$$

Where $E_i = p_i\ x_i$; $\alpha_i = a_i\ p_i + b_i\ p_j$; $\beta_i = c_i$ and $u_i = e_i\ p_i$. Equation (3) is the exact representation of the Engel curve, which expresses the relationship between the households' expenditure on commodity i (E_i) and income Y.

As the Engel curve is derived from constrained maximisation, it has to meet the general restrictions of demand theory. Since prices are assumed to be the same across households when using cross section data, the restrictions in terms of price derivatives such as homogeneity, symmetry and negativity of own price effect cannot be tested. This leaves only the 'adding up' condition to be tested, which in terms of the parameters of eq. (3) implies that α_i and β_i must sum to zero and unity, respectively; i.e., $\sum\alpha_i = 0$ and $\sum\beta_i = 1$.

An implicit assumption of this study is that all the households have the same utility function. This is however a rather strong assumption because preference ordering can vary from one income group to another and may even change from one family to another. This is likely to introduce bias in the estimated parameters if similar households have different expenditure patterns.

The choice of an appropriate functional from is also an important issue in deriving the Engel curve and has been the subject of many empirical studies. Various functional forms have been used in the literature, but consensus on the most appropriate form has not been developed. The different functional forms used include linear, semi-logarithmic, double logarithmic, etc. In this study, we make use of the linear and double-logarithmic forms which have also been used by Burney and Khan (1991), in their earlier analysis of household consumption patterns by the urban/ rural sectors of the country.

Empirical work on the examination of household consumption patterns has generally used household income and/or consumption expenditure as the explanatory variables. The total household consumption expenditure is a preferred indicator of household welfare over household income, because income data have a higher likelihood of suffering from measurement errors and may also include a transitory component. Moreover, household income in rural sectors of developing countries like Pakistan are vulnerable to large fluctuations due to seasonal patterns of cropping as well as the unpredictability of agricultural activities. In view of the shortcomings of using income, this study would make use of household consumption expenditure as the explanatory variable in the Engel curve equation. Moreover, we would also use the household size as an explanatory variable to capture the effect of economies of scale in consumption in large households, which Houthakker (1957) has referred to as a combination of two effects – the specific effect and the income effect.

III. DATA

The study is based on the micro data tapes of the Pakistan Social and Living Standards Measurement Survey (PSLM) 2007-08 conducted by the Federal Bureau of Statistics. This nationally representative survey consists of data on a sample of 15,512 households. Out of this sample, observations for 4 households having household size greater than 34 were dropped from analysis. Thus, the analysis carried out in this paper is based on a sample of 15,508 households across the four provinces of Pakistan, the distribution of which is reported in Table 1.

Table 1

Distribution of Sample Size, by Province and Sector

Sectors	Punjab	Sindh	KPK	Balochistan	Total
Overall	6636	3765	2934	2173	15508
Urban	2768	1672	1048	765	6253
Rural	3868	2093	1886	1408	9255

The examination of household consumption patterns is carried out for the 12 commodity groupings used by Burney and Khan (1991). These consumption categories include food and drinks, clothing and footwear, fuel and lighting, housing, transport and communications, household effects, personal effects, health care, education, entertainment, durables and miscellaneous items. The details of commodities covered within each of the 12 groups are given in Appendix 1.

The survey data contains information on both the amount spent on purchase of a particular commodity as well as its imputed value in case it is self-produced and/ or received as gift in kind. For the purpose of this study, we group together both these two sets of information to get the total expenditure on each commodity, which is the amount spent on buying that commodity plus its imputed value.

In the second part of the paper, where the impact of remittances on provincial consumption patterns is examined, a total sample of 2,383 households is observed to be receiving remittances. Out of this sample, 76 observations with missing values for the remittance variable are dropped from analysis, while one outlier[4] observation is also deleted, which leaves a total sample of 2,306 households receiving remittances across the four provinces of Pakistan. For the purpose of our analysis, remittances are defined to include both the foreign remittances sent by migrant family members from outside Pakistan as well as the domestic remittances sent from within Pakistan during the year 2007-08. The sample of households not receiving remittances comes to a total of 13,125 observations.

The average household monthly consumption expenditures across the four provinces of Pakistan along with their urban-rural breakup, given in Table 2 shows that mean expenditures are highest in KPK (Rs 14,350 per month), followed by Punjab and Sindh. Average household expenditures are observed to be the lowest for the province of Balochistan, at Rs 11,392 per month. These provincial averages, however, hide substantial intra-provincial variations *vis a vis* the urban-rural sectors, with this variation being the highest for Sindh. Monthly consumption expenditures of households in rural Sindh (Rs 9,851) are 42 percent lower than those of their counterparts in the more developed urban centers (Rs 17,074), comprising mainly metropolitan Karachi, which is the hub of economic activity of the entire country. Following Sindh, the ratio of urban to rural expenditures are seen to be the highest for Punjab at 1.49 and Balochistan at 1.35, while this ratio is lowest for KPK, where the monthly consumption expenditures of urban households are 1.28 times higher than those of their rural counterparts.

[4] This includes one household that reported receiving Rs. 10 million as remittance during the reference year.

Table 2

Average Monthly Household Consumption Expenditure (Rs), by Province and Sector

Sectors	Punjab	Sindh	KPK	Balochistan
Overall	14221.87	13058.81	14350.59	11391.56
Urban	17602.64	17074.68	16709.21	13672.59
Rural	11802.54	9850.711	13039.96	10152.22

The average household expenditure shares of the 12 groups of commodities for the whole sample are reported in Table 3a for all four provinces, while the urban-rural breakdown within each province is given in Table 3b. In order to test for statistical significance between the expenditures shares for urban-rural sectors within each province, Table 3b also presents results for the two sample t-test with equal variance. Overall, expenditures on food and drinks account for the highest share of total household consumption expenditures across all provinces, ranging from a low of 45.25 percent for Punjab to a high of 55.25 percent for Balochistan. Moreover, rural households across all four provinces are observed to be spending considerably more on this expenditure category compared to their urban counterparts, with the urban-rural disparity being the highest for Balochistan at close to 12 percentage points. The urban-rural difference is statistically significant for the food and drinks category in all four provinces.

Following food and drinks, housing is found to be receiving the highest share of total consumption expenditure across all provinces, followed by miscellaneous items in Punjab and Sindh and fuel and lighting in KPK and Balochistan. Within the housing category, the expenditure shares across urban and rural areas of all provinces differ significantly, with urban households spending proportionately much more on housing than their rural counterparts. This variation is highest in the province of Sindh, where rural households allocate 10.3 percent of their budget on housing compared to double that proportion for their urban counterparts at 20.8 percent.

Table 3a

Average Expenditure Shares for Different Commodity Groups, by Province (Overall)

Commodity Groups	Punjab	Sindh	KPK	Balochistan
Food and drinks	45.25	48.12	48.78	55.25
Clothing and Footwear	5.97	4.97	5.97	4.21
Fuel and Lighting	8.35	6.26	9.30	9.03
Housing	14.02	14.96	9.60	11.30
Transport and Communications	4.96	7.43	4.52	5.88
Household Effects	0.68	0.48	0.76	0.41
Personal Effects	3.79	3.83	2.97	3.14
Healthcare	3.38	3.31	5.05	2.22
Education	2.98	2.03	3.41	1.41
Entertainment	0.60	0.67	0.29	0.47
Durables	1.23	0.25	0.60	0.08
Miscellaneous	8.79	7.69	8.75	6.61

Table 3b

Average Expenditure Shares for Different Commodity Groups, by Province (Urban-Rural)

	Punjab			Sindh			KPK			Balochistan		
	Urban	Rural	T-test	Urban	Rural	T-test	Urban	Rural	T-test	Urban	Rural	T-test
Food and drinks	39.75	49. 19	–32.04*	41.69	53.26	–35.83*	44.49	51.17	–15.45*	47.49	59.46	–26.91*
Clothing and Footwear	5.61	6.23	–9.61*	4.26	5.54	–22.12*	5.6	6.18	–6.73*	4.03	4.3	–3.64*
Fuel and Lighting	7.79	8.75	–9.69*	6.41	6.14	3.00*	8.15	9.94	–11.05*	8.08	9.54	7.72*
Housing	19.34	10.21	43.20*	20.75	10.34	36.07*	14.77	6.72	27.16*	17.73	7.81	29.34*
Transport and Communications	5.38	4.66	5.88*	6.98	7.79	–4.77*	4.66	4.45	1.36	6.07	5.77	1.49
Household Effects	0.65	0.71	–1.41	0.55	0.41	5.13*	0.66	0.81	–2.14*	0.41	0.4	0.55
Personal Effects	3.82	3.77	1.45	4.03	3.66	8.19*	3.03	2.94	1.50	3.31	3.04	4.12*
Healthcare	2.99	3.66	–5.61*	2.72	3.79	–12.38*	4.24	5.5	–6.30*	2.06	2.31	–2.94*
Education	4.19	2.11	17.95*	3.4	0.93	22.38*	4.96	2.54	11.83*	2.39	0.89	14.90*
Entertainment	0.91	0.38	16.13*	1.17	0.27	27.40*	0.51	0.17	8.56*	0.96	0.2	20.15*
Durables	1.20	1.26	–0.52	0.28	0.22	0.81	0.73	0.53	1.33	0.05	0.1	–0.61
Miscellaneous	8.36	9.1	–4.46*	7.75	7.64	0.80	8.2	9.05	–3.06*	7.41	6.17	7.47*

* Significant at 5 percent level of significance.

Table 3b

In terms of the remaining 9 commodity groups, rural households across all 4 provinces are seen to be spending proportionately and significantly more on clothing and footwear and health care; while urban households spend proportionately and significantly more on education and entertainment. In case of durables, the average expenditure shares are not statistically different between the urban and rural sectors of all four provinces.

IV. RESULTS

The results of the empirical analysis of household consumption patterns across the four provinces of Pakistan, as well as by their urban and rural areas, are presented and discussed in this section. The Engel curves have been estimated using both the linear and double log functional forms, employing the Ordinary Least Squares (OLS) method. The estimated marginal expenditure shares for the 12 commodity groups are reported in Table 4 for all provinces along with their disaggregation by urban and rural sectors.

Table 4

Marginal Expenditure Shares for Different Commodity Groups, by Province and Sector

Commodity Groups	Sectors	Punjab	Sindh	KPK	Balochistan
Food and drinks	Overall	0.184	0.212	0.165	0.329
	Urban	0.183	0.201	0.164	0.289
	Rural	0.193	0.353	0.168	0.444
Clothing and Footwear	Overall	0.037	0.020	0.031	0.021
	Urban	0.031	0.019	0.028	0.017
	Rural	0.046	0.038	0.037	0.025
Fuel and lighting	Overall	0.049	0.044	0.033	0.049
	Urban	0.056	0.041	0.034	0.036
	Rural	0.038	0.054	0.037	0.074
Housing	Overall	0.194	0.336	0.204	0.221
	Urban	0.256	0.354	0.248	0.291
	Rural	0.066	0.079	0.099	0.051
Transport and Communications	Overall	0.098	0.084	0.088	0.109
	Urban	0.098	0.081	0.090	0.113
	Rural	0.099	0.144	0.087	0.106
Household effects	Overall	0.027	0.011	0.020	0.009
	Urban	0.015	0.011	0.015	0.009
	Rural	0.047	0.011	0.031	0.007
Personal effects	Overall	0.029	0.040	0.015	0.037
	Urban	0.033	0.041	0.015	0.045
	Rural	0.020	0.028	0.013	0.021
Healthcare	Overall	0.022	0.019	0.040	0.027
	Urban	0.019	0.019	0.044	0.024
	Rural	0.028	0.029	0.039	0.035
Education	Overall	0.076	0.080	0.124	0.064
	Urban	0.089	0.082	0.136	0.078
	Rural	0.048	0.038	0.086	0.019
Entertainment	Overall	0.011	0.019	0.006	0.011
	Urban	0.011	0.020	0.006	0.009
	Rural	0.011	0.014	0.005	0.015
Durables	Overall	0.230	0.089	0.287	0.238
	Urban	0.156	0.061	0.293	–0.002*
	Rural	0.308	0.475	0.294	0.669
Miscellaneous	Overall	0.159	0.133	0.186	0.092
	Urban	0.152	0.139	0.128	0.084
	Rural	0.181	0.126	0.303	0.101

*Estimation based on a sample of 47 households.

There is observed to be considerable variation across the four provinces; marginal expenditure shares of households in Punjab and KPK are highest on durables (23 percent and 29 percent, respectively) followed by housing. Households in Sindh tend to spend marginally the highest on housing at 34 percent, followed by food and drinks (21 percent) and miscellaneous items (13 percent). In Balochistan, the highest marginal spending of households goes on foods and drinks at 33 percent, which is followed by durables and housing, at 24 percent and 22 percent, respectively. On the other hand, the marginal expenditure shares of households in Punjab and KPK are the lowest for entertainment, which is followed by healthcare in Punjab and personal effects in KPK and household effects for both provinces. Households in Sindh and Balochistan spend lowest at the margin on household effects. This is followed by marginal expenditures on entertainment and clothing and footwear.

This provincial overview of marginal expenditure shares, however, masks considerable variations in consumption patterns across the urban and rural sectors of the provinces. The marginal propensity to spend of the rural households in all provinces is substantially higher for food and drinks, particularly in case of Sindh and Balochistan, where rural households spend 35 percent and 44.4 percent more at the margin, respectively, compared to 20 percent and 29 percent for their urban counterparts. Moreover, rural households in all four provinces tend to spend more at the margin on clothing and footwear and durables, while urban households have higher marginal expenditure shares for education.

The analysis of expenditure elasticities, reported in Table 5 shows that for all four provinces; housing, transport and communications, education, household effects, durables and miscellaneous items are luxury goods, with expenditure elasticities exceeding unity, while entertainment is also a luxury in all provinces except Sindh. Of the remaining five expenditure categories—food and drinks, clothing and footwear, fuel and lighting and personal effects can be classified as necessities across all provinces, while healthcare is a necessity in all provinces except Balochistan.

The urban-rural breakup of the expenditure elasticities show some exception to the overall trends observed for each province above. For instance, personal effects are seen to be a luxury good in rural Sindh, while education is a necessity only in rural Balochistan, contrary to trends observed for the remaining provinces as well as their urban-rural disaggregates. In case of urban Punjab and urban Balochistan, durables come across as necessities.

The preceding discussion clearly highlights that the household consumption patterns across the four provinces of the country are far from being homogeneous. Considerable variation can be observed not only across provinces but also among the urban-rural areas within a province, in terms of the mean household budget shares, the marginal expenditure shares and expenditure elasticities of the 12 expenditure groups analysed. This confirms our original hypothesis that consumption patterns are likely to diverge across provinces, due to the different socio-economic and cultural conditions prevailing in each province.

Table 5

Expenditure Elasticities for Different Commodity Groups, by Province and Sector

Commodity Groups	Sectors	Punjab	Sindh	KPK	Balochistan
Food and Drinks	Overall	0.648	0.618	0.590	0.749
	Urban	0.645	0.622	0.582	0.741
	Rural	0.713	0.765	0.627	0.891
Clothing and Footwear	Overall	0.779	0.612	0.780	0.575
	Urban	0.786	0.615	0.721	0.539
	Rural	0.781	0.858	0.855	0.557
Fuel and Lighting	Overall	0.699	0.875	0.528	0.712
	Urban	0.691	0.809	0.511	0.620
	Rural	0.727	0.950	0.608	0.832
Housing	Overall	1.307	1.371	1.442	1.257
	Urban	1.217	1.225	1.353	1.241
	Rural	1.015	0.916	1.142	0.548
Transport and Communications	Overall	1.512	1.185	1.220	1.771
	Urban	1.564	1.178	1.305	1.751
	Rural	1.503	1.652	1.156	1.927
Household Effects	Overall	1.184	1.151	1.122	1.498
	Urban	1.188	1.303	1.107	1.570
	Rural	1.228	1.510	1.150	1.554
Personal Effects	Overall	0.751	0.946	0.740	0.978
	Urban	0.777	0.926	0.694	1.142
	Rural	0.651	0.838	0.740	0.793
Healthcare	Overall	0.770	0.596	0.841	1.342
	Urban	0.772	0.720	0.885	1.245
	Rural	0.857	0.864	0.950	1.590
Education	Overall	1.716	1.869	1.839	1.463
	Urban	1.563	1.517	1.623	1.697
	Rural	1.630	1.757	1.852	0.846
Entertainment	Overall	1.205	0.816	1.232	0.865
	Urban	0.961	0.822	0.718	0.641
	Rural	1.323	0.727	1.426	1.263
Durables	Overall	1.444	1.043	1.742	1.037
	Urban	1.462	0.894	1.956	0.265
	Rural	1.615	2.558	1.760	2.089
Miscellaneous	Overall	1.471	1.276	1.510	1.333
	Urban	1.511	1.402	1.494	1.174
	Rural	1.556	1.317	1.601	1.393

V. REMITTANCES AND PROVINCIAL HOUSEHOLD CONSUMPTION PATTERNS

The preceding section has provided recent empirical evidence on the household consumption patterns for the provinces of Pakistan as well as analysed it by urban and rural sectors within each province, using household survey data for 2007-08. This section will build on the previous analysis by examining the impact of remittances on household consumption patterns for the four provinces.[5] This will involve computing the average

[5]A disaggregation of this analysis by urban/ rural sectors within each province is not feasible as the sample of households receiving remittances in Sindh and Balochistan is very small.

expenditure shares, marginal expenditure shares and expenditure elasticities for households receiving remittances as well as those households which are non-recipients of remittances, across all the four provinces. The consumption patterns of both these two set of households will then be compared to see how remittances have affected the consumption decisions of households who are recipients of remittances with those households that are not receiving remittances.

Previously, Malik and Sarwar (1993) have examined differences in consumption patterns between remittance recipient and non-recipient households, using data from the 1987-88 round of the HIES. They estimated the Engel curves for three expenditure groups—consumption expenditure, durable expenditure and total expenditures and tested for the differences in consumption patterns of households, for overall Pakistan, its four provinces and their urban/ rural areas. Their results show that the average expenditure shares of households receiving domestic and/or foreign remittances in Punjab and Sindh are significantly different for all three expenditure groups from their counterparts not receiving remittances; while in case of Balochistan the expenditure functions are dissimilar only for expenditures on durables.

In terms of marginal expenditures, they found that both the domestic migrant households and international migrant households in Punjab, Sindh and Balochistan have higher spending at the margin with respect to total expenditures and consumption expenditures compared to non-migrant households, although this pattern varies across the urban-rural sectors of different provinces. Households receiving foreign remittances in Sindh, KPK and rural Punjab were seen to have higher marginal expenditures for the durable expenditure group, across both the urban and rural sectors, compared to households receiving no remittances and/ or domestic remittances.

Most recently, Ahmed, *et al.* (2010) conducted a micro-econometric analysis to examine the difference between the consumption behavior of households receiving remittances and those not receiving them, using data from Pakistan Social and Living Standards Measurement Survey 2005-06. Their analysis, however, was carried out only for Pakistan along with its urban-rural disaggregation, although the study did estimate the share of foreign remittances in household monthly income by province. Foreign remittances were estimated to contribute, on average, 5.1 percent, 0.7 percent, 9.4 percent and 1.6 percent to the income of households in Punjab, Sindh, KPK and Baluchistan, respectively.

We start off our analysis by presenting some basic data on households receiving remittances in Table 6. The figures show that the highest number of households receiving remittances is residing in the province of Punjab—representing around 56 percent of the sample. This is followed by KPK, where 902 households are getting domestic and/ or foreign remittances, while the sample of households receiving remittances in Sindh and Balochistan is quite small at 52 and 21 observations, respectively. The regional breakup of the sample within each province shows that in Punjab and KPK, the majority of remittances are received by rural households (65 percent and 74 percent, respectively). In case of Sindh, almost 66 percent of the remittance recipient households are located in the urban areas.

Table 6

Basic Facts about Remittances, by Province and Sector

	Sectors	Punjab	Sindh	KPK	Balochistan
No. of HHs Receiving Remittances	Overall	1281	79	902	44
	Urban	446	52	230	21
	Rural	835	27	672	23
% of HHs Receiving Remittances	Overall	19.41	2.10	30.89	2.04
	Urban	16.20	3.12	22.07	2.80
	Rural	21.71	1.29	35.78	1.64
Average Remittance (Rs per Year)	Overall	100562.1	89612.66	100365.9	126295.5
	Urban	129450.2	112007.7	108193	140047.6
	Rural	85132.1	46481.48	97686.9	113739.1

The proportion of total households receiving remittances is observed to be the highest in KPK, where nearly 31 percent of all households received remittances in 2007-08, with this proportion being much higher for the rural sector of the province at 36 percent. In Punjab, over 19 percent of the households were getting remittances, with this proportion being 16 percent and 22 percent, respectively, in the urban and rural sectors of the province. The share of households receiving remittances is the lowest in Balochistan and Sindh, at around 2 percent.

In terms of the size of the average remittance per year, this figure is seen to be the highest for Balochistan, where households on average got Rs. 126,296 per year in transfers in the form of domestic and/or foreign remittances. The lowest level of mean remittances is observed for KPK at Rs 89,613 per annum. There is, moreover, a large urban-rural disparity in the average remittances across all four provinces, which is most pronounced in Sindh with the average remittance of urban households being 2.4 times that of their rural counterparts.

In order to determine the impact of remittances on household consumption patterns across the 4 provinces of the country, we estimate in double log form the Engel curves for each of our 12 expenditure groups, using the full sample of households used in section I, for each province.[6] A dummy variable which takes the value one if the household is receiving domestic and/ or foreign remittances is included as an explanatory variable in this analysis. The results of this model are presented in Table 7, which shows the intercept and the coefficients for total household consumption expenditure, household size and the remittance dummy and also includes the adjusted R-squared statistic to show goodness of fit. It can be seen that the remittance dummy is statistically insignificant for durables across all 4 provinces; while for the expenditures groups—personal effects and entertainment, it is insignificant across a combination of three provinces. For the remaining expenditure categories, the remittance dummy is significant across all four provinces for food and drinks and transport and communications, while for clothing and footwear, housing and household effects, it is statistically significant across a combination of three provinces.

[6] This estimation is carried out for a sample of 15,431 households, after dropping 76 missing values and an outlier value for the remittance variable.

Table 7

Estimation of the Effect of Remittances on Household Consumption Patterns, by Province

Commodity Groups	Provinces	Intercept	Consumption Expenditure	HH Size	Remittance Dummy	Adj R squared
Food and Drinks	Punjab	2.033	0.649	0.234	–0.017	0.772
	Sindh	2.367	0.619	0.228	–0.048	0.785
	KPK	2.600	0.588	0.269	0.031	0.799
	Balochistan	1.398	0.750	0.146	0.003	0.791
Clothing and Footwear	Punjab	–1.377	0.775	0.312	0.057	0.612
	Sindh	–0.162	0.611	0.385	–0.025*	0.580
	KPK	–1.322	0.769	0.294	0.112	0.626
	Balochistan	0.316	0.572	0.190	0.133	0.432
Fuel and Lighting	Punjab	0.035	0.696	0.110	0.057	0.500
	Sindh	–1.757	0.876	0.021*	–0.015*	0.497
	KPK	1.617	0.523	0.187	0.081	0.417
	Balochistan	–0.037	0.717	0.066	–0.084*	0.355
Housing	Punjab	–4.347	1.314	–0.448	–0.077	0.515
	Sindh	–4.600	1.370	–0.513	0.133	0.655
	KPK	–5.986	1.450	–0.503	–0.084	0.354
	Balochistan	–4.332	1.258	–0.294	0.247*	0.289
Transport and Communication	Punjab	–7.357	1.518	–0.445	–0.160	0.501
	Sindh	–4.316	1.186	–0.127	–0.289	0.554
	KPK	–5.017	1.231	–0.227	–0.143	0.454
	Balochistan	–9.544	1.775	–0.346	–0.471	0.575
Household Effect	Punjab	–6.696	1.174	–0.124	0.119	0.251
	Sindh	–7.069	1.133	0.258	0.614	0.260
	KPK	–6.500	1.110	0.119*	0.129*	0.196
	Balochistan	–9.276	1.481	–0.303	0.288*	0.356

Continued—

Table 7—(*Continued*)

Personal Effects	Punjab	–1.325	0.750	0.175	0.001*	0.623
	Sindh	–2.822	0.947	–0.006*	–0.058*	0.683
	KPK	–1.372	0.741	0.103	–0.013*	0.525
	Balochistan	–3.150	0.974	–0.089	0.131	0.512
Healthcare	Punjab	–1.885	0.763	0.097	0.135	0.207
	Sindh	–0.333	0.592	0.256	0.178	0.228
	KPK	–1.997	0.836	0.102	0.050*	0.275
	Balochistan	–6.967	1.352	–0.149	–0.232	0.489
Education	Punjab	–9.765	1.718	–0.416	0.120	0.433
	Sindh	–11.364	1.867	–0.465	0.439	0.382
	KPK	–10.383	1.836	–0.609	–0.022*	0.378
	Balochistan	–8.339	1.457	–0.082*	–0.085*	0.333
Entertainment	Punjab	–5.465	1.206	–0.735	–0.095*	0.298
	Sindh	–2.179	0.817	–0.192	–0.047*	0.367
	KPK	–6.602	1.251	–0.569	–0.287	0.191
	Balochistan	–2.472	0.867	–0.252	0.113*	0.241
Durables	Punjab	–8.485	1.437	–0.244	0.076*	0.183
	Sindh	–6.711	1.050	0.639	–0.889*	0.170
	KPK	–11.011	1.752	–0.636	–0.026*	0.241
	Balochistan	–7.544	1.205	–0.234*	–1.382*	0.113
Miscellaneous	Punjab	–7.110	1.465	0.029*	0.099	0.573
	Sindh	–5.855	1.277	0.302	–0.034*	0.573
	KPK	–7.779	1.494	0.192	0.162	0.569
	Balochistan	–5.993	1.327	0.429*	0.128*	0.500

*Not significant at 5 percent level of significance.

Table 7

Table 7

As the remittance dummy is found to be statistically significant for most the expenditure groups across provinces, we proceed to further extend our analysis by computing separately the average expenditure shares, marginal expenditure shares and expenditure elasticities for the sample of households receiving remittances and the sample of households not receiving remittances. The linear and double log functional forms of the Engel curves have been estimated for both set of households. The average expenditure shares, marginal expenditure shares and expenditure elasticities for both set of households—those receiving remittances and those not getting remittances, are reported side by side in Tables 8 through 10.

A comparison of the average expenditure shares of households receiving remittances with those not receiving remittances shows differential impact of remittances across provinces and commodity groups (Table 8). This table also presents the results of the two sample t-test to test for the significance of the difference in budget shares between remittance recipient and non-recipient households within each province. Across all four provinces, average expenditure shares of households receiving remittances are observed to be significantly lower on transport and communication and food and drinks except Balochistan compared to their counterparts not receiving remittances, with this gap being highest in Sindh (over 6 percentage points). Another noteworthy finding is the higher budgetary shares of households receiving remittances on education and household effects. The finding for education is, however, statistically not significant for Balochistan.

In case of housing, remittance recipient households in Sindh have a significantly higher budget share compared to non-remittance recipient households (22.5 percent vs. 14.8 percent), while their counterparts in KPK spend significantly less on this category. Remittance recipient households in Sindh have a significantly lower average expenditure share on clothing and footwear category, while their counterparts in KPK have a significantly higher budget share on this expenditure group. In case of durables, no statistically significant difference is observed between the expenditure shares of remittance recipient and non-recipient households across all four provinces of the country, contrary to *a priori* expectation that households receiving remittances tend to spend more on durable goods.

In terms of the marginal expenditure shares, households getting remittances have a lower spending at the margin on food & drinks in all provinces (Table 9). In case of fuel and lighting, marginal expenditure shares of remittance recipient households in all provinces except KPK are lower than those for their counterparts not receiving remittances. On the other hand, households receiving remittances spend more at the margin on education in all provinces, especially Balochistan, in comparison to non-recipient households. For the other commodity groups, mixed trends can be observed for remittance recipient and non-recipient households across different provinces.

The analysis of the expenditure elasticities of households receiving remittances and those not receiving them (Tables 10), does not show any significant differences across both these categories of households. For both set of households across all four provinces; food and drinks, clothing and footwear and fuel and lighting are necessities, i.e., a one percent increase in total consumption expenditures results in an increase of less than one percent in the spending on these expenditure categories. Of the remaining expenditure categories; housing, transport and communications, education and miscellaneous items can be classified as luxury goods for both types of households,

Table 8

Average Expenditure Shares (With/ Without Remittances), by Province

	Punjab			Sindh			KPK			Balochistan		
	R	WR	T-test	R	WR	T-test	R	WR	T-test	R	WR	T-test
Food and Drinks	43.54	45.65	–5.34*	41.86	48.26	–4.95*	48.26	49	–1.57*	53.8	55.36	–0.9
Clothing and Footwear	6.03	5.96	0.84	4.06	4.99	–4.37*	6.27	5.83	4.98*	4.55	4.2	1.36
Fuel and Lighting	8.57	8.28	2.30*	6.42	6.26	0.5	9.4	9.24	0.92	7.97	9.07	–1.69
Housing	13.9	14.06	–0.56	22.5	14.8	6.67*	8.78	9.97	–3.47*	12.98	11.2	1.32
Transport and Communications	4.62	5.04	–2.73*	5.97	7.47	–2.54*	4.13	4.7	–3.58*	4.33	5.88	–2.33*
Household Effects	0.84	0.65	4.10*	0.92	0.47	4.73*	0.9	0.7	2.78*	0.66	0.4	3.45*
Personal Effects	3.74	3.8	–1.24	3.69	3.83	–0.88	2.87	3.02	–2.49*	3.57	3.13	2.04*
Healthcare	3.82	3.28	3.58*	3.63	3.31	1.03	4.86	5.15	–1.38*	1.77	2.24	–1.61
Education	3.59	2.83	5.11*	2.84	2	2.07*	3.86	3.21	2.99*	1.7	1.4	0.84
Entertainment	0.6	0.6	0.07	0.84	0.67	1.44	0.22	0.32	–2.35*	0.51	0.46	0.41
Durables	1.33	1.2	0.81	0.01	0.25	–0.85	0.53	0.64	–0.71	0.01	0.08	–0.28
Miscellaneous	9.43	8.64	3.83*	7.27	7.7	–0.9	9.92	8.23	5.91	8.15	6.58	2.74*

R: With remittance.
WR: Without remittance.
* Significant at 5 percent level of significance.

Table 8

Table 9

Marginal Expenditure Shares (With/ Without Remittances), Overall

	With Remittances				Without Remittances			
Commodity Groups	Punjab	Sindh	KPK	Balochistan	Punjab	Sindh	KPK	Balochistan
Food and Drinks	0.151	0.198	0.162	0.204	0.195	0.213	0.165	0.335
Clothing and Footwear	0.282	0.014	0.033	0.018	0.035	0.021	0.030	0.021
Fuel and Lighting	0.047	0.032	0.037	0.029	0.050	0.045	0.032	0.051
Housing	0.180	0.387	0.161	0.321	0.213	0.335	0.223	0.217
Transport and Communications	0.108	0.081	0.105	0.088	0.096	0.084	0.080	0.109
Household Effects	0.013	0.001	0.023	0.006	0.028	0.011	0.019	0.009
Personal Effects	0.033	0.042	0.014	0.042	0.027	0.041	0.016	0.036
Healthcare	0.039	0.018	0.039	0.030	0.018	0.019	0.042	0.027
Education	0.103	0.119	0.136	0.173	0.077	0.080	0.118	0.057
Entertainment	0.014	0.021	0.006	0.008	0.011	0.020	0.006	0.011
Durables	0.256	0.001	0.209	–0.0001*	0.246	0.096	0.329	0.294
Miscellaneous	0.132	0.156	0.211	0.010	0.149	0.132	0.174	0.092

* Estimation based on 4 observations.

Table 9

Table 10

across all four provinces. Household effects are a necessity for remittance recipient households in Sindh, contrary to trends observed for both set of households across all provinces. Similarly, while personal effects are necessities for non-recipient households in all four provinces, they are a luxury for remittance recipient households in Sindh.

VI. CONCLUDING REMARKS

The purpose of this study has been to empirically test for the homogeneity of household consumption patterns across the four provinces of the country as well as explore the urban-rural variations within each province. The paper estimated average expenditure shares, marginal expenditure shares and expenditure elasticities at the provincial level as well as by urban/rural sectors within each province, using household level micro data for the year 2007-08.

We find support for the notion that household consumption patterns across the four provinces of the country are not homogeneous and in fact also exhibit variations across the urban/ rural divide within each province. The results indicate that expenditures on food and drinks account for the highest share of total household consumption expenditures across all provinces, with rural households spending considerably more on this expenditure head. Following this, housing is found to be receiving the highest share of total consumption expenditure across all provinces and within this category, urban households spend proportionately more than their rural counterparts.

Analysis of marginal expenditure shares reveals that households in Punjab and KPK have highest marginal spending on durables, followed by housing. Households in Sindh tend to spend marginally the highest on housing followed by foods and drinks and miscellaneous items. The marginal expenditure shares of rural households in all provinces are substantially higher for food and drinks, Moreover, rural households in all four provinces tend to spend more at the margin on clothing and footwear and durables, while urban households have higher marginal expenditure shares for education.

The analysis of expenditure elasticities, shows that for all four provinces; housing, transport and communications, education, household effects, durables and miscellaneous items are luxury goods, while entertainment is also a luxury in all provinces except Sindh. Of the remaining five expenditure categories—food and drinks, clothing and footwear, fuel and lighting and personal effects can be classified as necessities across all provinces, while healthcare is a necessity in all provinces except Balochistan. The urban/ rural breakup of expenditure elasticities some exceptions to the overall trends observed for each province above.

The study also examined the role of remittances in determining the level and distribution of household expenditures for the 12 expenditure groups across all four provinces, by comparing the consumption patterns of remittance recipient households with non-recipient households. This comparison shows differential impact of remittances across provinces and commodity groups. Across all four provinces, households receiving remittances are observed to spend proportionately and significantly less on transport and communication and food and drinks except Balochistan compared to their counterparts not receiving remittances. Another noteworthy finding is the higher budget shares of households receiving remittances on education in all provinces except Balochistan. In case of housing, remittance recipient households in Sindh have a significantly higher budget share compared to non-remittance recipient households, while for KPK the trend is reversed. In case of durables, no statistically significant difference is observed between the expenditure shares of remittance recipient and non-recipient households across all four provinces of the country.

In terms of the marginal expenditure shares, households getting remittances have a lower spending at the margin on food and drinks and a higher spending on education in all provinces, in comparison to non-recipient households. For the other commodity groups, mixed trends can be observed for remittance recipient and non-recipient households across different provinces. Our preliminary analysis highlights that remittances have played an important role in removing liquidity constraints of recipient household in all provinces, resulting in higher investment in education by these households.

APPENDIX – 1

Details of Commodity Groups

1. Food and Drinks	Milk and milk products, meat poultry and fish, fresh fruits, dry fruits and nuts, cereals, pulses, edible oils and fats, tea and coffee, baked and fried products, miscellaneous food items,
2. Clothing and Footwear	Clothing, clothing material and services, footwear and repair charges, other expenses on tire, tube, spare parts, repairs of vehicle etc. and service charges.
3. Fuel and lighting	Gas, electricity, fire-wood, kerosene oil, other household effects (bulbs, tubes, switches, battery cells, lamp shades etc.)
4. Personal effects	Personal care articles, personal care services, household laundry, cleaning and paper articles, personal durable effects (wrist / pocket watches, sun glasses, etc.), laundry and cleaning equipment (washer / dryer, vacuum cleaner, iron, iron board, etc.)
5. Housing	House rent and housing expenses, house and property tax etc.
6. Transport and Communications	Personal transport and travelling, petrol charges, repairing of wheel puncture, annual driving license fee, expenses on traveling by road by train and by air, vehicle registration fee, etc
7. Household effects	Readymade pillow covers, bed sheets, blankets, curtains, mosquito nets etc., purchase of cloth(for pillow covers, bed sheets quilts etc.) & purchase of cotton (for quilts, pillows, etc.), carding and other stitching charges on household textile, chinaware, silverware and kitchen equipment, furniture, fixture and furnishing, other household effects,
8. Healthcare	Purchase of medicine, hospitalisation expenses, medical fees, laboratory and physician's charges.
9. Education	School/college fees and private tuition fees, books and exercise note books / copies, stationary etc. other education expenses (bags, professional society membership, transportation etc.), hostel expenses, calculators, personal computers, mobiles etc,
10. Entertainment	Recreation & reading, expenditure on hobbies, cable installation recreational membership fee, toys, games, photography, lodging charges etc, radio and musical instruments(tape recorder, gramophone, TV, VCR, VCP, cassettes), recreational equipment (cameras, projector, shot gun, angling kit, bats, balls etc.)
11. Durables	Electric/ oil fans (table, pedestal, ceiling, exhaust), air conditioners, air coolers, refrigerators, freezers, heater, boiler, geyser (electric, gas, oil), table lamp, sewing machine, knitting machine (electric / hand), other (trunks, suitcase etc.), wall / table clock, water pipes (rubber, nylon, plastic), thermos bottle etc., service and repair charges of household effects, mentioned above
12. Miscellaneous	Stationery supplies such as pen, pencils, stapling machine, pin etc. (other than education purpose), crockery & cutlery for daily use, taxes & fines and all other miscellaneous expenditure, personal effects and service and repair charges

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Economic, Political and Institutional Determinants of Budget Deficits Volatility in Selected Asian Countries

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1. INTRODUCTION

The extent of government deficits and debt has been one of the most debated issues in economics in recent years. High and volatile fiscal deficits may be harmful to welfare, for instance, debt-to-GDP ratio is negatively related with the long run fiscal sustainability, therefore, affecting the living standards of future generation [Alesina and Perotti (1996); Alesina and Rodrik (1994) and Persson and Tabellini (1994)]. High and volatile deficit may also increase the level and volatility of inflation since central bank is deficient in independence [Fata and Mihov (2010)]. Many academics have tried to understand the determinants of the large public deficits, but unfortunately the literature on fiscal deficit volatility is rare.

Budget deficits were initially considered to be a merely macroeconomic phenomenon, but starting from the 1980s due to emergence of political economics, researchers have considered this issue from both economic and political perspectives. Further, the fact that many industrialised countries had been facing considerable budget deficits following the first oil crisis in 1973 and these deficits increased persistently over the following decades of high growth whereas the economic theory suggests these deficits should reduce during more prosperous times. As a consequence, the debt levels have been increasing steadily over the same period, and interestingly the deficits and debt level varies in size among various countries even facing similar economic shocks. In order to explain the cross-country differences for deficits and debt levels, the existing normative economic theory alone may not be considered sufficient. Therefore, political variables, such as the political stability, law and order, and institutional factors, like democracy, are included as an additional explanatory variable in models that have tried to give a positive explanation for the observed patterns in deficits [Woo (2003); Fatas and Mihov (2010)].

In addition to the persistently increasing budget defects its volatility is also a major challenge for many developed and developing countries for several reasons. First, due to

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high deficit volatility, it is not possible to predict the timing and magnitude of fiscal policies and this generates inefficiency of economic decision-making. Second, the fiscal deficit volatility may also cause the government spending volatility and the distortions created by temporary or infrequent measures to meet these fluctuations in spending. When government spending volatility depends on fiscal deficit volatility, the quality and efficiency of the government services: health or education may also be reduced. Third, high fiscal deficit volatility may divert investment towards short term investment projects and leads to irreversible human capital losses. High deficit volatility may lead to high volatility of interest rates which represents a financial burden for investments. The pursuit for models explaining budget deficits from a positive viewpoint has considerably achieved attention over the last three decades; however, the search for models for budget deficit volatility is slightly new issue.

The major focus of the present study is to empirically investigate the sources of fiscal deficit volatility for South Asian and ASEAN countries for the period 1984 to 2010. The study adds to existing literature by examining the economic political and institutional factors that causes instability in budget deficits. The persistence in budget deficit volatility is captured by lag budget deficit volatility in the model. The study highlights the effect of increased openness and high inflation on budget deficit volatility analysis. The analysis include the quantitative and qualitative role of political instability on the budget deficit instability in general, the role of institutions: democracy and some governance variables: corruption, law and order and conflicts in particular. The sample of the countries include four major South Asian countries: Pakistan, Bangladesh, India and Sri Lanka and five major ASEAN countries: Indonesia, Malaysia, Thailand, China, Philippines as these countries have common characteristics of large and persistent as well as instable budget deficit.

The study is organised as follows. Section 2 discusses the theoretical and empirical literature on this area. In Section 3 the overview of the fiscal deficit in these two regions is discussed briefly. The methodology and data is presented in Section 4. The empirical results are discussed in Section 4 and last section concludes the study.

2. LITERATURE REVIEW

A common feature of fiscal behaviour in the majority of developed and developing countries over the last thirty years is the persistence rise of fiscal deficits. In addition to the damages of high fiscal deficit, its volatility is also a major challenge for many countries. The issue of budget deficit and its determinants is extensively empirically examined; however, the instability of budget deficit is not seriously investigated. This section reviews some of the relevant literature in this area.

The literature on this issue can be categorised according to the various politically oriented variables as e.g., political stability, size of government, fragmentation of government vs. institutional factors, type of budgetary procedures, negotiation power of unions etc. The definition of particular explanatory variables has received considerable attention [Roubini and Sachs (1989) and De Haan and Sturm (1994)]. The equilibrium model proposed by Barro (1979) and Lucas and Stokey (1983) argues that in order to minimise distortions, tax rates should be relatively constant over time and therefore spending and revenue shocks should be smoothed by budget deficits and surpluses.

However, tax-smoothing' model does not explain why there is rise and persistence of the budget deficits that emerged following the oil crises in the 1970s, and neither why countries facing similar economic shocks experienced varying levels of fiscal deficits. Alesina and Perotti (1995, 1996b) argue that economic theory alone cannot explain this issue; one should therefore try to resolve in the perspective of political and institutional aspects of the question. In this framework, Person (2001) and Person and Tabellin (2001) find that political and institutional variables also matter for fiscal responsiveness. Hallerberg and Strauch (2002) and Sorensen, *et al.* (2001) argue that fiscal policy is less anti-cyclical in election years. Lane (2003) shows that countries with volatile output and dispersed political power are the most likely to run pro-cyclical policies. Fatas and Mihov (2003, 2006) find that strict budgetary constraints lead to lower policy volatility and reduce the responsiveness of fiscal policy to output shocks. Alesina and Tabellini (2008) suggest that most of the pro-cyclicality of fiscal policy in developing countries can be explained by high levels of corruption. Afonso, *et al*. (2008) show that while country and government sizes and income have negative effects on the discretionary component of fiscal policy, they tend to increase fiscal policy persistence.

As regards institutions, Persson and Tabellini (1999) find that majoritarian elections lead to more redistribution and larger governments and that presidential regimes lead to less redistribution and smaller governments. Under presidential systems the government is more transparent and independent centralised authority [Shugart and Carey (1992)]. Hence, economic policy can be formulated and implemented without much delay or interference. The opposite may be true of the parliamentary system, depending on the electoral laws and their degree of proportionality. Therefore, fiscal outcomes may be different across regimes (presidential versus parliamentary) and electoral systems (proportional versus majoritarian). Alesina and Perotti (1995) and Persson and Tabellini (1997) find that large deficits and debts have been more common in countries with proportional rather than majoritarian and presidential electoral systems. In countries with coalition governments and frequent government turnovers, and in countries with lenient rather than strict budget processes. Henisz (2004) suggests that the presence of institutional checks and balances may improve economic outcomes. Woo (2003) emphasises the role of political factors (government fragmentation, political instability and institutions), social polarisation (ethnic division and income inequality), and institutional factors (budgetary procedures and rules, bureaucratic, efficiency, and democracy). Leachman, *et al.* (2007) show that fiscal performance is better when fiscal budgeting institutions are strong.

The empirical evidence on the relationship between income inequality and fiscal deficit is limited. Woo (1999) provides the first econometric evidence that income inequality is a significant determinant of public deficits. Alesina and Perotti (1996a) find evidence that income inequality increases political instability. Alesina and Rodrik (1994) and Persson and Tabellini (1994) suggest that there may be a tendency of the majority to vote for large redistributive spending in a democratic country with an unequal income distribution. Woo (1999) develops a model of fiscal deficits in which the polarisation of preferences play a decisive role. In a highly polarised society, policy-makers face greater incentives to maintain higher spending for their preferred sectors, leading to larger deficits.

Roubini and Sachs (1989a, 1989b) focus on the relationship between deficits and the structure of the governments (fragmentation) and conclude that the deficits do tend to be positively associated with the fragmentation. Edin and Ohlsson (1994) reveal that the former conclusion may be due to the definition and dimension of the variable, capturing government fragmentation, claiming that only minority governments have a particular tendency to develop large deficits, and differences between majority governments with different numbers of participating parties are insignificant. De Haan and Sturm (1994) find support for neither of the two hypotheses; conclude that there are no significant differences in explanatory power among single party, majority governments, coalition governments and minority governments. Edin and Ohlsson (1991) and Kontopoulos and Perotti (1999) argue that minority governments are associated with larger deficits. Minority governments attributes lack of coordination because there are more participants in the decision-making process. A deficit can arise in this situation because individual policy-makers fail to internalise the full cost of their own spending financed through common tax revenues.

The political business cycles approaches and the partisans theories indicate how politicians influence macroeconomic outcomes. One implication of the political business cycle theories [Nordhaus (1975); Rogoff and Sibert (1988); Rogoff (1990), among others] is that all politicians will implement the same expansionary economic policy before elections. The theories of political business cycles can be distinguished in models assuming adaptive [Nordhaus (1975)] and rational expectations [Rogoff and Sibert (1988); Rogoff (1990)]. In the traditional approaches with adaptive expectations, opportunistic policy-makers can take advantage of a Phillips curve trade-off. Opportunistic policymakers can fool naive voters and stimulate the economy immediately before each election. Alt and Lassen (2006) point out that the greater is the transparency of the political process, the lower is the probability that politicians behave opportunistically. Partisan models emphasise policy-makers' ideological motivations and argue that right-and left-wing parties follow different policies. Perotti and Kontopoulo (2002) show that ideology only influences the budget process via expenditures and finds no significant evidence that it leads to differences in surpluses or deficits. Volkerink and De Haan (2001) use an ideology index and find similar results. Mulas-Granados (2003) finds that left wing governments are not directly associated with higher or lower deficits.

In more recent literature, different definitions of the degree of fragmentation are considered e.g. Volkerink and De Haan (2001) find that the number of spending ministers has stronger and more robust explanatory power than the number of parties in the government. Perotti and Kontopoulos (2002) find supportive results and show that the latter variable even turns insignificant. Franzese (2002) has distinguished between two types of models that are generally used to explain and interpret the behaviour of politicians. Opportunistic models argue that policy is determined by electoral motivations: Politicians just follow policies which maximise their probability of winning the next elections. Political cycles depending on these policies typically show higher deficits in election years or shortly before because government allocates bonuses to the electorate in order to gain popularity right before the elections. Mink and De Haan (2005) find that during election years deficits tend to be higher, whereas in the year preceding the elections they are not. On the other hand, Andrikopoulos, *et al.* (2004) considers larger time period and find that right-wing governments tend to be in favour of fiscal stabilisation during election times. Alesina and Roubini (1997) find no significantly higher deficits for left-wing governments as compared to other governments.

The above literature review suggests that it would be interesting to investigate the economic, political and institutional factors that are source of budget deficit instability in selected Asian countries persistently facing high fiscal deficits.

3. OVERVIEW OF FISCAL DEFICIT IN SAMPLE ASIAN COUNTRIES

The resources available for fiscal policy is limited for South Asian countries in particular and developing countries in general and there is political pressure for specific public expenditures that is difficult to oppose. These issues hold for developing countries and most of these apply to the case of South Asian countries [Jha (2009)]. India has registered an increase in their revenue expenditure ratio overtime whereas Pakistan, Bangladesh and Sri Lanka have shown a decline in this ratio. The public expenditure to GDP ratio has risen in India during 1995 to 2009 but has fallen in Pakistan and Sri Lanka. So public deficit in South Asian countries remains high for Pakistan and Sri Lanka and countries face considerable resource constraints on financing of the deficit that result from their expenditure in excess of revenues.

The efficiency of public expenditure can be haul out through transparency, accountability and corruption in the public sector on a scale of 1 (low) to 6 (high) [World development Indicators (2010)]. India is the best performer among South Asian countries but has shown no progress in its performance between 2005 and 2008. Bangladesh’s score enhanced after 2006 but remained stagnant thereafter. Pakistan’s performance has been the worse among the South Asian nations, however Sri Lanka’s performance was comparable to India’s in 2005 and 2006 but then worsen.

Malaysia faced persistent fiscal deficits in the decade of 2000s, averaging just above 5 percent of GDP from 2000-05. By 2007, the fiscal deficit had fallen below 4 percent, but with the commencement of the financial crisis, the decline in growth and the consequent fiscal stimulus measures, the deficit raised to 7.1 percent of GDP in 2009 and 5.8 percent in 2010.The Indonesian government pursued an expansionary fiscal policy to sustain domestic demand during the global downturn. Improvement in Indonesia's macroeconomic fundamentals and political stability are creating a centre of attention for foreign investors. Tax revenues are anticipated to increase in 2010 on more concentrated collection efforts. All this is expected to be sufficient to finance the fiscal deficit, but there is a need to reform the subsidy structure and efficiency of commodity revenues in Indonesia to attain long term fiscal sustainability [*World Development Indicators* (2010)]. In general governments in ASEAN countries over the time assumed a simulative role however fiscal prudence continue to be maintained for fiscal deficit to be at the manageable level.

In short, low tax/GDP ratios and inelastic expenditure/GDP ratios in south Asia and ASEAN countries leads to structurally unshakable fiscal deficits. Furthermore, quality of institution that creates economic stability and a move towards democratic regimes is also essential for the stability of fiscal deficit in South Asian Region.

The decade wise average deficit to GDP ratio across countries. In Malaysia deficit to GDP ratio was averaged on 5.6 during 1981–1990, 4 percent during 1991–2000 and it was average 5 percent during 2001–2010. In Indonesia deficit to GDP ratio was averaged on 1.1 during 1981–1990, 6 percent during 1991-2000 and it was average 2.1 percent during 2001-2010.

In Thailand deficit to GDP ratio was averaged on 1.13 percent during 1981-1990, 2.38 percent during 1991-2000 and it was average 3.66 percent during 2001-2010. In Philippines deficit to GDP ratio was averaged on 2 percent during 1981-1990, 5 percent during 1991-2000 and it was average 2 percent during 2001-2010. The fiscal balance of the region's four ASEAN countries (Indonesia, Malaysia, Philippines and Thailand) are projected to remain in the range of –1.2 percent to –2.4 percent of GDP in 2011-15 [Southeast Asian Economic Outlook (2010)]. In china deficit to GDP ratio was averaged on 0.017 during 1981-1990, 0.008 during 1991-2000 and it was average 0.007 during 2001-2010.

In Pakistan deficit to GDP ratio was averaged on 7 percent during 1981-1990, 5 percent during 1991-2000 and it was average 4 percent during 2001-2010. In India deficit to GDP ratio was averaged on 8 percent during 1981-1990, 5 percent during 1991-2000 and it was average 0.04 during 2001-2010. In Sri Lanka deficit to GDP ratio was averaged on 0.09 during 1981-1990, 8 percent during 1991-2000 and it was average 8 percent during 2001-2010.

4. METHODOLOGY AND DATA

The investigation of the sources of budget deficit volatility is used based on the theoretical insights of Alesina and Perotti (1995) and Person and Tabellini (1997) and empirical work of Woo (2003) and Henisz (2004) build around the role of institutions on the economic activity. The present study focuses on the economic, political and institutional determinants of budget deficit volatility. The rolling standard deviation for three years of budget deficit to GDP is used to measure volatility and dynamic panel data models are estimated for the period 1984 to 2010 for major South Asian and AESIAN countries. The empirical specification is dynamic panel data models to take account of persistence in the volatility behaviour and identify the factors determining the volatility of budget deficit is given below:

$$BDV_{it} =_{i} \alpha_{it} + \alpha BDV_{it-1} + \beta ECON_{it} + \gamma INST_{it} + \delta C_{it} + v_i + \varepsilon_{it} \quad \ldots \quad (1)$$

$$BDV_{it} = \alpha BDV_{it-1} + \beta ECON_{it} + \gamma INST_{it} + \delta C_{it} + v_i + \varepsilon_{it}$$

Where BDV is logarithm of volatility of budget deficit for the country *i* for the period *t*, $ECON_{it}$ is set of macroeconomic variables, $INST_{it}$ is set of political and institutional variables, C_{it} is set of control variables to capture country specific characteristics.

The vector of economic variables measures the structural characteristics of countries include budget deficit as percentage of GDP, real per capita GDP, inflation and openness. The higher budget deficit causes more frequent changes in government spending and taxation, therefore, it is expected that level of budget deficit is positively associated with budget deficit instability. Low income countries have inefficient tax and spending system and they are more prone to budget deficit and in addition they are more expose to socio-political conflicts [Roubini (1991)]. The real GDP per capita is included to capture the difference in the level of economic development between the countries and relationship with budget deficit volatility is mixed. There is evidence that supports a negative relationship and reason is that the low income countries have shorter and more volatile business cycles due to less developed financial markets and weak economic institutions [Fatas and Mohov (2006)] and these countries often opt discretionary fiscal policy [Rand and Tarp (2002)]. However, Woo (2003) come up with a positive relationship between per capita GDP and budget deficit arguing that a growing economies have more resources and may be in a better position to solve socio-economic distributional problems which may help to deal budget deficits and consequently more volatile budget deficit. The inflation is included to take account of the level of economic uncertainty. As uncertainty causes volatility in government expenditures and revenue which further affects the volatility of budget deficit. The inflation effects budget deficit also through higher nominal interest payments. Therefore, it is expected that higher inflation leads to more budget deficit instability. The external shocks are captured by the degree of openness measured as natural logarithm of the ratio of exports plus imports ratio to GDP. It is expected that degree of openness positively contribute to the budget deficit volatility of the country. The population growth is used as control variable and it is expected that it is negatively associated to budget deficit volatility. Large population leads to spread the cost of financing government spending over a large pool of tax payers giving the benefits of increasing return to scale and consequently providing the goods and services in more stable fashion and resultantly less volatility in budget deficits.

The vector of variables that capture political instability and quality of government institutions are political stability which include: law and order, military in politics, corruption, democratic accountability, bureaucracy quality, internal, external, ethnic and religious conflicts socioeconomic conditions. The variables incorporated in the model are Institutions include: law and order (strength and impartiality of the legal system and popular observance of law), the bureaucratic quality (the bureaucracy has expertise and strength to govern without drastic changes in policy and interruption in the government services) and investment profile (factors effecting investment risk (contract viability, profit repatriation and payment delays); democracy include: democracy accountability and military in politics (the involvement of military in politics even at peripheral level is a diminution of democratic accountability) and government stability (government unity, legislative strength and popular support); social and economic conditions include components that constraint the government actions and fuel social dissatisfaction; conflict include: internal conflict, external conflict and ethnic and religious tensions.

The dynamic panel specification given in model (1) contains fixed country specific effects and lag dependent variable is correlated with error term. To deal with country specific fixed effects and endogeneity, Arellono and Bond (1991) suggests applying the Generalised Method of Moments after first differencing the equation. The first difference remove the country specific effects and instruments set includes the levels and lags of dependent and exogenous variables. In difference-GMM estimates lag variables are weak instruments [Blundell and Bond (1998)], therefore efficiency can be increased by adding the original equation in the level to the system, if the first difference of the explanatory variables are uncorrelated with original effects. Lagged dependent and exogenous variables can be used as instrument variables.

Data and Sample

The study used annual data on economic, political and institutional variables, from 1984 to 2010. The existence of missing values for different variables reduces the number of countries to four in South Asian region and five in ASEAN Region. The source of economic data is international financial statistics and world development Indicators. Political and institutional variables are obtained from International Country Risk Data Guide (ICRG).

Economic variables revealing structural distinctiveness of the countries include, budget deficit to GDP, real GDP per capita, inflation, openness. The reason for taking log of budget deficit to GDP ratio is to explore the direction of relationship between level of deficit and deficit volatility and for income is to allow for variation in economic development among countries. Likewise, inflation is taken to test the hypothesis that whether the higher level of inflation is associated with higher level of budget deficit volatility and openness calculated as ratio of national trade to GDP is taken to explore the effect of external shocks on budget deficit volatility. Furthermore a demographic variable i.e., population growth is taken to control for country size effects.

To explore the effect of political instability on budget deficit volatility, the study uses political instability index constructed in ICRG by assigning risk points to political risk components which include government stability, socioeconomic conditions, investment profile, internal conflict, external conflict, corruption, military in politics, law and order, democratic accountability, bureaucracy quality, religion and ethnic tensions. The minimum number of points that can be given to every constituent is zero and the maximum number depends on the fixed weight that component is given in overall risk assessment, lower the risk point higher the total risk and higher the risk point lower the total risk.

5. EMPIRICAL RESULTS

The determinates of budget deficit volatility are estimated applying the dynamic panel model and Generalised method of Moments of Blundell and Bond (1998) is used as estimation technique that allows to deal with country specific effects and any edogeneity that may be due to the correlation of the country specific effects and dependent variable.

The analysis begins by estimating the macroeconomic determinants of budget deficit volatility; population growth is used as control variable to take account of country specific effects. The set of macroeconomic determinants include real GDP per capita, deficit to GDP ratio and inflation. Lag of budget deficit volatility is used to assess the existence of inertia in the budgetary process. Thereafter political and institutional variables are included in the model, as political stability is important determinants of fiscal deficit stability. It is expected that political uncertainty is source of constraining and damaging economic activity and decrease GDP growth which in turn affects budget deficit instability. The political instability is a multidimensional phenomenon and cannot be captured by a single variable [Woo (2003)]. It suggests that there other factors like better law and order situation and socioeconomic conditions, less corruption, less involvement of military in government and better quality of bureaucracy, more government stability and above all less conflicts. In addition to political stability component sub components are also included in the budget deficit volatility model. In the present study the determinants of budgets deficits are estimated for two regions, South Asia and ASEAN countries for the period 1984 to 2010, to capture the difference in structural characteristics in these two regions Four countries are selected for South Asia and five countries for the ASEAN region.

The results of the basic specification of model are reported in model 1 of Table 2. The results indicate that budget deficit volatility persistence and it is highly significant. It is well documented behaviour of the fiscal policy that it has inertia. This result is also justified by the fact that changes in government revenue tend to lead changes in expenditures, however spending increase are easier to accommodate than spending reduction and resultantly in the context of revenue volatility, there is bias in favour of deficit which in turn generate budget deficit volatility. Fatas and Mhov (2010) argue that increase in spending is hard to reverse and politically difficult and institutional environment has association with this persistence. Agnello and Sausa (2009) also confirm the persistence in the budgetary process. The results show that real GDP per capita and inflation has a positive and significant effect on the budget deficit volatility. The real GDP per capita captures the degree of economic development during the sample period. The positive relationship of income with the budget deficit volatility suggests that the countries with high per capita income have more instability in budget deficits and this result is confirmed by Fatas and Mihov (2006, 2010) and Woo (2003). Fatas and Mihov (2010) have pointed out fiscal policy is not conducted by benevolent government trying to maximise social welfare function and fiscal policy is too volatile. Therefore due to bad fiscal management and lack of internalising the spending decisions leads to growing deficits and accumulation of debt. Woo (2003) supports positive relationship indicating that growing economies have more resources and they may be in a better position to deal with the fiscal deficit problem. The results show that the budget deficit volatility decreases as the as population growth increases. The higher the population growth more stable becomes budget deficit as large population allows the benefits of increasing return to scale, hence enabling the government to provide the public goods in less volatile way as it leads to spread the cost of financing government spending over a large pool of tax payers. The results reported for model 2 Table 2 show that the budget deficit volatility increases as the degree of openness increases and exposure of more external shocks make the budget deficit more volatile. External shocks can be source of fiscal instability especially in developing countries. Changes in export and import prices can affect public sector balance either through profits of exporting or through import tariffs and taxes on exports. The growth of terms of trade is expected to be associated with similar budget deficits and to have a greater impact in economies that are more open to trade. Large and volatile external shocks can decline economic activity which in turn affects the deficits. Agnello and Sausa (2009) and Fatas and Mahov (2010) also show that degree of openness is positively associated with budget deficit volatility and spending volatility respectively. The other economic variables have the same relationship as in the closed economy specification given in model1.

When the political and institutional variables are included to broaden the analysis the role of economic variables remain unchanged as shown by the results presented in models 3, 4, 5 and 6 in Table 2. This ensures the results obtained latter by including the institutional and political variables do not capture the residual of the other economic variables during the sample period. Fatas and Mihov (2010), Edwards and Tabellini (1991), Roubini (1991), Abgello and Sousa (2009) and Alisena, *et al.* (2003) have come up with same conclusions. Political economic theory argues that fiscal policy depends on political and institutional environment [Alesina and Perotti (1995)] and empirical evidence show that government that face more political instability and bad governance are less likely use discretionary fiscal policy and possible cost of restrictions are lack of flexibility to deal with economic fluctuations Institutions and political variables does matter for fiscal policy and have a significant impact on fiscal outcome such as budget deficit when the institutional environment provide the desired discipline to restrict fiscal policy and improve macroeconomic performance [Woo (2003), Alesina and Parotti (1996), Fatas and Mihov (2003)]. The governments, where political system is such that role of military in politics is high, bureaucratic quality is low and stability conditions are not good, may face constraints in implementing the fiscal policies. This reduces the government ability to respond to economic shocks in timely manner and effect is instability in the budget deficit. The result reported for model 3 shows that political instability is significantly associated with budget deficit instability. The law and order situation and bureaucratic quality creates a situation that fiscal authorities cannot adjust promptly to the changes in economic conditions and that indirectly cause budget deficit instability [Fatas and Mihov (2010)]. This type of non-adjustment may show up with volatility, procyclical or that the other extreme countercyclical fiscal policy. Lane (2003) and Heinisz (2000) show that political constraints affect the cylicity of fiscal policy and Agnello and Sousa (2009) document that high level of political instability and less democracy is associated with higher budget deficit volatility. Agnello and Sousa (2009) find that a high level of political stability and lower level of democracy is associated with higher level of budget deficit volatility.

Table 1

Summary Statistics

	Mean	Std. Dev.	Maximum	Minimum
Budget Deficit Volatility	9.38	2.59	16.78	4.14
Budget Deficit to GDP	–0.11	0.52	0.75	-5.84
Inflation	5.93	3.60	18.63	0.29
Political Stability	4.65	1.00	6.9	2.38
Real Per Capita GDP	5.59	0.87	7.00	2.99
Population Growth	2.63	1.73	7.95	-1.94
Openness	0.00	2.00	16.37	-5.99

Table 2

Evidence of the Determinants of Budget Deficit Volatility

	Mod 1	Mod 2	Mod 3	Mod 4	Mod 5	Mod 6	Mod 7	Mod 8
Constant	0.61	0.08	2.04*	–0.08	–1.27	–2.17	0.08	–1.40)
	(1.09)	(–0.09)	(2.01)	(–0.09)	(–1.04)	(–1.04)	(0.04)	(–0.85)
Lag Deficit Volatility	0.16*	0.12*	0.13*	0.12*	0.13*	0.12*	0.18*	0.13*
	(2.91)	(2.15)	(2.31)	(2.15)	(2.20)	(2.27)	(1.78)	(2.35)
Real Per Capita GDP	0.23*	0.21*	0.21*	0.22*	0.23*	0.21*	0.20*	0.23*
	(8.38)	(8.37)	(7.42)	(6.21)	(8.05)	(8.58)	(7.93)	(8.44)
Deficit to GDP	0.20	0.21***	0.24**	0.22**	0.30*	0.28*	0.39*	0.27*
	(1.40)	(1.83)	(1.88)	(1.85)	(1.98)	(1.96)	(2.63)	(1.96)
Inflation	0.04*	0.22**	0.04*	0.04**	0.06*	0.05*	0.04*	0.04*
	(1.87)	(1.76)	(1.89)	(1.76)	(2.43)	(2.09)	(1.91)	(1.99)
Population Growth	–0.13*	–0.17*	–0.10***	–0.17	–0.19*	–0.10*	–0.07*	–0.10*
	(–1.86)	(–1.71)	(–1.76)	(–1.74)	(–1.78)	(1.84)	(–1.98)	(–1.83)
Openness		0.03***	0.01**	0.03*	0.01**	0.03*	0.02**	0.03**
		(1.87)	(1.84)	(1.74)	(1.74)	(1.76)	(1.72)	(1.73)
ASEAN	–0.31	–2.76*	0.48*	–0.97*	–0.37*	–0.58***	0.45*	0.31*
Dummy	(–0.77)	(2.28)	(–2.05)	(–2.19)	(–2.45)	(–1.82)	(–2.14)	(–2.24)
Political Stability			–0.26*					
			(–2.91)					
Democracy				–0.65*				
				(–3.36)				
Low Level of					–0.30*			
Corruption					(–2.67)			
Better Institutions						–0.17*		
						(–2.19)		
Better Socio-economic							–0.31*	
Conditions							(–5.11)	
Less Conflicts								–0.11**
								(–1.72)
R^2	0.65	0.66	0.72	0.70	0.72	0.71	0.69	0.67
Hansan (p-value)	0.41	0.28	0.35	0.54	0.44	0.32	0.29	0.60

Note: *indicates significant at 1 percent, **indicates significant at 5 percent, and ***indicates significant at 10 percent. The error terms are heteroskedasticity and autocorrelation adjusted.

The political and institutional variables are significantly related to budget deficit volatility with expected signs as shown by the results reported in Table 2. The results indicate that high level of political stability is associated with more budget stability. Higher corruption and low institutional quality (legal and bureaucracy) and conflicts (internal, external, ethnic and religious) lead to more fluctuations in the budget deficit. Improvement in social and economic condition and high level of democracy cause reduction in the budget deficit volatility. Alesina and Tabellini (2008) suggest that most of the pro-cyclicality of fiscal policy in developing countries can be explained by high levels of corruption. The difference between two regions is captured by including a dummy which take value 1 for ASEAN counties and zero for South Asian countries and results indicate a significant difference with expected negative sign for most of the models indicating that the ASEAN countries have less budget deficit instability. These results are supported by the findings of other studies; Fatas and Mihov (2003) conclude that political constraints are significant determinants of government spending variability when institutional variables and economic controls are included. Woo (2003) emphasises the role of political factors (government fragmentation, political instability and institutions), social polarisation (ethnic division and income inequality), and institutional factors (budgetary procedures and rules, bureaucratic, efficiency, and democracy) on budget deficit. He identifies that high level of social and political unrest might be strong expression of dissatisfaction with the current government and its politics and more likely to be shorten the tenure of politicians and government is more likely to engage in short term polices at the expense of macroeconomic stability

5. CONCLUSIONS

In the present study the economic, political and institutional sources of budgets deficits are estimated for two regions South Asia and ASEAN countries for the period 1984 to 2010. Four countries are selected for South Asia and five countries for the ASEAN region. The determinates of budget deficit volatility are estimated applying the dynamic panel model and generalised method of moments of Blundell and Bond (1998) that allows to deal with country specific effects and any edogeneity that may be due to the correlation of the country specific effects and dependent variable.

The analysis begins by estimating the macroeconomic determinants of budget deficit volatility. The results reveal high income, high inflation rate and large budget to GDP ratio are associated with large budget instability. The small countries with low population growth have more volatile budget deficits. Lag of budget deficit volatility is positive and significant indicating that the budget deficit volatility has a persistent effect and this result is consistent with the inertia of the budgetary process. High corruption, low institutional quality (legal and bureaucracy) and conflicts (internal, external, ethnic and religious) cause more fluctuations in the budget deficit. The high level of democracy and better social and economic condition reduces the budget deficit volatility. The results indicate that the ASEAN countries have less budget deficit instability. The results of the current study leads to important implication for government that by improving the quality of institutions, creating situations for economic stability and moving towards democratic regimes would ensure more stable fiscal deficits and resultantly positive effect on the long term economic growth.

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Impact of Judicial Efficiency on Debt Maturity Structure: Evidence from Judicial Districts of Pakistan

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1. INTRODUCTION

Broadly there are two theories about the determinants of maturity of credit in a financial system. These two theories are related to the power of creditors and information availability. The pioneers and proponents of the first theory are Townsend (1979), Aghion and Bolton (1992), and Hart and Moore (1999). The power theory of creditors postulate that if creditors are powerful, can enforce contracts through judicial system at lower cost and in a short time, get hold of the collateral, or get control of the firm, they will be more willing to increase volume and maturity of loans. On the other hand, the information theory emphasises on the importance of availability of information about the borrower in the lending decisions. It suggests that lenders will not be too much worried about adverse selection problems if adequate information is available. The second theory was developed by Jaffee and Russell (1976) and Stiglitz and Weiss (1981).

Inefficient judicial system lowers the probability of loan's recovery from opportunistic borrowers or those borrowers who are in financial distress. This probability sinks further low when the loan has a long maturity. In case of short-term loans, lenders can monitor and review the behaviour and financial health of the borrowers at frequent intervals and may refuse to renew the loan upon maturity if the need arises. This ability of the short-term lenders reduces the need of using judicial system for loan recovery. In contrast, lender of long-term loans will have to wait until the maturity of the loan i.e. cannot call back the loan before maturity even if he knows that the financial health of the borrower is deteriorating with the passage of time. This means that lenders of long-term loans cannot employ the early preventive measures of defaults like the lenders of short-term loans do. Rather long-term lenders will have to resort to a court of law if the borrower defaults at the time of maturity. Resultantly, the law protecting the rights of the lenders and the judicial system enforcing the loan contracts will be one of the major determinants of long-term financing. Based on the above arguments, it is hypothesised that the maturity of a firm's debts is positively correlated with efficiency of justice.

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In the presence of inefficient judicial system that makes the enforcement of contracts difficult or costly, lenders will prefer to issue short-term debt than long-term debt. Short-term debt leaves borrowers with little opportunity to indulge in activities that can create moral hazards for creditors [Diamond (1991, 1993); Rajan (1992)]. Specifically, when the maturity of debt is short, borrowers have limited time for opportunistic behaviour. If they violate the terms and conditions of the loan contract, creditors will review their behaviour upon maturity of the loan, and if necessary, may deny renewal of the credit. Such frequent monitoring lowers the probability of greater losses, which is not possible in long-term loans because in long-term loans the borrowers have sufficiently long period during which their opportunistic behaviour may increase the probability of default to a greater extent.

The objective of this paper is to test hypotheses derived from the above discussion, using corporate financial data and judicial efficiency data collected from judicial districts of Pakistan. Specifically, we test two broader hypotheses. The first hypothesis to be tested is that short-term financing ratio will be higher where judicial efficiency is low. And the second hypothesis to be tested is that the straight-forward relationship between judicial efficiency and debt-maturity as portrayed above can be moderated or strengthened by several firm-specific variables such as firm size and the ratio of fixed assets-to-total assets. The second hypothesis is based on the information asymmetry problems and the fact that some firm-specific features are additional guarantees that a firm will not default on its loan. Since lending to undesirable borrowers is more costly in an inefficient judicial system, information availability about borrowers is crucial in lending decisions where judicial efficiency is low. When lenders cannot effectively distinguish between desirable and undesirable borrowers due to asymmetric information, lenders rely on some firm characteristics to derive information about the borrowers. Specifically, firm size and availability of collateral can eliminate or mitigate problems engendered by asymmetric information [Magri (2006)].

The above two hypotheses suggest that debt-maturity of a firm depends not only on the institutional settings around the firm, but also on the firm specific characteristics and the interaction between firm-specific and institutional features.

The motivation for this research comes from the observation of a large number of firms with negative equity figures, and yet a few cases of forced bankruptcies among Pakistani listed firms. The firms with negative equity figures are presumably in financial distress. Theoretically, the large number of firms in financial distress should have led to a higher incidence of forced bankruptcies. However, data from the Securities and Exchange Commission of Pakistan (SECP) show that cases of forced bankruptcies are negligible. The question is "why do creditors of the financially-distressed firms hesitate to go to court against these firms in Pakistan and force their liquidation through judicial process?" One explanation might be that the judicial system is inefficient and the court process is slow and costly in Pakistan. The empirical research shows support for this argument. For example, Claessens, Djankov, and Klapper (2003) used data of 1472 listed firms in five East Asian countries and found that judicial efficiency was an important determinant of whether creditors forced firms into liquidation or not. They argue that creditors use judicial system for firms' bankruptcies only when they know that the loan features and judicial process present good probability of recovery of the loan amount. A direct measure of judicial efficiency in one country relative to other countries is provided by the World Bank in its "Doing Business" report which is published annually to present various analytical accounts of a country's business environment such as how easy or difficult it is to start business in the country, to get credit, to enforce contracts and many other aspects of doing business. The "Doing Business 2010: Pakistan" ranks Pakistan 158 out of 183 countries for overall contract enforcement. The report shows that average number of days taken by courts in resolving commercial disputes is 978 days and cost is 23.8 percent of the claim. The comparative statistics in the report show that Pakistan is too low on the ranking scale when compared to good countries that have best practices.

Both the negligible number of forced bankruptcies and the World Bank report "Doing Business 2010: Pakistan" indicate that judicial efficiency is low across the board in Pakistan. But it is reasonable to expect that judicial efficiency will vary across different districts because of demand pressure and limited judicial resources in these districts. If judicial efficiency is low or high in different districts in Pakistan, has it anything to do with the pattern of financing of listed firms in these districts? Both theoretical and empirical research imply that content and enforcement of law have both direct and indirect impact on the financial structures of firms. With all of the above facts and assumptions, Pakistan is a good candidate for testing the impact of within-country judicial efficiency on various aspects of corporate financial decisions. Thus, this study exploits the variation in judicial efficiency across different districts of Pakistan and relates these variations to corporate financial decisions. Specifically, this study quantifies the impact of judicial inefficiency on debt-maturity structure. Additionally, this paper will also help in answering the question that why corporate short-term financing ratio is high in Pakistan as reported in several studies such as Shah and Khan (2009), Shah and Khan (2007), and Shah and Hijazi (2004).

The rest of the paper is organised as follows. In next section, we review the extant literature and draw implication of poor judicial process for debt maturity decisions. Also in this section, we discuss control variables that have widely been identified as determinants of debt-maturity structure. In Section 3, we discuss the model specifications. Section 4 presents and discusses results of the empirical models. And Section 5 concludes the paper.

2. JUDICIAL EFFICIENCY, FIRM-SPECIFIC CHARACTERISTICS AND DEBT-MATURITY

Besides the direct relationship between debt-maturity and judicial efficiency as discussed in the Introduction, several firm-specific attributes determine the maturity structure of a firm's debt. At the same time, these attributes serve as intervening variables to change the role played by judicial efficiency in debt-maturity structure. For firm specific variables, there are four major theories that try to explain the maturity-structure of a firm's debts. These theories are the agency theory, the maturity-matching theory, the signalling and liquidity risk theory, and the tax advantage theory. The proxies suggested by these theories and philosophical arguments in support of these proxies are discussed next.

2.1.1. Firm Size

Smith and Warner (1979) argue that smaller firms face higher agency costs because shareholders and creditors in these firms have more conflicts due to risk shifting and claim dilution. Short-term debt can be an effective tool to control such agency costs [Barnea, *et al.* (1980)]. Furthermore, small firm do not have as much information in hard form as large firms do because it is relatively costly for small firms to generate and distribute information [Pettit and Singer (1985)]. Lack of information creates severe information asymmetry problem for small firms. The information asymmetry limits the ability of small firms to access capital market for long-term debt. Besides the above, Easterwood and Kadapakkam (1994) argues that small firms cannot access capital markets for long-term debt because large-fixed-flotation costs of fixed securities render this option less economical for them.

2.1.2 Firm Size and Judicial Efficiency

In the presence of asymmetric information problems, lenders are usually more exposed to adverse selection problems. The expected costs of adverse selection are high when judicial efficiency is low. Since information asymmetry problem is severe with small firms as mentioned above, lenders will hesitate to advance long-term loans to small firms.

Moreover, Titman and Wessels (1988) argue that large firms can withstand large negative external shocks because they are more diversified and have large capital base. This is why the expected probability of financial distress of large firms is lower than the small firms. Recovering loan from a financially-distressed firm requires the involvement of judiciary. If judicial process is costly or inefficient, long-term loans to small firms will not be easily available.

Both of the above arguments about firm size suggest that judicial efficiency could impact small firms more. Where judicial efficiency is low, small firms will have more short-term loans on their balance sheets. There is some empirical evidence to support the above arguments. Demirguc-Kunt and Maksimovic (1999) studied empirically the maturity of firms’ liabilities in thirty developed and developing countries over the period 1980-1991. They showed that only large firms had higher long-term external financing to total assets in countries where judicial efficiency was higher. They found that the effect was also economically very significant. For example, the size of the coefficient suggested that the incremental effect of judicial efficiency on debt-maturity was 0.25.

2.1.3. Assets Maturity, Collateral and Judicial Efficiency

Myers (1977) suggests that solution to the well-known under-investment problem of agency theory is to match the maturity of a firm’s debt to that of its assets. The maturity matching makes it sure that payments of loan are scheduled to correspond with the decline in the value of assets in place. It suggests that current assets should be financed with short-term debt and long-term assets with long-term debt. Stohs and Mauer (1996) also suggest maturity matching but give a different explanation. They say that when a firm has longer maturity of assets than that of its debt, the cash flow from its assets will not be sufficient to meet the debt obligation. Demirguc-Kunt and Maksimovic (1999) add another aspect of asset maturity in relation to debt maturity. They suggest that fixed assets facilitate borrowing by serving as collateral. The above arguments suggest that a positive relationship is expected between the ratio of fixed-assets-to-total-assets and the maturity structure of debt.

2.1.4. Collateral and Judicial Efficiency

As argued in the preceding section 2.1.2, collateral solves many asymmetric information problems in credit contracts, such as issues related to project valuation, uncertainty about quality of the project, riskiness of the borrower, and moral hazards. As collateral mitigates the severity of these issues, the impact of judicial inefficiency could not be the same on the debt-maturity of firms that have more fixed assets to offer as collateral for the loan as compared to firms that have few fixed assets.

2.1.5. Growth Opportunities

Myers (1977) identified some unique circumstance where a firm might abandon positive NPV projects in the presence of risky debt. This is phenomenon was named as the underinvestment problem. He suggested that underinvestment problems can be controlled with short-term debt because the debt will mature before the expiration of the growth options. His arguments imply a negative relationship between debt-maturity and the firm's growth rate. Consistent with the above, Barclay and Smith (1995), Guedes and Opler (1996), Barclay, Marx, and Smith (2003) and Varouj, Ying, and Jiaping (2005) all find a negative relationship between proxies for growth and corporate debt maturity.

For the measurement of growth variable, previous research studies have used both book-value and market-value based approaches. This paper prefers the book value-based approach (geometric mean of the annual percentage increase in assets). The reason why we prefer book value approach is that the data period covers the years 2001 to 2006. KSE experienced a phenomenal increase in 2002 and onward. The market-value based proxy might unnecessarily indicate that the listed companies experienced abnormal growth in 2002 and onward. In contrast, the book-value approach provides a stable measure of growth. Under book-value approach, growth opportunities are denoted by the variable $GROWTH_i$, which is a time series mean of annual percentage increases in the total assets of a firm. The time series mean of annual percentage increases in the assets of firm i is calculated to smooth the year-to-year extreme variations. This is why the variable $GROWTH_i$ changes in cross-sections but remains constant over time for firm i.

2.1.6. Firm Quality

Flannery (1986) stated that debt maturity can be used as a signalling device. Since frequency of monitoring increases with short-term financing, lower-quality firms will not prefer to use more short-term debt and subject themselves to more monitoring. However, Mitchell (1991) disagreed with Flannery (1986) by highlighting the importance of transaction costs of short-term debt. He argued that lower-quality firms cannot afford high transaction costs of rolling over short-term debt as could high-quality firms. Consequently, lower-quality firms have to prefer long-term debts. In support of Mitchell (1991), Jun and Jen (2003) argued that a stronger and financially healthier firm can use more of short-term debt as the firm is likely to be less affected by refinancing and the interest risk.

We follow Barclay and Smith (1995) for the measurement of firm's quality. Their proxy assumes that higher-quality firms normally have positive future abnormal profits. Abnormal profit is the difference between current earnings and one period lagged earnings. Since year to year fluctuations in percentage terms may be arbitrary and confusing for the debt-maturity regressions, this is why a firm's quality is proxied by a variable $QUALITY_i$ which takes the value of 1 if a firm has positive abnormal profit in most of the sampled years, otherwise 0.

2.2. Testable Hypotheses

In view of the above theoretical framework and empirical evidences, the following set of testable hypotheses is developed where only the alternative hypotheses are listed. The null hypotheses can be derived in usual manner where no relationship is expected between the explained and the explanatory variables.

The following set of testable hypotheses is developed for debt-maturity ratios of listed firms.

H_1 Short-term financing ratio is higher in districts where judicial efficiency is low.
H_2 In districts where judicial efficiency is low, small firms have higher short-term financing ratios than large firms.
H_3 In districts where judicial efficiency is low, firms with little collaterals have higher short-tem financing ratios than firms with more collateral.
H_4 Growing firms have higher short-term financing ratio than non-growing firms in districts where judicial efficiency is low.
H_5 Judicial inefficiency has greater negative impact on the debt-maturity ratios of firms with more volatile cash flows than on debt-maturity ratios of firms with stable cash flows.
H_6 Debt-maturity ratio increases with the size of the firm.
H_7 Firms with more collaterals have higher debt-maturity ratios.
H_8 Growth opportunities decreases debt-maturity ratio.
H_9 debt-maturity ratios is negatively associated with volatility of firm's cash flows.

3. METHODOLOGY

3.1. Sample and Data Sources

The sample of years for judicial statistics is primarily determined by the availability of data on judicial districts. The four provincial High courts resumed the publication of their annual reports in the year 2001, while this practice was discontinued for several years. At most, annual reports of the High courts could be obtained up to the year 2003. Hence in this study, the sample period for judicial statistics is from 2001 to 2003. Judicial districts to be included in the sample were determined by location of the head offices of the listed firms. Out of a total of 104 judicial districts, the listed firms were found to be concentrated in 27 districts. Expecting that judicial efficiency remains somehow constant in short period of time in a given district, a time series average of judicial efficiency ratio for each district was calculated based on its three years of judicial efficiency ratios.

The source for the financial data of listed firms is "Balance Sheet Analysis of Stock Exchange Listed Firms" a publication of the State Bank of Pakistan (SBP). To synchronise the financial data of firms with judicial statistics, the starting year of firms' data was taken to be the year 2000. As it will be discussed in the coming paragraphs, the variables *GROWTH* and *VOL* needed to be calculated from the average of yearly change in total assets and profitability-to-total assets respectively, the year 2000 was taken as a base year for these calculations and was dropped in all other calculations. Resultantly, the financial data for listed firms come from the years 2001 to 2006.

For the sample of firms to be included in the analysis, the study initially planned to include all listed firms. However, firms in financial industries were dropped as their capital structures and debt-maturity structures are totally different from non-financial firms. Also, to remove outliers, the study dropped all firm-year observations that were below 1 percentile or above 99 percentile. The study also removed firms that were presumably in financial distress as denoted by their negative equity figures. Specifically, firms were excluded that had the ratio of total-debt-to-total-assets above 0.95. Finally an unbalanced panel of 370 firms with 1976 firm-year observations could be saved.

3.2. Measurement of Variables

3.2.1. *The Measure of Debt-maturity*

Empirically, different proxies have been used for debt-maturity. For example, some studies have used the ratio of debt maturing in more than one year and five years to total debt e.g. Ozkan (2000). Others have used the ratio of debt maturing in more than 3 years to total debt [Barclay and Smith (1995); Varouj, *et al.* (2005)]. Given the structure of available data, this study can use only the ratio of debt maturing in more than one year to total debt because the State of Bank of Pakistan's publication '*Balance Sheet Analysis of Joint Stock Companies Listed on the Karachi Stock Exchange*' does not provide data on different maturities of debt. Thus the debt-maturity is the ratio of debt maturing in more than one year to total debt.

3.2.2. *The Measure of Judicial Efficiency*

To measure judicial efficiency, previous studies have used mainly three types of proxies. In most of the cross-country studies that looked into the relationship of efficiency of justice and finance, [e.g. Modigliani and Perotti (1997); La Porta, *et al.* (1998); Kumar, *et al*. (1999); Giannetti (2001); Giannetti (2003)], the authors have used a subjective index either prepared by the authors themselves or by some international organisation like the Business International Corporations (BIC).

In studies where judicial efficiency is measured within a single country, more objective measures of judicial efficiency have been used. For example, Fabbri and Padula (2004), Fabbri (2002) and Jappelli, *et al.* (2005) used either a ratio of pending cases to number of disposed-off cases or the ratio of pending cases to number of cases instituted in a one year. A similar proxy of judicial efficiency used by some studies is the ratio of pending cases per 1000 persons in a given district/province [Jappelli, *et al.* (2005)]. And a third proxy is the average time taken by the district/provincial court from the point of institution of cases up to the point of disposal of the same [Magri (2006)].

Options available to this study do not allow the use of the first proxy because judicial efficiency index like the one prepared by Business International Corporations is not available/suitable for districts in Pakistan. The study cannot use the third proxy as well because data on average time taken in deciding a case by a high court at district level is also not available. Given these constraints, the study can only use the proxy of judicial efficiency where pending cases are normalised by some base figure like number of cases disposed off in a year, number of cases instituted in a year, or population of the given district. This study uses the following measure of judicial efficiency:

$$JE1 = \frac{\textit{Number of cases pending in a given district at the end of the year}}{\textit{Number of cases initiated during that year}}$$

Other possible proxies for judicial efficiency may include:

$$JE2 = \frac{\textit{Number of cases pending in a given district at the end of a year}}{\textit{Number of cases disposed - off during that year}}$$

$$JE3 = \frac{\textit{Number of cases pending in a given district at the end of the year}}{\textit{Population of the district measured in thousands}}$$

$$JE4 = \frac{\textit{Number of cases pending in banking court (where such courts are present)}}{\textit{Population of the district measured in thousands}}$$

Efficiency of the high court is expected to be lower if we get a higher value for *JE* because greater number of pending cases in relation to number of cases disposed-off, would indicate that the given high court is either slow in deciding cases or unable to meet the demand placed on it in comparison to other district high courts.

As discussed above, another useful proxy of the efficiency of justice can be median time analysis which measures the average time taken by a district high court in solving a case from the point of institution of the case to the point of final decision. However, availability of data in Pakistan on the length of trials is the main constraint in the way of conducting such an analysis. Fortunately, research studies report that proxies of judicial efficiencies based on pending cases and median time are well correlated. For example, using data on 27 Italian districts, Jappelli, *et al.* (2005) report that measures like *JE1* or *JE2* have a correlation of 0.6 with a measure of judicial efficiency based on median time taken by a court in deciding a case.

As mentioned above, the study uses the ratio of pending cases at the end of the year to cases initiated during a year. For simplicity, the *JE1* is simply represented by *JE* in the rest of the paper. This measure is well correlated with the other measures of judicial efficiency, which indicates that any of these measures can be used to proxy for the efficacy of justice in Pakistan.

3.2.3. Measurement of Other Explanatory Variables

The Table 1 presents names, measurement, and hypothesised signs of the explanatory and explained variables and the interaction terms in light of the discussion in the literature review. These proxies have been widely used in debt-maturity structure research.

Table 1

Names and Measurement of the Variables

Name of Variable	Denoted by	Measured by
Debt-maturity	*DEMA*	Ratio of long-term liabilities to total liabilities
SIZE	*SIZE*	Natural log of total assets
Tangibility	*TANG*	Net fixed assets / total assets
Growth1	*GROWTH*	Average of annual percentage change in total assets
Growth2	*MVBV*	Market value per share/ book value per share
Volatility	*VOL*	Coefficient of variation of profitability
Jud. Efficiency	*JE*	Ratio of pending cases at year's end to disposed-off cases during the year
QUALITY	*QUALITY*	Equals 1 if abnormal profit is positive in majority of years, otherwise zero
S1×JE		S1 is equal to 1 if afirm is in the 1st quartile of *SIZE*, otherwise 0
S2×JE		S2 is equal to 1 if afirm is between the 1st and the 2nd quartile of *SIZE*, otherwise 0
S4×JE		S4 is equal to 1 if a firm is above the 3rd quartile of *SIZE*, otherwise 0
T1×JE		T1 is equal to 1 if afirm is in the 1st quartile of *TANG*, otherwise 0
T2×JE		T2 is equal to 1 if afirm is between the 1st and the 2nd quartile of *TANG*, otherwise 0
T4×JE		T4 is equal to 1 if a firm is above the 3rd quartile of *TANG*, otherwise 0
G1×JE		G1 is equal to 1 if *MVBV* is equal to or below the 1st quartile, otherwise 0
G2×JE		G2 is equal to 1 if *MVBV* is between the 1st and the 2nd quartile, otherwise 0
G4×JE		G4 is equal to 1 if *MVBV* is above the 3rd quartile, otherwise 0
Quality×JE		Quality Equals 1 if abnormal profit is positive in majority of years, otherwise zero

3.3. Specification of the Models

This study uses a panel data framework to analyse the relationship between proxies for firms' financial decisions and a set of explanatory variables including judicial efficiency. Panel data has several distinct advantages over simple cross-sectional or time series data as discussed by Hsiao (1986). For example, panel data allows us to account for unobserved heterogeneity and provides us large data points that results in more degrees of freedom and lower collinearity among explanatory variables. The basic form of the regression equation is as follows:

$$y_{it} = \beta x_{it}^{'} + \alpha z_i + \varepsilon_{it} \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (1)$$

Where i ranges from 1,2,3,4,…N and t ranges from 1,2,3,4,…T, hence y_{it} is the debt-maturity ratio of firm i at time t. $x^{'}_{it}$ represents various explanatory variables. $\alpha z^{'}_{i}$ is individual effect and $z^{'}_{I}$ denotes a constant term and captures all observable and unobservable variables. If $z^{'}_{i}$ is constant across all cross-sectional units (i.e., the cross-sectional units do not differ among themselves with respect to debt-maturity decisions and/or the constraints they face), then the pooled ordinary least squares(OLS) is a better option to use as OLS will provide consistent and efficient estimates of the coefficients of the explanatory variables under such assumptions.

However, it is reasonable to expect that there will be systematic differences in the debt-maturity ratios of different firms because of industry effects, managers' risk preferences, and/or different incentive structures available to some firms like government subsidised loans (e.g. export refinance scheme of the State Bank of Pakistan that is available only to exporters). If these unobservable effects are not isolated, they will inflate the error term of regression like it happens in the case of omitted variables. To deal with such problems, panel data offers to use either fixed effects or random effects models. The fixed effects model can be specified in the following form:

$$y_{it} = \beta x_{it} + a_i + \varepsilon_{it} \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (2)$$

Where $\alpha_i = \alpha z^{'}_{i}$ and captures the firms' fixed effects that are constant over time but varies across cross-sectional units. Fixed-effects model is costly as it looses too many degrees of freedom due to the construction of dummy variables. Random effects models give efficient estimates if it can be assumed that the individual effects are not correlated with the included explanatory variables. Greene (2006) suggests that such a model under a panel data framework may be formulated as under:

$$y_{it} = \beta x_{it} + [az_i^{'}] + \{az_i^{'} - E[az_i^{'}]\} + \varepsilon_{it} \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (3)$$

This could be simplified to the form

$$y_{it} = \beta x^{'}_{it} + a + u_i + \varepsilon_{it} \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (4)$$

The above random effect formulation considers the u_i to be group specific random element.

To choose between fixed-effects model and random-effects model in an objective manner, Hausman (1978) suggested a test which has a null hypothesis that fixed effects and random effects estimators do not differ systematically. If the null hypothesis is rejected, then the fixed effects model is the best one.

Using the above panel data framework, the study estimates two types of regression equations. In a restricted model, first it is assumed that the influence of judicial efficiency is uniform on all firms. And then in a less restricted model, the study allows for the possibility that judicial efficiency has differential impact on the debt-maturity decisions of firms that are classified in quartiles on basis of their selected attributes. To avoid the problem of simultaneity, all such explanatory variables are lagged one period back excluding *VOL* and *GROWTH*.

Since this study tests mainly two hypotheses, the panel data models are first estimated without including the interaction terms between explanatory variables and *JE* (Baseline estimation). Then for testing the effect of interactions between explanatory variables and *JE* on debt-maturity ratios, differential panel data models are estimated by including interaction terms between *JE* and the explanatory variables (differential regressions).

3.3.1. Baseline Estimation

Under the assumption that judicial efficiency has uniform effect on all firms, following restricted model is specified for the debt-maturity regressions.

$$Y_{it} = a + \beta_1 SIZE_{i,t-1} + \beta_2 TANG_{i,t-1} + \beta_3 GRWOTH_{i,} + \beta_4 VOL_i + \beta_5 QUALITY + \beta_6 JE_i + \eta_{1-5} YRS_i + \lambda_{1-27} IND_i + \varepsilon_{it} \quad \ldots \quad \ldots \quad (5)$$

Where Y_{it} is the debt-maturity ratio for firm i at time t and *SIZE*, and *TANG*, are explanatory variables that have been lagged one period whereas *GROWTH* and *VOL* remain constant throughout the sample period for a given firm and hence does not need to be lagged. *QUALITY* is a dummy variable that takes the value of 1 if a firm has positive changes in its net income in most of the years; otherwise it takes the value of 0. *JE* is the measure of judicial efficiency. *YRS* are five dummy variables for years with one reference category to capture aggregate shocks that affect all firms alike and hence remain constant across firms but vary across time. *IND* represents dummy variables for each industry. There are twenty-eight industries in the sample. All of these dummy variables are tested for their joint significance in each regression model.

3.3.2. Differential Impact of Judicial Efficiency

In the less restricted model, it is assumed that the relationship between judicial efficiency and debt-maturity is not linear for all firms as discussed in detail in the theoretical framework section. To check this possibility, this study introduces interaction terms between the measures of judicial efficiency and dummy variables that are based on the quartiles of selected explanatory variables. For an explanatory variable, three dummy variables and one referent category are defined. Against the referent category the other variables are compared. For example, if we specify *S3* as the 3rd quartile of the variable *SIZE* to be the referent category, the other three dummy variables *S1*, *S2*, *S4* corresponding to 1st , 2nd and 4th quartiles of the variable *SIZE* are defined as follows:

$$S1 = \begin{cases} 1 \text{ if } SIZE \text{ value is in the 1st quartile} \\ 0 \text{ otherwise} \end{cases}$$

$$S2 = \begin{cases} 1 \text{ if } SIZE \text{ value is in the 2nd quartile} \\ 0 \text{ otherwise} \end{cases}$$

$$S4 = \begin{cases} 1 \text{ if } SIZE \text{ value is in the 4th quartile} \\ 0 \text{ otherwise} \end{cases}$$

.

These definitions yield the following values for each of the *SIZE* quartiles:

Quartile of *SIZE*	S1	S2	S4
1	1	0	0
2	0	1	0
3	0	0	0
4	0	0	1

The definitions and symbols of the dummy variables for the quartiles of other explanatory variables are given in Table 1. To avoid the problem of multicollinearity, interaction terms for all variables are not included in one regression model. Rather separate regressions are run to include interaction terms between a single explanatory variable and the *JE*. Each regression model is estimated twice this way; one for fixed effects and the other for random effects. All specifications include full set of dummy variables for years and industries.

To test the differential effect of judicial efficiency on the debt-maturity decisions of firms that are classified into quartiles on the basis of their selected attributes, the study includes three interaction terms between the dummy variables based on quartiles of the selected variables and the measure of judicial efficiency. The missing variable, which is a reference category, is represented by the variable *JE*. Since this analysis is focused on knowing the impact of judicial efficiency on the debt-maturity decision of small and large firms, firm having more and less tangible assets etc., it will be better that the referent category is one of the middle quartiles dummy variables against which the interactive effects of the 1st and the 4th quartiles can be compared. This is why the 3rd quartile is selected to be referent category in all regression models.

4. REGRESSION RESULTS

4.1. Results of the Main Effects Model

Table 2 reports the results of the main effects model where the dependent variable is the ratio of long-term debt to total debt. First column of the table displays the names of the variable whereas the second and third columns report the coefficient of the fixed-effects model and beta coefficients respectively. Beta coefficients have been calculated on the standardised value of the explanatory and the explained variables to show the relative importance of the explanatory variables on a standardised scale. The standard errors and t-statistics are the same for both the usual and beta-coefficients. Standard errors are shown in parenthesis with each explanatory variable.

As expected, firm size has positive coefficient. Its beta coefficient shows that firm size has the largest economic impact on the firms' debt-maturity ratios. For example, one standard deviation increase in firm size increases the debt-maturity ratio by 0.694 standard deviations. This confirms to the well-established signalling and trade-off theories of debt-maturity structure.

Similar to the effect of firm size on debt-maturity structure, the second variable *TANG* also has positive and statistically significant coefficient. Its coefficient in the fixed-effects model shows that 100 percentage points increase in the ratio of fixed assets-to-total assets increases the debt-maturity ratio by 13.6 percentage points. Its relative

Table 2

Baseline Estimation

Table 2 presents results of main effects models where debt-maturity ratio of 370 KSE listed firms is regressed on a measure of judicial efficiency, *JE*, and other control variables over the period 2001-2006. The second and the third columns show coefficients of these variables from fixed effects model and their beta coefficients. Robust standard errors are given in parentheses. The *, **, and *** show statistical significance at 1 percent level, 5 percent level, and 10 percent level respectively. Lower part of the table presents R^2, and F-statistics for fixed-effects model. The regression specification includes five dummy variables for years and twenty-seven dummy variables for industries. The explained variable $DEMA_{it}$ is the ratio of long-term debt to total debt. *SIZE* is the natural logarithm of total assets. *TANG* is the value of net fixed assets over total assets. *GROWTH* is the average of annual percentage change in total assets. *VOL* is the coefficient of variation of *PROF*. *QUALITY* is a dummy variable that takes the value of 1 if a firm has positive abnormal profit in most of the sampled years; otherwise 0. *JE* is the ratio of pending cases at the end of the year to cases initiated during a year.

Variables	Fixed-Effects	Beta-coefficients
$SIZE_{i,t-1}$	0.093(0.017)*	0.694(0.017)*
$TANG_{i,t-1}$	0.136(0.061)**	0.148(0.061)**
$GROWTH_i$	−0.165(0.069)**	−0.112(0.069)**
VOL_i	0.019(0.012)	0.108(0.012)
QUALITY	0.005(0.034)	0.011(0.034)
JE_i	−0.155(0.057)*	−0.162(0.057)*
Constant	0.01(0.122)	0.01(0.122)
R^2_Within	0.0432	
Between	0.1244	
Overall	0.101	
F-Statistics	6.48 (0.00)	

economic significance is given by its beta coefficient which is 0.148, being third largest coefficient after *SIZE* and *JE*. This statistically and economically significant coefficient confirms the maturity-matching hypothesis.

The variable $GROWTH_i$ has negative coefficient and is significant only 5 percent level. And the next two variables do not have any statistical significance. The results indicate that volatility of net income (*VOL*) and a firm's quality ($QUALITY_i$) are not associated with the maturity structure of the firm's debt at reasonable level of statistical significance. Also their economic significance is the lowest among all explanatory variables.

Finally, the coefficient of *JE* suggests that worsening judicial efficiency is associated with lower debt-maturity ratios. The relationship is significant at 1 percent level of significance. Besides the high statistical significance, the coefficient of *JE* is also economically large, being the second largest after *SIZE*. For example, one standard deviation increase in judicial inefficiency results in 0.162 standard deviation decrease in the long-term debt-to-total-debt ratio. This confirms the hypothesis that lenders hesitate to extend long-term debt when judicial efficiency is low.

4.2. Results of Regressions with Interaction Terms

To explore the possibility that worsening judicial efficiency does not impact all firms equally with respect to their debt maturity level, interaction terms among the selected explanatory variables and the measure of judicial efficiency are used in the next set of regressions. To avoid the problem of multi-collinearly, interaction terms for all variables are not included in one regression. Rather a separate regression is estimated to interact three dummy variables based on the quartile of a selected variable with the measure of judicial efficiency. The three dummy variables are based on the 1st, 2nd, and 4th quartile of the included explanatory variables where the missing 3rd quartile serves as reference category. Since the variable *QUALITY* is a dummy variable, the concept of quartile does not apply here, which means that only one interaction terms is available for it.

Results of these separate regressions are reported in Panel A and B of Table 3. The heads of the columns show the names of the variable for which the interaction terms have been included. Each regression specification includes five dummy variables for years and twenty-seven dummy variables for industries. The joint significance the years' dummies and industries' dummies is tested with Wald-test. In all regressions, all these dummy variables were found to be jointly significant at 1 percent. Wald-test is also applied to the interaction terms in each regression to test the joint significance of these interactions.

Results of the Hausman test in all regression models indicated that fixed effects model better fit the data; random effects models are not estimated and reported for the sake of parsimony. Dummy variables for the third quartile of included variables are not included in the regression so that the missing quartile serves as a reference category, the coefficient of *JE* represents slope of judicial efficiency for firms in the third quartile of the given variable in all regressions of Panel A and B of Table 3. For example, coefficient of *JE* in Table 3 under the column *SIZE* is actually the slope of the judicial efficiency for firms belonging to the third quartile of *SIZE*.

Coefficients of the interaction terms like *S1*JE*, *S2*JE* and *S4*JE* are the incremental slopes of judicial efficiency above (if coefficient of the interaction term is positive) or below (if coefficient of the interaction term is negative) the slope of *JE*. Similar interpretations apply to other variables in their respective columns.

The differential slopes of the interaction term *S1*JE* and *S4*JE* are significantly different from the reference category at 1 percent level of significance. Coefficients of the first two interaction terms, *S1*JE* and *S2*JE*, are negative while coefficient of the last interaction term *S4*JE* is positive. As mentioned above, *JE* represents the coefficient of *JE* for firms belonging to the 3rd quartile of *SIZE*. The coefficient of *JE* is –0.144 indicating that 100 percentage points drop in judicial efficiency reduces debt-maturity ratio of firms in the 3rd quartile of *SIZE* by 14.4 percentage points. This effect is severe for firms that belong to the 1st quartile of *SIZE*. This is evident from the differential coefficient of *S1*JE*, which is −0.072. This negative coefficient suggests that worsening judicial efficiency has an additional negative effect of 7.2 percentage points on the debt-maturity ratio of firms in the 1st quartile of *SIZE* as compared to its effect on debt-

Table 3

Panel A – Differential Impact of JE on Debt-Maturity

Panel A and Panel B present results of regression models with interaction terms where debt-maturity ratio of 370 KSE listed firms is regressed on a measure of judicial efficiency, *JE*, firm-specific variables, and the interaction terms between quartile dummies of the explanatory variables and the variable *JE* over the period 2001-2006. Robust standard errors are given in parentheses. The *, **, and *** show statistical significance at 1 percent level, 5 percent level, and 10 percent level respectively. Lower part of the table presents R^2, and F-statistics for fixed-effects model. The regression specification includes five dummy variables for years and twenty-seven dummy variables for industries. The explained variable $DEMA_{it}$ is the ratio of long-term debt to total debt. *SIZE* is the natural logarithm of total assets. *TANG* is the value of net fixed assets over total assets. *GROWTH i*s the average of annual percentage change in total assets. *VOL* is the coefficient of variation of *PROF*. *QUALITY* is a dummy variable that takes the value of 1 if a firm has positive abnormal profit in most of the sampled years; otherwise 0. *JE* is the ratio of pending cases at the end of the year to cases initiated during a year.

Variables	*SIZE*	*TANG*	*GROWTH*
$SIZE_{i,t-1}$	0.07(0.018)*	0.087(0.018)*	0.093(0.017)*
$TANG_{i,t-1}$	0.125(0.06)**	0.092(0.063)	0.136(0.061)**
$GROWTH_i$	−0.175(0.07)*	−0.262(0.072)*	0.000(0.00)
VOL_i	0.006(0.015)	0.024(0.012)***	−0.04(0.02)**
QUALITY	−0.001(0.032)	0.013(0.035)	0.005(0.034)
JE_i	−0.144(0.05)*	−0.206(0.056)*	−0.012(0.164)
S1×JE	−0.072(0.029)*		
S2×JE	−0.02(0.015)		
S4×JE	0.063(0.018)*		
T1×JE		−0.046(0.02)**	
T2×JE		−0.029(0.012)**	
T4×JE		0.069(0.013)*	
GT×JE			0.056(0.08)
G2×JE			0.077(0.061)
G4×JE			0.11(0.115)
Constant	0.073(0.076)	0.073(0.076)	0.059(0.123)
R^2 - Within	0.0597	0.0432	0.0774
Between	0.1234	0.1244	0.2029
Overall	0.1019	0.101	0.1709
F-Statistics	5.10 (0.00)	5.52 (0.00)	4.20 (0.00)

maturity ratio of firms in the 3rd quartile of *SIZE*. The overall impact of judicial inefficiency on the debt-maturity of firms in the 1st quartile of *SIZE* is −21.6 percentage points (−14.4 −7.2). This impact is far greater than the impact of worsening judicial efficiency on the debt-maturity ratios of firms in the 4th quartile of *SIZE*. For example, the impact of worsening judicial efficiency on debt-maturity of firms in the 4th quartile of *SIZE* is only −9.1 percentage points (−14.4 + 6.3). These findings are in line with the hypothesis that firm size reduces information asymmetries and serves as a proxy for the firm's ability to absorb unexpected shocks. Such features of borrowers reduce the lenders' concern about the adverse selection and subsequent borrowers' delinquency.

The differential coefficients in the third column of Table 3 for the variable *TANG* indicate almost similar results as discussed above. The results indicate that poor enforcement of contracts has smaller negative impact on the debt-maturity levels of firms that have more fixed assets-to-total assets as compared to firms that have less fixed assets-to-total assets. For example, the overall impact of judicial inefficiency on the debt-maturity level is only −0.137

for firms in the 4th quartile of *TANG* whereas it is −0.252, −0.235, and −0.206 for firms in the 1st, 2nd and 3rd quartile of *TANG* respectively. These results indicate that firms having more fixed assets as a percentage of total assets are affected less by worsening judicial efficiency.

The variable *GROWTH* was dropped by the econometric software STATA when interaction terms of its quartiles were included. This may be because of high collinearity between *GROWTH* and its interaction terms. To test it in an alternative way, a dummy *GT* variable was created based on the 50th percentile of *GROWTH*. *GT* assumed a value of 1 if a firm had a *GROWTH* value of more than the 50th percentile of *GROWTH*, otherwise 0. *GT* was interacted with the *JE*. A separate regression was estimated to include this interaction term *GT*JE* instead of including the dummy variables based on the quartiles of *GROWTH*. Results of the regression showed that *GT*JE* has a negative and statistically significant value of −0.298. However, the main variable *GROWTH* showed an insignificant coefficient. Thus growth opportunities and their interaction terms do not present a clear picture in the differential equation of debt-maturity structure.

The last two variables, reported in Panel B of Table 3, do not show consistent or significant results as well. For example, the coefficient of *VOL* is not statistically

Table 3

Panel B: Differential Impact of JE on Debt-Maturity

Panel B present results of regression models with interaction terms where debt-maturity ratio of 370 KSE listed firms is regressed on a measure of judicial efficiency, *JE,* firm-specific variables, and the interaction terms between quartile dummies of *VOL and QUALITY* and the variable *JE* over the period 2001-2006. Robust standard errors are given in parentheses. The *, **, and *** show statistical significance at 1 percent level, 5 percent level, and 10 percent level respectively. Lower part of the table presents R^2, and F-statistics for fixed-effects model. The regression specification includes five dummy variables for years and twenty-seven dummy variables for industries. The explained variable $DEMA_{it}$ is the ratio of long-term debt to total debt. *SIZE* is the natural logarithm of total assets. *TANG* is the value of net fixed assets over total assets. *GROWTH i*s the average of annual percentage change in total assets. *VOL* is the coefficient of variation of *PROF*. *QUALITY* is a dummy variable that takes the value of 1 if a firm has positive abnormal profit in most of the sampled years; otherwise 0. *JE* is the ratio of pending cases at the end of the year to cases initiated during a year.

	VOL	*QUALITY*
$SIZE_{i,t-1}$	0.093(0.017)*	0.093(0.017)*
$TANG_{i,t-1}$	0.136(0.061)**	0.14(0.061)**
$GROWTH_i$	−0.649(0.15)*	−0.41(0.167)*
VOL_i	0.012(0.025)	−0.047(0.027)***
QUALITY	0.005(0.034)	−0.091(0.138)
JE_i	0.333(0.079)*	0.001(0.248)
V1×JE	−0.547(0.098)*	
V2×JE	0.009(0.039)	
V4×JE	−0.173(0.062)*	
Q×JE		0.111(0.135)
Constant	−0.474(0.22)**	0.059(0.1)*
		0.057(0.05)
R^2 - Within	0.0432	0.0439
Between	0.1244	0.1239
Overall	0.101	0.102
F-Statistics	5.52 (0.00)	4.84 (0.00)

significant at any conventional level. Its interaction terms, though statistically significant, do not demonstrate a consistent pattern. Debt-maturity ratios of firm in the 1st, 2nd, 3rd, and 4th quartiles of *VOL* change by −0.214, 0.3339, 0.333, and 0.16 units when there is one unit positive change in the *JE* (positive change in *JE* shows deterioration in the efficiency of justice). And finally, neither the variable *QUALITY* nor its interaction term is significant at conventional levels of 1 percent, 5 percent or 10 percent.

5. CONCLUSIONS

The main objectives of this paper was to quantify the effect of judicial efficiency on debt-maturity structure of firms listed at KSE and to highlight the importance of efficient judicial system for the development of capital markets. This paper accomplishes these objectives by analysing the impact of judicial efficiency and other firms-specific factors on debt-maturity structure of 370 KSE-listed non-financial firms over the period 2001-2006. The baseline results show that large firms and firms with more tangible assets have more long-term debts whereas growing firms have more short-term debt. The results clearly indicate that debt-maturity decreases with inefficiency of judiciary; however, volatility of net income and firm’s quality do not show any statistically significant relationship with debt-maturity ratio. Results of regressions also show that worsening judicial efficiency has greater negative effect on debt-maturity of small firms than on debt-maturity of large firms. Similarly, worsening judicial efficiency has greater negative impact on the debt-maturity ratios of firms with fewer tangible assets than on firms with more tangible assets.

Policy Implications

Results of the regression models have important implications for financial deepening and capital-market development in Pakistan.[1] Results suggest that inefficient judicial system not only reduces debt-maturity at aggregate level, but also has an additional negative impact on the debt-maturity ratios of small firms and firms with little collaterals. These results highlight the importance of judicial efficiency for small firms both in their capital structures and debt-maturity structures. Being unable to borrow and achieve optimum capital structure, small firms lose one important and cheaper sources of capital. Second, small firms under inefficient judicial system will find it difficult to borrow for the long-term. The excessive use of short-term financing may be very risky for small firms because their cash flows are more likely to fluctuate than those of large firms. Second, in developing countries like Pakistan, small firms are considered to be the engine of economic growth. Difficulty in accessing long-term financing means that their growth opportunities remain limited. In addition, if they finance long-term projects with short-term debts, it will create a maturity mismatch between assets and liabilities, increasing the chances of financial distress which will subject such firms to those many indirect costs of financial distress/bankruptcy like lower expenditure on research and development and employees training, deterioration in quality of goods and services and decline in sales. The inability of small firms to borrow optimally for exploiting growth opportunities will translate into economic stagnation of the overall economy.

[1]The importance of financial system development and economic development has long been recognised and documented in the extant literature. For a survey of this literature, see Shah and Shah (2011).

Several measures can be suggested to mitigate the negative impact of judicial inefficiency. The first measure, of course, is to expedite the process of pending cases resolution at all levels of the high courts. Since this requires huge allocation of additional resources, one alternative is to focus specifically on the efficiency of banking courts. Banking courts are limited in number and hence can be targeted even with limited resources. Second, the network of banking courts can be increased to lighten the burden on the existing courts. In the meantime, as the results suggest that information availability about the borrowers plays an important role both in the debt-maturity decisions of creditors, information sharing among financial institution should be encouraged and banks credit monitoring systems should be strengthened. At present, the Credit Information Bureau (CIB) is performing the duty of obtaining and disseminating information related to credit history of the borrowers. CIB is helpful in reducing the adverse selection problem; however, results of the study indicate that information unavailability is still a big issue in lending decisions. This highlights the need for improvement in the functioning of CIB. The second problem of information asymmetry i.e., moral hazards can be overcome by strengthening the monitoring system.

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Relative Efficiency of Decision Making Units Producing Both Desirable and Undesirable Outputs: A Case of Textile Processing Units in Pakistan

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1. INTRODUCTION

Textile processing is Pakistan's leading industrial manufacturing sub-sector with regard to production, export and labour employment. It produces almost 30 percent of the manufacturing value added, employs 40 percent of the manufacturing sector labour force and represents 63 percent of the total exports of Pakistan. The number of textile processing mills in rural and urban Punjab province and urban Sindh province has grown greatly since the mid-1970s, most of which started operating without proper planning and waste treatment plants, disposing of untreated toxic waste into nearby drains, irrigation canals or rivers. Major textile industrial estates in large cities such as Lahore, Faisalabad, Karachi, and Sialkot contribute 70 percent of the total pollution loads of water bodies.

The textile processing industry in Pakistan, as elsewhere, is characterised by the vast quantity of water consumed and the variety of chemicals used in the process. Liquid wastes from various stages of the operation contain substantial pollution loads in terms of organic matter and suspended material such as fibres and grease. This wastewater is discharged untreated or at the best partially treated, and causes serious environmental impacts on natural water bodies and land in the surrounding area. According to a joint report published by the Pakistan Environmental Protection Agency (PEPA) and Japanese International Cooperation Agency (JICA) 2005, 9000 million gallons of wastewater having 20,000 tons of BOD5 (Biological Oxygen Demand) loading are daily discharged into water bodies from the industrial sector into natural streams, canals, rivers and the sea.

The regulatory system framework for implementation of environmental policy in Pakistan evolved over a period of fifteen years. It began with promulgation of the Pakistan Environmental Protection Ordinance (PEPO) of 1983 (repealed in 1997), notification of NEQS (National Environmental Quality Standards) in 1993 and revision of NEQS in 1999. The NEQS provide for targeted end-of-pipe standards for industrial and municipal effluents for 32 liquid and 16 gaseous parameters. The compliance regime for NEQS was established through the PEPA (Pakistan Environmental Protection Act) 1997.

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This paper is an attempt to measure the relative efficiency of textile processing units in Pakistan using the data envelopment technique. This technique includes measurement of the relative efficiency of any production unit or decision making unit (DMU) that uses multiple inputs and generates multiple outputs, including undesirable outputs (pollutants). The efficiency scores determine the relative efficiency of firms in realising their efforts towards cleaner production and abatement of wastewater pollution discharged into water bodies. A large number of inefficient firms (as found here) implies that pollution control is far from satisfactory.

The following Section 2 provides a brief literature review of the various models and efficiency measurements usually based on the assumption that inputs have to be minimised and outputs have to be maximised. Over the last few years, in a growing number of applications, undesirable outputs (need to be minimised) which are jointly produced with the desirable outputs are incorporated into the production model. The review is followed by Section 3 which is a brief description of methodology of Data Envelopment Analysis (DEA) and its application to textile producing units in Pakistan adopted in this paper. Next, Section 4 deals with the data used in this work and estimation of firms' efficiency scores followed by conclusions in the last Section 5.

2. LITERATURE REVIEW ON DEA AND MODELS WITH UNDESIRABLE OUTPUTS

Data envelopment analysis is a relatively new 'data oriented', non-parametric method of relative efficiency measurement of decision making units (DMUs) which produce multiple desirable and undesirable (pollution) outputs using multiple inputs. DEA uses linear programming to evaluate the relative efficiencies and inefficiencies of peer DMUs. DEA's empirical orientation and absence of *a priori* assumptions have resulted in its use in a number of studies involving efficient frontier estimation. DEA has been applied to a wide range of contexts such as education, health care, transportation and manufacturing [Coelli, *et al.* (2005)].

Farrell (1957) first developed the basic ideas in DEA and applied to empirical data in an attempt to correct deficiencies in productivity indices, leading to the replacement of the concept of productivity with the more general concept of 'relative efficiency'. Building on the evaluation of individual firms by Farrell, a non-parametric method was developed by Charnes, Cooper, and Rhodes (1978, 1981) as DEA. It is basically the extension of single-input and single-output efficiency analysis to multi-input and multi-output situations. Compared to the parametric approach, DEA has no assumptions about functional form. Efficiency of a DMU is determined by relative efficiency scores of other DMUs that lie on or below the efficient frontier. In general terms, DEA is a methodology which is therefore directed to frontiers rather than central tendencies. Charnes, *et al.* (1978), proposed an input oriented mathematical programming DEA model which assumed constant returns to scale. This DEA has since been widely used to measure the performance of various kinds of DMUs. In contrast, Banker, Charnes, and Cooper (1984) developed an output-oriented DEA model, which measures radial efficiency of DMUs, simultaneously constructs the best practice frontier, characterises its shape, assumes variable return to scale and provides a performance evaluation for every observation in the sample. Classical DEA models, such as in Charnes, *et al.* (1994), primarily assume that inputs have to be minimised and outputs have to be maximised. However, in a seminal work Koopmans (1951) had already identified smoke pollution and waste as undesirable outputs generated in the production process that need to be minimised. Fare, *et al.* (1989) implemented the non-parametric approach on a 1976 data set of 30 US mills which use wood pulp and three other inputs in order to produce paper but also four pollutants. Their results exhibit that the performance rankings of DMUs turned out to be very sensitive to whether the undesirable outputs were included. Other studies show similar results [e.g. Pittman (1983); Tyteca (1996, 1997)].

Fare, *et al.* (1996) presented an environmental performance indicator by decomposing overall productivity into an environmental index and a productive efficiency index. They assumed weak disposability for undesirable outputs and used DEA modeling techniques developed previously by Fare, *et al.* (1989). Two data sets were examined using these models for US fossil fuel-fired electric utilities. The ranking of utilities identified using the new model was significantly different to rankings from the traditional model, suggesting that traditional DEA models might not be reliable. As DMUs are responsible for the joint production of bad outputs along with desirable outputs, it makes sense to credit a DMU for its provision of desirable output and to penalise it for its production of emissions when evaluating its performance.

Sieford and Thrall (1990) reviewed the various advantages of non-parametric approaches (including DEA) over parametric approaches. One of the significant benefits of non-parametric approaches is the robustness of linear programming methods used to solve DEA problems. Also additional information and new insights with respect to traditional econometric methods are provided by DEA models. Charnes and Cooper (1985) also indicate that another advantage is the feasibility to include an environmental variable in a DEA-based production model which is neither an economic resource nor a product, but a by-product. Since DEA has proven useful for modelling operational processes for performance evaluation, there are a number of DEA spread sheet models e.g. Zhu (2002) that can be used in performance evaluation of DMUs and benchmarking.

In the framework of DEA, Scheel (2001) adopted various approaches to deal with undesirable outputs which have to be minimised. Seiford and Zhu (2002) have shown that standard DEA model can be used to improve the performance of polluting firms by increasing the desirable outputs and decreasing the undesirable outputs. In recent years, reflection of undesirable outputs in the production process and modelling for efficiency/performance measurement has steadily grown. As emphasised by James (1994), 'environmental performance measurement is here to stay but is still in its early stages', and it is evident that 15 years later James's statement remains valid. Moreover, James and Bennett (1994) indicated that, 'The scale of the challenge is such that even the simplest measures are better than none at all. Immediate actions of almost any kind can signal a serious intent to the world, make some reduction of environmental impacts, reduce the risk of negative reactions by regulators, customers and other stakeholders and provide a platform for further action. The over-riding necessity is to begin the process of using business environ metrics to encourage continuous improvement of corporate environmental performance'. In the present study, a data envelopment analysis method as developed in Sieford and Zhu (2002) is applied to the textile processing firms in Pakistan, in order to determine their relative efficiency by modelling undesirable factors (BOD5, COD) in efficiency evaluation.

3. DATA ENVELOPMENT ANALYSIS (DEA)

DEA entails the use of linear programming methods to build a non-parametric piecewise surface over the data to estimate efficiency measures relative to this surface, the efficient technology or production frontier. The technical efficiency scores of each firm or decision making unit (DMU) relative to the best observed practice can be obtained by applying DEA techniques.

3.1. Modelling Undesirable Outputs in the Efficiency Valuations Using DEA Framework

The DEA frame work has conventionally been applied with the implicit assumption that efficient production provides increase in outputs with increased inputs. In reality this assumption may not hold, although an increase in inputs subsequently provides increased output, efficiency may not necessarily be established due to undesirable by-products. In textile processing, fabric is produced which is marketable output and water polluting factors like BOD and COD are its by-products which need to be reduced to increase the performance of DMU. Tyteca (1997) used models of US fossil fuel-fired electric utilities to obtain the best practice frontier of utilities or DMUs exhibiting the best environmental behaviour. He applied four alternative models which includes three linear programming models with different approaches to incorporate undesirable outputs. Dyson, *et al.* (2001) have also developed various methods of taking undesirable output into account. Scheel (2001) categorised different ways of dealing with undesirable outputs into direct and indirect approaches. The key indirect approaches to deal with undesirable output are as follows:

- Undesirable outputs are considered as inputs.
- To transform undesirable output into desirable output, it is deducted from a large number.
- The inverse of undesirable output is considered as a desirable one.

This paper follows Seiford and Zhu (2002) to estimate the relative efficiency of textile processing units (DMUs) in Pakistan. Textile processing involves use of chemicals, bleach and dyes to print fabrics which results in high levels of water polluting factors as undesirable by-products like BOD (Biological Oxygen Demand) and COD (Chemical Oxygen Demand). This results in inefficient production and undesirable outputs which needs to be reduced to improve the efficiency and performance of DMUs. Seiford and Zhu (2002) use classification invariant property to justify the application of a standard DEA model that can be employed to improve the performance by increasing the desirable outputs and decreasing the undesirable outputs. This approach can also be applied in certain conditions such as a water pollution treatment plant, where increase in inputs can lead to improved performance. An important feature of the method is that it adopts and preserves the linearity and convexity of DEA.

3.2. Envelopment Models

The input oriented VRS envelopment model where the inputs are minimised and outputs are kept at their current levels is written as:

$$\theta = \min \theta$$

subject to

$$\begin{aligned} &\textstyle\sum_{j=1}^{n} \lambda j\, xij \le \theta xio && i = 1,2,\ldots,m; \\ &\textstyle\sum \lambda j\, yrj \ge yro && r = 1,2,\ldots,s; \qquad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (1) \\ &\textstyle\sum \lambda j = 1 && \\ &\lambda j \ge 0 && j = 1,2,\ldots,n; \end{aligned}$$

where as here *DMUo* represents one of the *n DMUs* under evaluation and *xio* and *yro* are the *i*th input and *r*th output for *DMUo* respectively. Since $\theta = 1$ is a feasible solution to (1), the optimal value to (1) $\theta^* \le 1$. If $\theta = 1$ then the current input levels cannot be reduced (proportionally), indicating that DMUo is on the frontier. Otherwise, if $\theta^*<1$ then DMUo is dominated by the frontier. θ^*represents the efficiency score (input-oriented) of DMUo.

$$\min\theta - \varepsilon\left(\textstyle\sum s_i^{-} + \sum sr^{+}\right)$$

subject to

$$\begin{aligned} &\textstyle\sum_{j=1}^{n} \lambda j\, xij + si^{-} = \theta\, xio && i = 1,2,\ldots,m; \\ &\textstyle\sum \lambda j\, yrj - sr^{+} = yro = 1,2,\ldots,s; && \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (2) \\ &\textstyle\sum \lambda j = 1 && \\ &\lambda j \ge 0 && j = 1,2,\ldots,n; \end{aligned}$$

The output oriented VRS envelopment model can be expressed as:

$$\max \phi - \varepsilon\left(\textstyle\sum si^{-} + \sum sr^{+}\right)$$

subject to

$$\begin{aligned} &\textstyle\sum \lambda_j\, xij + si^{-} = \bar{x}io && i = 1,2,\ldots,m; \\ &\textstyle\sum \lambda_j\, yrj - sr^{+} = \phi\ \bar{y}ro && r = 1,2,\ldots,s; \qquad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (3) \\ &\textstyle\sum \lambda j = 1 && \\ &\lambda j \ge 0 && j = 1,2,\ldots,n; \end{aligned}$$

ϕ^* represents the efficiency score (output-oriented) of DMUo. The above model can be calculated in a two stage process. ϕ^* is first calculated by ignoring the slacks and then optimise the slacks by fixing the ϕ^* in the following linear programming problem.

$$\max\textstyle\sum s_i^{-} + \sum s_r^{+}$$

subject to

$$\begin{aligned} &\textstyle\sum_{j=1}^{n} \lambda j\, xij + s_i^{-} = xio && i = 1,2,\ldots,m; \\ &\textstyle\sum \lambda_j\, yr_j - sr^{+} = \phi^*\, yro = 1,2,\ldots,s; && \ldots \quad \ldots \quad \ldots \quad \ldots \quad (4) \end{aligned}$$

$\sum \lambda j = 1$
$\lambda j \geq 0 \qquad j = 1,2,\ldots,n;$

DMUo is efficient if and only if $\phi^* = 1$ and $s_i^{-*} = s_r^{+} = 0$ for all i and r. We can get the slacks through

$$si^{-} = x_{io} - \sum_{j=1}^{n}\lambda_j x_{ij} \qquad i = 1,2,\ldots, m; \qquad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (5)$$
$$sr^{+} = \sum\lambda_j y_{rj} - \phi^* y_{ro} \qquad r = 1,2,\ldots,s;$$

It is to be noted that $\phi^* \geq 1$ and $\phi^* = 1$ if and only if $\theta^* = 1$. This indicates that model 1 and model 3 above identify the same frontier.

3.3. Efficiency Invariance

Suppose that inputs and outputs are transformed to $\bar{x}_{ij} = x_{ij} + u_i$ and $\bar{y}_{rj} = y_{rj} + v_r$, where u_i and v_r are nonnegative. Then the input-oriented VRS model become

$$\min\theta - \varepsilon\left(\sum s_i^{-} + \sum s_r^{+}\right)$$

subject to

$$\sum_{j=1}^{n} \lambda_j x_{ij} + s_i^{-} = \theta\, \bar{x}_{io} \qquad i = 1,2,\ldots,m;$$
$$\sum\lambda_j y_{rj} - s_r^{+} = \bar{y}_{ro} \qquad r = 1,2,\ldots,s; \qquad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (6)$$
$$\sum \lambda_j = 1$$
$$\lambda_j \geq 0 \qquad j = 1,2,\ldots,n;$$

and output–oriented VRS model become

$$\max \phi - \varepsilon\left(\sum s_i^{-} + \sum s_r^{+}\right)$$

subject to

$$\sum \lambda_j x_{ij} + s_i^{-} = \bar{x}_{io} \qquad i = 1,2,\ldots,m;$$
$$\sum \lambda_j y_{rj} - s_r^{+} = \phi\, \bar{y}_{ro} \qquad r = 1,2,\ldots,s; \qquad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (7)$$
$$\sum \lambda_j = 1$$
$$\lambda j \geq 0 \qquad j = 1,2,\ldots,n;$$

Generally, there are three categories of invariance under data transformation in DEA. The first one is "classification invariance" where the classifications of efficiencies and inefficiencies are invariant to the data transformation. The second category is the "ordering invariance" of the inefficient DMUs. The third one is the "solution invariance" in which the new DEA model after data transformation must be equivalent to the old one that is both mathematical programming problems must have exactly the same solution. Seiford and Zhu (2002) deal only with the classification invariance.

3.4. Undesirable Outputs in DEA

y^{g}_{rj} and y^{b}_{rj} denote the desirable or good and undesirable or bad outputs, respectively. We always want to increase y^{g}_{rj} and decrease y^{b}_{rj} to improve the performance of a DMU. However in the output-oriented VRS envelopment model which is the standard BCC model, both y^{g}_{rj} and y^{b}_{rj} are supposed to increase to improve the performance. To get the level of desirable outputs increased and to decrease the undesirable outputs following approach is adopted.

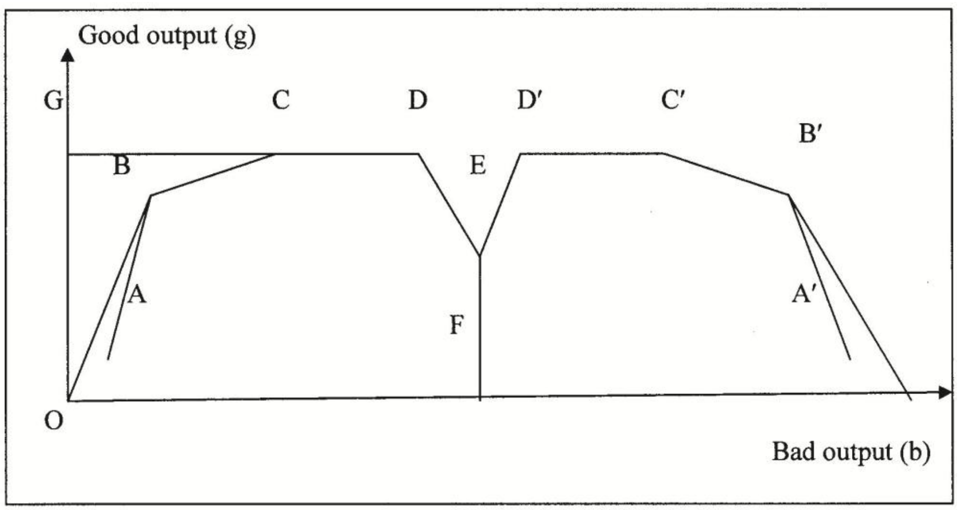
Each undesirable output is first multiplied by "–1" and then find a proper value v_r to let all negative undesirable outputs be positive. That is, $y^{b}_{rj} = -y^{b}_{rj} + v_r = 0$. This can be achieved by $v_r = \max j \ \{y^{b}_{rj}\} + 1$, for example. Based upon (7) we have

max h

subject to

$$
\begin{aligned}
&\textstyle\sum^{n}_{j=1} \lambda_j y^{g}_{rj} \geq h y^{g}_{ro} \\
&\textstyle\sum \lambda_j \ \bar{y}^{b}_{rj} \geq h \ \bar{y}^{g}_{ro} \qquad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \qquad (8) \\
&\textstyle\sum \lambda_j x_{ij} \leq x_{io} \\
&\lambda_j \geq 0, \ j = 1,\ldots,n
\end{aligned}
$$

It should be noted that (8) increases desirable outputs and decreases undesirable outputs.



Adapted from Seiford and Zhu (2002).

Fig. 1. Treatment of Bad Outputs

Figure 1 illustrates three approaches for treating the undesirable outputs. The input used by five DMUs (A, B, C, D and E) is equal to produce one desirable output (g) and one undesirable output (b). First, under the output oriented BCC model (25), the area OGCDEF is the conventional output set. If we treat the undesirable output as (b) an input, then ABCD becomes the BCC frontier. For the proper translation vector, we can rotate the output set at EF and obtain the symmetrical region. In this case, DMUs A′, B′, and C′, which are, respectively, the adapted points of A, B and C, are efficient. Adapting from Seiford and Zhu (2002), the envelopment model is applied in this paper with variable returns to scale (VRS) to the data of inputs and outputs for the year 2008 from textile processing units in Pakistan. The water pollution indicators, BOD5 and COD are taken as undesirable outputs, as commonly done in literature. This approach is mainly based on the use of DEA classification invariance under which classifications of efficiencies and inefficiencies are invariant to the data transformation. There are different possibilities to treat the undesirable outputs in the DEA-BCC framework. Here, three different approaches to deal with the undesirable outputs are being followed. First, the undesirable outputs are ignored. Second a linear monotone decreasing transformation is applied to the undesirable outputs and then adapted variables are viewed as outputs. Third, the undesirable outputs are treated as inputs.

4. DATA FOR ESTIMATION AND EFFICIENCY SCORES

The data set used in the estimation of efficiency consists of data from the year 2008 for 45 textile processing mills located in the vicinity of the Malir and Lyari rivers, which run across the Karachi industrial area and finally enter the Arabian Sea. The data were collected using a structured questionnaire for a field survey of textile processing mills. All textile processing units or DMUs have similar characteristics in terms of technology for both the production of fabric and waste treatment. The production process produces a desirable output (printed fabric) together with undesirable outputs like water pollutants: BOD5 and COD. Textile processing mills use capital, labour, fuel, raw material and chemicals as inputs to produce the printed fabrics. The quantity of these inputs, the desirable output and the undesirable outputs (BOD and COD) taken as average value for the year 2008, are shown in Table 1.

Table 1

Descriptive Statistics (Sample Size = 45)

Variable	Description	Units	Mean	Std. Dev	Minimum	Maximum
LABR	Labour employed	No. of persons/year	2596	950.53	1006	4521
MATINP	Grey cloth / Chemicals	Rupee value in millions	1629	4531.3	827.51	12576
FUEL	Power and Gas	Rupee value in '000'	6112	1987.01	2844	10943
CAPT	Total Capital	Rupee value in millions	2674.63	4292.9	1603.32	9224.82
Y (Output)	Printed Fabric	yards	33077976	9668818	12758749	51098874
BOD_5	Pollutant	mg / l	346.27	115.51	140	581
COD	Pollutant	mg / l	1250.73	750.45	329	2884

The water polluting firms in the industrial sector of Pakistan are required to meet the liquid effluent standards set for the pollutants (80mg/l for BOD and 150mg/l for COD) by the Pakistan EPA. Command-and-Control regulatory instruments are used to make firms comply with the standards. Very few firms in the sample have effluent treatment plants but some firms, as reported, are using process changes in production and input choices to achieve the effluent standards.

4.1. Estimation of Firms' Efficiency Scores

The efficiency scores of all DMUs are estimated by applying different quantitative models for performance evaluation and benchmarking. DEA Frontier software developed by Zhu (2008) uses Excel solver and does not set any limits on inputs and outputs. These are basically spread sheet models for the output oriented VRS envelopment model and undesirable measure model which are being applied to get estimations of efficiency scores. Table 2 gives the efficiency measures for each DMU or textile processing unit.

Table 2

Efficiency Scores of 45 Textile Processing Units

DMU	Model I	Model II	Model III
1	1.106701	1.039566	1.014200
2	1.139328	1.009178	1.000000
3	1.132166	1.094247	1.085104
4	1.179916	1.177310	1.179916
5	**1.000000**	**1.000000**	**1.000000**
6	**1.000000**	**1.000000**	**1.000000**
7	1.049286	1.049285	1.049286
8	1.037722	1.025142	1.013967
9	**1.000000**	**1.000000**	**1.000000**
10	**1.000000**	**1.000000**	**1.000000**
11	**1.000000**	**1.000000**	**1.000000**
12	1.125148	1.049618	1.038030
13	1.220981	**1.000000**	**1.000000**
14	**1.000000**	**1.000000**	**1.000000**
15	1.265766	1.095057	1.049963
16	1.210730	1.150288	1.120810
17	1.432088	1.189601	1.193484
18	1.167627	**1.000000**	**1.000000**
19	**1.000000**	**1.000000**	**1.000000**
20	**1.000000**	**1.000000**	**1.000000**
21	**1.000000**	**1.000000**	**1.000000**
22	1.004653	1.004653	1.004653
23	1.095247	1.081207	1.070313
24	1.018209	1.018209	1.018209
25	**1.000000**	**1.000000**	**1.000000**
26	1.405910	1.203907	1.279710
27	1.312115	1.136050	1.141400
28	1.219111	1.026875	1.032218
29	1.390636	1.181342	1.192111
30	1.107591	1.000000	1.000000
31	1.416295	1.243812	1.261432
32	**1.000000**	**1.000000**	**1.000000**
33	1.058579	1.050387	1.049436
34	**1.000000**	**1.000000**	**1.000000**
35	1.070015	1.023394	1.000000
36	1.153019	1.066987	1.021070
37	1.216947	1.094275	1.039358
38	1.318040	1.079603	1.026924
39	1.086955	1.003116	**1.000000**
40	**1.000000**	**1.000000**	**1.000000**
41	1.128723	**1.000000**	**1.000000**
42	1.298825	1.052930	1.011868
43	1.163383	**1.000000**	**1.000000**
44	1.412412	1.136864	1.084632
45	1.116544	**1.000000**	**1.000000**

Model I depicts the efficiency value or optimal value to the model when the undesirable outputs are ignored. The only output used in this model is printed fabric as a desirable output and pollutants, BOD and COD are not included. Model I shows that there are 13 efficient DMUs and the remaining 32 are inefficient when we ignore the undesirable output in the production process. The DEA model used for estimation of efficiency scores of DMUs (textile processing mills) is DEA classification invariance under which classifications of efficiencies and inefficiencies are invariant to the data transformation. The efficiency scores of DMUs obtained from Model II with the translation vector for increase in desirable output and decrease in undesirable outputs; show that 19 DMUs are efficient as compared to 13 in Model I. This clearly indicates that some producers do give consideration to the reduction in undesirable outputs or behave in socially desirable ways. It is also possible that some of the government environmental policies such as compliance to the national environmental quality standards are being followed by some DMUs which allocate some inputs for pollution control activities. As the second column in Table 2 indicates, most of the inefficient units Model I are less efficient compared to units in Model II. While several DMUs in Model II are inefficient, they are still producing under some pollution control policy or constraint. These results confirm the findings of Fare, *et al.* (1989) and Seiford and Zhu (2002). Figure 2 shows the efficiency scores of DMUs Model II, as this model provides the more realistic scores to reveal the performance of DMUs with respect to performance measurement.

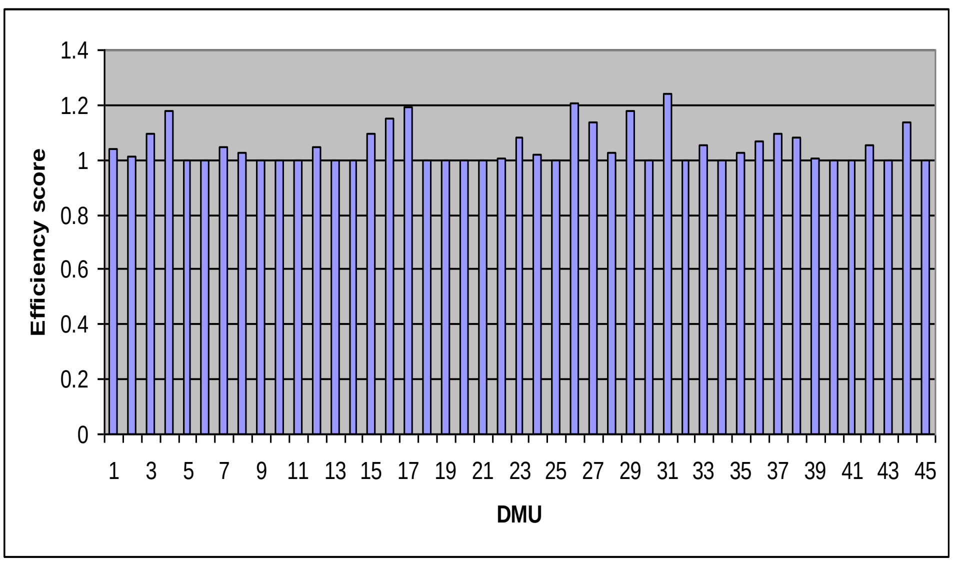


Fig. 2. Estimated Efficiency Scores of Model II across DMUs

Model III gives the efficiency scores of DMUs when both undesirable outputs are treated as inputs. Although this does not reflect the reality of the production process, the results indicate that minimisation of inputs leads to better performance in terms of pollution abatement. However, from the efficiency scores of textile processing units in Pakistan, it is clearly evident that the majority of units in the textile processing industry are not very concerned about water pollution abatement. Existing government policies to control pollution are obviously not as effective as to make all producers comply with the environmental quality standards.

4.3. Constant Returns to Scale vs. Variable Returns to Scale in DEA

The concept of returns to scale is that it relates to the average product. Fried, *et al.* (2008) have explicitly dealt with the concept of returns to scale in production. An average product in a single input/single output case can be readily defined. Let a production unit have input level x and output y, then its average product is y/x. Returns to scale relate to how under efficient operation, average product would be effected by scale size. If the operation is not efficient, then changes in average product as scale size changes can be due both to changes in efficiency and to changes in scale size and it would not be possible to differentiate between the two.

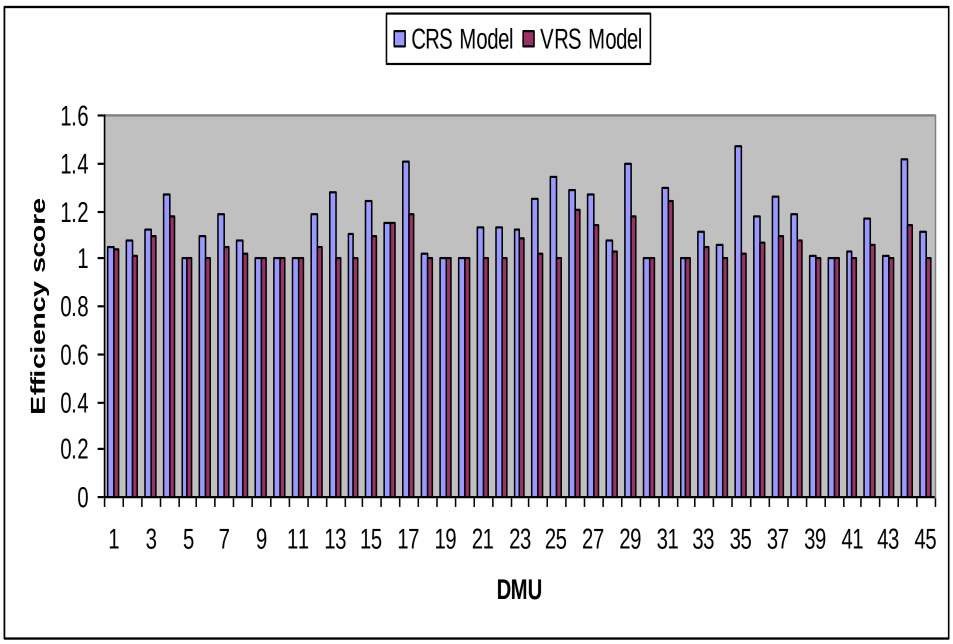


Fig. 3. Efficiency Scores of CRS Model and VRS Model

The estimated efficiency scores of textile processing mills using CRS model and VRS model, presented in Table 3 are shown in Figure 3. The efficiency scores for CRS model are higher than VRS model for all mills. The results in Table 3 are consistent with the findings of Ahn, Charnes, and Cooper (1989) in that a point found to be efficient for the CCR Model (with constant returns to scale constraint) will also be efficient for the BCC model (with variable returns to scale assumption) whereas the converse is not necessarily true. All efficient DMUs 5, 9, 10, 11, 19, 20, 30, 32 and 40 in the CRS column are also efficient in the VRS column, but DMUs number 6, 13, 14, 18, 21, 25, 34, 41, 43 and 45 are only efficient in the VRS column.

Table 3

Comparison of Efficiency Scores of CRS and VRS Models

DMU	CRS Model	VRS Model
1	1.04571	1.03956
2	1.07453	1.00917
3	1.12252	1.09424
4	1.26693	1.17731
5	**1.00000**	**1.00000**
6	1.09543	1.00000
7	1.18620	1.04928
8	1.07932	1.02514
9	**1.00000**	**1.00000**
10	**1.00000**	**1.00000**
11	**1.00000**	**1.00000**
12	1.18512	1.04961
13	1.28079	**1.00000**
14	1.10313	**1.00000**
15	1.24596	1.09505
16	1.15385	1.15028
17	1.40600	1.18960
18	1.02222	**1.00000**
19	**1.00000**	**1.00000**
20	**1.00000**	**1.00000**
21	1.13111	**1.00000**
22	1.12992	1.00465
23	1.11893	1.08120
24	1.25383	1.01820
25	1.34005	**1.00000**
26	1.28425	1.20390
27	1.26527	1.13605
28	1.07693	1.02687
29	1.39663	1.18134
30	1.00000	**1.00000**
31	1.29827	1.24381
32	**1.00000**	**1.00000**
33	1.11196	1.05038
34	1.05719	**1.00000**
35	1.47297	1.02339
36	1.17814	1.06698
37	1.26378	1.09427
38	1.18418	1.07960
39	1.01387	1.00311
40	**1.00000**	**1.00000**
41	1.02631	**1.00000**
42	1.17024	1.05293
43	1.01353	**1.00000**
44	1.41978	1.13686
45	1.11100	**1.00000**

5. CONCLUSIONS

This paper estimates the relative efficiency of production of highly water polluting industry in Pakistan that is textile processing industry. Theoretical aspects of data envelopment analysis technique are being discussed which is employed to measure the relative efficiency of decision making units that uses several inputs to produce desirable and undesirable outputs. Modelling undesirable outputs in the efficiency valuations using the DEA framework is a comparatively new approach in the literature using the classification invariance property. In the context of BCC model, the classification invariance property is used and a linear monotonic decreasing transformation is applied to treat the undesirable outputs so that the output-oriented BCC model permits the expansion of desirable outputs and the contraction of undesirable outputs. Data on the inputs and outputs, including undesirable outputs, from 45 textile processing units in Pakistan for the year 2008 are used to empirically test three different models of efficiency measurement. The results of the analysis are consistent with those found in other studies. The efficiency scores of individual manufacturing firms confirm the fact that some of the producers are showing environmental consciousness may be due to regulatory measures in place but overall the situation is far from satisfactory. Effective measures and instruments are still needed to check the rising pollution levels in water resources discharged by textile processing industry of the country.

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Growth and Financing Behaviour of Firms of Textile Industry in Pakistan: A Panel Data Analysis

IJAZ HUSSAIN

INTRODUCTION

Companies finance their assets by using mix of debt and equity. Firms with relatively more extensive use of debt choice are said to be financially more leveraged. The firms with relatively more extensive use of interest bearing long term debt relative to equity choice are said to be financially more geared. Choice of long term interest bearing debt and equity has serious implications for the value of the firm as a whole and all stakeholders.

Significant variation in gearing ratio exists at aggregate level, across various sectors, firms and over time. We notice substantial variation in overall corporate gearing (GR) and debt-equity ratio (DER) of corporate sector from 2000 to 2009 (Figures 1 and 2). Interestingly overall economic conditions and equity market has also seen visible changes during the fore-mentioned periods (Figure 3). This implies that, in view of changing economic conditions, most of the firms or sectors placed great deal on their capital structure decisions. Real interest rate remained very low over this period and even negative in some years from 2005 to 2009 (Figure 3). Extremely low interest rates gave a boost to financial leverage (gearing ratio) to its peak in 2005 followed by sharp rise in non-performing loans starting from 2007 onwards (Figure 5) which now is likely to pose a big challenge for financial sector and push economy into another crisis.

Gearing ratio of the textile sector has shown its peak level during 2005 due to negative real rate interest followed by an explosion in its financing costs which along with removal of textile quota and acute energy crisis later on hampered their profitability (Figure 4) and ability to repay its debt. Quarterly Performance Review of the Banking System (December 2010) reports loans of Rs 705.2 billion of textile sector alone by the end of 2009 out of which non-performing loan is Rs 171.5 billion which constitutes 31.3 percent of the total non-performing loans. This motivates us to explore various aspects of gearing ratio of the firms of textile industry in Pakistan.

All studies on capital structure of Pakistani firms in past have focused on only firm-specific determinants of financial leverage and completely ignored the impact of macroeconomic and institutional changes. This study explores whether these changes in corporate gearing are a consequence of macroeconomic and institutional changes or changes in firm specific factors?

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Fig. 1. Debt-Equity Ratio (%)

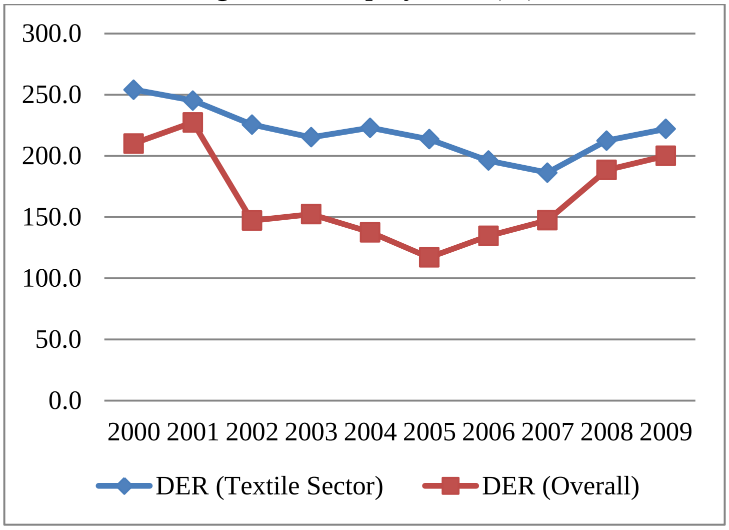


Fig. 2. Gearing Ratio (%)

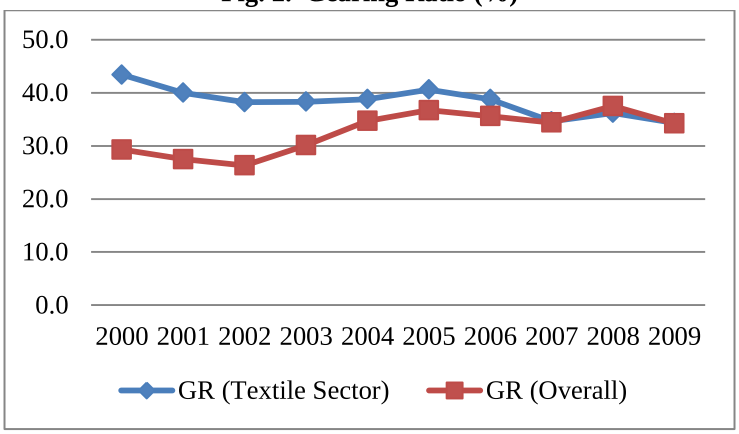
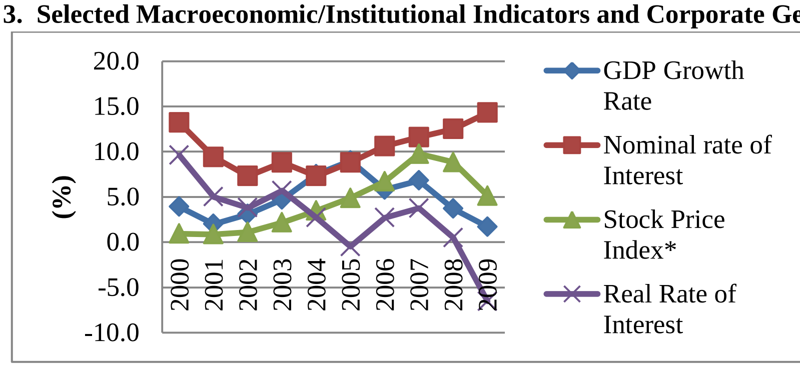


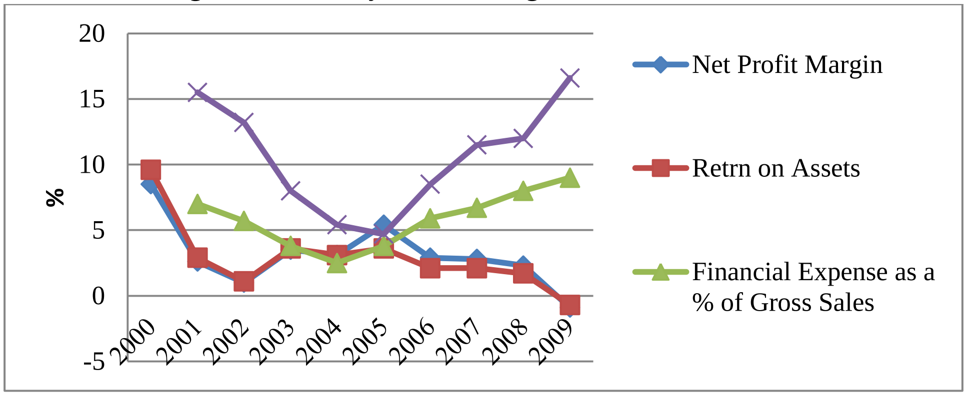
Fig. 3. Selected Macroeconomic/Institutional Indicators and Corporate Gearing



Source: Balance Sheet Analysis of Non-Financial Companies Listed in Karachi Stock exchange of Pakistan (Various Issues) *Hand Book on Statistics of Pakistan* (2010), State Bank of Pakistan.

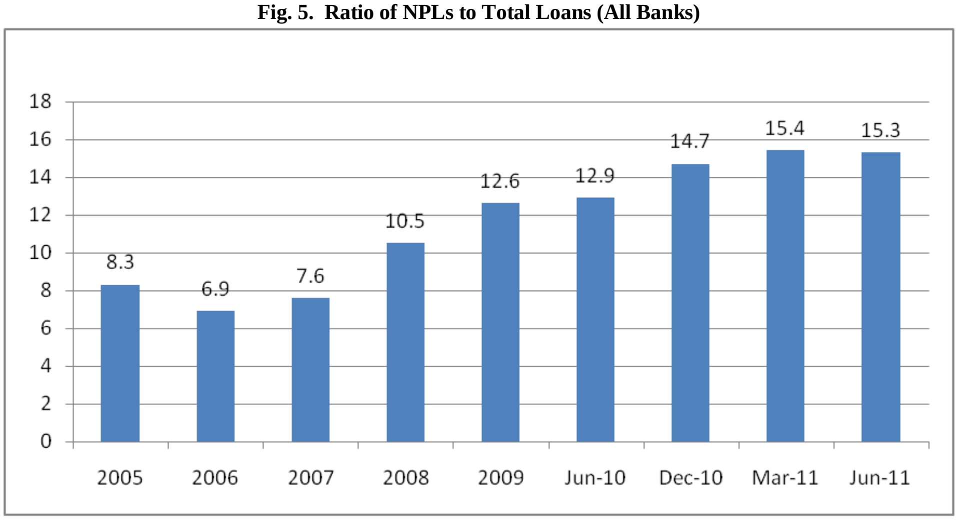
*Karachi General Index divided by 1000.

Fig. 4. Profitability vs. Financing Costs of Textile Sector



Source: Balance Sheet Analysis of Non-Financial Companies Listed in Karachi Stock Exchange of Pakistan (Various Issues).

Fig. 5. Ratio of NPLs to Total Loans (All Banks)



Source: Financial Soundness Indicators (June, 2011), Banking Surveillance Department, State Bank of Pakistan.

Rest of the paper is organised as follows: Section I reviews literature. Section II identifies data sources, variables and methodology. Section III presents findings and Section IV presents conclusion and gives policy recommendations.

I. LITERATURE REVIEW

The debate of debt-equity choice is well documented in literature. Literature provides a range of theories (including MM theory, trade-off theory, signaling theory, pecking order theory and agency theory), academic researches and empirical evidence to address this issue. Capital structure debate started with the seminal paper of Modigliani and Miller (1958). They prove in this paper that under some restrictions (perfect market, absence of taxes, bankruptcy or financial distress costs), value of the firm is independent of the choice of debt or equity. This controversial proposition led to an unending debate on capital structure decisions.

A vast range of literature debates on the consequences of relaxing the assumptions of MM theory. This literature can be classified into two groups namely trade-off (target leverage) models and the models of signalling and pecking order (financing hierarchies) [Shuetrim, *et al*. (1993)]. Trade-off Target leverage models introduce debt tax shield, bankruptcy risk, financial distress costs and agency costs to MM theory while models of signalling and pecking order introduce information asymmetry, transaction costs, dilution of ownership and fund liquidity constraints [Shuetrim, *et al*. (1993)].

Modigliani and Miller (1958) received severe criticism to their controversial proposition. Modigliani and Miller (1963) extended their work by introducing corporate taxes in their model. This work suggests that deductibility of interest expense associated with debt reduces taxable income and tax liability. Therefore, choice of debt in capital structure provides tax shield (advantage) and motivates firms to rely entirely on debt. But firms, in practice, are never completely debt financed rather they use mix of debt and equity. Miller (1977) introduced the personal taxes on dividend income of shareholders and interest income of creditors in addition to corporate taxes and proved that incentive to use hundred percent debt fades away under various tax regimes. If earnings before interest and tax are low or negative, debt tax shield is low or completely disappears. This indicates that tax shield gains associated debt will diminish [Deangelo and Masulis (1980)].

Modigliani and Miller (1958 and 1963) and Miller (1977) completely ignored bankruptcy or default risk. As discussed in Shuetrim, *et al.* (1993), bankruptcy or likely default with increasing debt burdens involves some direct and indirect costs. Direct costs include liquidation fees, legal charges and trustees' fees in case of default while indirect costs include losses of sales, purchase, market share, creditors and suppliers due to disruption by creditors either in case of default or likely default [Shuetrim, *et al.* (1993)]. This also suggests inverse relation between risk or financial distress costs and gearing. Fixed component of financial distress costs constitutes a significant fraction of the value of smaller firms [Ang, *et al.* (1982)]. This signifies a positive relation between size and financial leverage. However, bigger firms may have less chances and low costs of bankruptcy through diversification [Graham, *et al.* (1998) and Gaud, *et al.* (2005)] and stable cash flows [Rajan and Zingales (1995)] suggesting a positive relation between debt and size. Default risk can be reduced through guarantees by the firms in the form of collateral. This implies positive relation between collateral and debt burden [Gertler and Gilchrist (1993); Chaplinksy and Neihaus (1990); Bradely, *et al*. (1984)]. Relatively higher financial distress costs for larger firms depress financial leverage [Marsh (1982); Titman and Wessels (1988); Ooi (1999); Chen (2003)] but if the larger firms diversify and are able to reduce their bankruptcy costs then trade-off theory predicts a positive sign between size and gearing ratio.

Jensen and Meckling (1976) accept agency costs arising from asymmetry between expected returns on investments by creditors and stockholders. Creditors are entitled to fixed interest payments while shareholders have limited liability and claims on residual earnings. Therefore, corporate managers, being agents to shareholders, may undertake risky investments to appropriate funds from creditors because higher gains from risky investments will accrue more to shareholders relative to those of creditors. Creditors react by tightening credit terms i.e., they demand high interest rate and higher value of collateral as a real guarantee. Lowe and Rohling (1993) also point out conflict of interest between corporate managers and shareholders. Bankruptcy on account of excessive use of debt puts jobs and reputation of the corporate managers at stake. Therefore, they feel reluctant to use excessive debt even for projects with positive net present value. But this type of agency cost is manageable through use of equity. Jensen (1986) points out another type of agency cost. In his view, corporate managers of larger firms with surplus cash flows may tend to invest in unprofitable projects because their remuneration depends on size of the firm. Moreover, higher debt will reduce this type of agency cost.

Myers and Majluf (1984) note that there exists an information asymmetry between corporate managers and investors and they also accept that being insiders corporate managers are relatively better informed about the actual worth of the firm and its equity. This asymmetric information argument led to the development of the signalling theory. If corporate managers choose debt as first choice of financing they signal to the market that firm expects stable cash flows in future. Pecking order theory suggests that if corporate managers choose equity as a first choice they send a signal to market to highlight that its equity is currently overvalued. This gives rise to negative stock price reaction from investors. Therefore, in order to avoid such negative price reaction, firms prioritise their financing choices from internal funds as first choice to debt and leaving equity as a financing means of last resort [Myers (1984)]. Such hierarchy of finances is known as pecking order theory in literature.

Capital structure of the firms of developed countries with similar institutional structures has been the subject of most of the researches [Teker, *et al.* (2009); Chen (2003)]. However, a very few studies focus on the firms from emerging market with institutional differences [Sayilgan, *et al.* (2006)].

Pakistani firms' financial leverage has also received very limited attention. To my knowledge, debate on determinants of financial leverage or capital structure of Pakistani firms started with the work of Shah and Hijazi (2004) followed by Tariq and Hijazi (2006), Shah and Khan (2007) and Rafiq, *et al*. (2008).

Most of these studies including those a very few on capital structure of Pakistani firms focus on understanding the firm specific determinants of financial leverage and completely ignore macroeconomic or institutional factors likely to influence capital structure decisions of the firms. To my knowledge, Shuetrim, *et al.* (1993) is the only study that includes asset prices, inflation, potential debt tax shield and fund cost differential in addition to the firm specific determinants of capital structure of Australian firms and identifies that macroeconomic variables also influence financial leverage.

Our paper contributes to the literature by introducing macroeconomic or institutional factors in addition to firm specific determinants of corporate financial leverage of the firms in textile industry in Pakistan.

II. DATA AND RESEARCH METHODOLOGY

Sample Set

This paper uses secondary data from "Balance Sheet Analysis (2000–2009) of Joint Stock Companies Listed on the Karachi Stock Exchange published by Statistics Department of State Bank of Pakistan." The sample of this study covers all 75 firms of textile industry with complete and consistent 10 years data series. This paper excludes the firms with incomplete and inconsistent data series. The firms with negative equity are also excluded.

Dependent Variable

Dependent variable for this study is financial leverage. Several measures of financial leverage including total debt divided by total assets [Rajan and Zingale (1995)], debt equity ratios based on book value or market values [Allen and Mizuno (1989); Gaud, *et al*. (2005); Ooi (1999)] exist in literature. Since this study intends to explore determinants of choice of long term debt and equity, therefore, this study uses gearing ratio i.e., long term debt divided by total assets as a proxy measure for financial leverage.

Explanatory Variables

Following Shuetrim, *et al.* (1993), identify two categories of explanatory variables:

(1) Firm specific variables including Profitability, efficiency, size, growth, collateral and risk.
(2) Macroeconomic or institutional variables including overall macroeconomic environment, equity market environment, potential debt tax shield, and real cost of debt (implicitly inflation).

Firm Specific Determinants of Corporate Financial Leverage:
Profitability (NPM) and Efficiency (ATO)

Trade-off theory predicts that in view of high tax burden and low risk, profitable and efficient firms take high debt burdens. [Sayilgan, *et al.* (2006)]. As noted in Gaud, *et al.* (2005), past profitability predicts future profitability; therefore, in view of confidence in repaying their debt, profitable firms employ more debt. Consistent with the view of Myers and Majluf (1984) and Myers (1984) in pecking order theory, profitable and efficient firms prefer to use internal funds, therefore, employ less debt. Results of Gaud, *et al.* (2005), Rajan and Zingales (1995), Donaldson (1961), Chen (2003), Wiwattanakantang (1999) and Ozkan (2001) are consistent with pecking order theory.

This paper uses Return on Assets as a proxy for profitability and efficiency. Return on Assets (ROA) is a composite measure for profitability and efficiency. ROA indicates degree of effective use of assets of the firm to generate profits.

$$ROA = NPM * ATO = \frac{Net\ Profit\ after\ Tax}{Net\ Sales} * \frac{Net\ Sales}{Total\ Assets}$$

Where Net Profit Margin (NPM) is the measure of profitability and Asset Turn Over (ATO) is the measure of efficiency i.e. effective use of assets to generate sales.

Size (TA)

Larger firms have relatively better access to credit market [Ferri and Jones (1979); Wiwattanakantang (1999)], favourable credit terms and stable cash flows [Graham (2000); Gaud, *et al.* (2005)] to repay their debt. Therefore, trade-off theory predicts positive relation between size and gearing. Relatively higher financial distress costs for larger firms depress financial leverage [Marsh (1982); Titman and Wessels (1988); Ooi (1992); Chen (2003)] but if the larger firms diversify and are able to reduce their bankruptcy costs then Trade-off theory predicts a positive sign between size and gearing ratio. Relatively better access to equity market motivates firms to rely on equity rather than debt [Chen (2003)]. Bigger firms have sufficient internal funds; therefore, Signalling and Pecking order theory also predicts a negative sign. This study uses total assets (TA) as a proxy variable for size.

Growth (LOG(GS))

Growing firms require more funds for their expansion. If firms deplete their internal funds during the growth process, the firms would prefer debt to equity. Therefore, signalling and pecking order theory suggests a positive impact of growth on corporate gearing [Drobetz and Fix (2003)]. If growing firms have limited access to equity market, they would tend to rely on debt choice for funding their growth process. This would be true for the countries where equity markets are underdeveloped. Growing firms are likely to be more liberal in their investments in risky projects, therefore, creating high agency costs for the bondholders. This will raise costs of debt for growing firms. Therefore, growing firms choose less debt. Therefore, trade-off theory suggests that corporate gearing is negatively related with growth. Results of Titman and Wessels (1988), Rajan and Zingales (1995) and Barclay, *et al.* (1995) are consistent with this view. This paper uses logarithm of gross sales (LOG(GS)) to measure firms' growth.

Collateral (PFA)

Larger value of collateral of a firm provides better access to credit market and favourable credit terms [Rafiq, *et al.* (2008); Shah and Khan (2007); Padron, *et al.* (2005); Rajan and Zingales (1995); Teker, Tasseven, and Tukel (2009)] therefore, trade off theory predicts a positive sign. In consistent with most of the studies, this paper uses proportion of tangible fixed assets (PFA) in total assets as an indicator for collateral.

Risk (EV)

Earning volatility whether on account of operational failure or inefficient management is considered as proxy for risk in literature. This study uses squared deviation of return on assets (EV) from mean as a measure of risk because this reflects earning volatility on account of both operational failure and management inefficiency.

Riskier firms with high risk of default and high bankruptcy costs [Padron, *et al.* (2005)] face poor access to credit market and also poor terms of credit. This discourages firms to choose debt financing. Therefore, trade off theory predicts negative relations of risk and debt financing. Riskier firms already faced with volatile earnings, low equity prices and in view of negative stock price reactions from market these firms will not use the choice of floating more equity. Thus signalling and pecking order theory predicts a positive relation between risk and debt financing. Faced with poor access to credit market, ultimately firms will have to rely on the choice of equity.

Macroeconomic Determinants of Corporate Financial Leverage:
Overall Macroeconomic Environment (GDPG)

Overall macroeconomic environment is also likely to affect gearing. We expect a positive relation between overall macroeconomic environment and gearing because corporate managers with positive expectations plan to enhance their production capacities by increasing their investment in tangible fixed assets for which they need internal or external financing. Therefore, positive expectations provide ground for debt financing [Sayilgan, Haraback, and Küçükkocaoğlu (2006)]. This paper uses growth rate of GDP (GDPG) as a proxy for overall macroeconomic environment.

Equity Market Environment (SPI)

We take first difference of Karachi general index (SPI) for stock prices as a proxy variable for equity market environment. Improvement in equity market environment provides better opportunities for issuing equity. We expect negative relation between gearing and equity market environment.

Cost of Debt

Nominal rate of interest is cost of using debt which is sum of real cost of debt and rate of inflation. Higher cost of debt discourages use of debt while higher rate of inflation encourages financial leverage. Therefore, we expect a negative relation between rate of interest and corporate gearing.

Table 1 below presents the proxies for dependent and explanatory variables:

Table 1

List, Definitions and Symbols of Proxy Variables

	Variable	Definition and Symbol
Dependent Variable		
1.	Corporate Gearing	GR: Gearing Ratio=book value of long term liabilities divided by book value of total assets.
Explanatory Variables		
2.	Profitability and Efficiency	ROA: Return on Assets=Net Profit Margin x Asset Turn Over =Net profit after tax divided by net sales x Sales divided by Total Assets
3.	Growth	LOG(GS); Logarithm of Gross Sales=Logarithm of gross sales
4.	Size	TA: Book value of Total Assets
5.	Collateral	PFA: Proportion of Fixed Assets=ratio between book value of fixed and total assets
6.	Risk	EV=Earnings Volatility=Squared deviation of Net Profit Margin from mean of 10 years Net Profit Margin
7.	Cost of Debt	I=Nominal Rate of Interest
8.	Equity Market Environment	SPI=Stock Price Index: Karachi General Index)
9.	Overall Macroeconomic Environment	GDPG: GDP Growth Rate

Annexure 1-A shows the summary statistics of the data set. Annexure 2-A shows the coefficients of correlation to rule out mutli-colinearity between the regressor variables. There is some evidence of co-Linearity between firms' growth and its size, cost of debt and equity market environment, cost of debt and GDP growth.

General functional form of the model used in this paper is as follows:

$$GR = f\,(ROA, GR(-1), LOG(GS), TA, PFA, EV, GDPG, D(KGI), I)$$

This study uses highly popular statistical model of panel data analysis that combines cross section and time series data and estimates pooled regression of a standard model in the following form:

$$GR_{it} = \beta_{0+}\beta_1 X_{it} + \beta_2 Z_t + \varepsilon_{it}$$

Where GR denotes corporate gearing ratio and subscript *i* specifies cross section dimension (firms) and *t* specifies time dimension of the data set. β_0 , β_1 and β_2 are unknown constants. X_{it} represents the set of firm-specific explanatory variables for firms which vary across firms as well as over time. Z_t is the set of macroeconomic or institutional explanatory variables that vary over time only. ε_{it} is composite error term comprising of firm-specific component μ_i, time-specific component $\propto_t$ and a component varying over time and across firms w_{it}.

Depending on the structure of the error term and nature of its correlation with explanatory variables, there are several ways to estimate our gearing model. Ordinary Least Squares is appropriate choice if there exist no unobservable firm- and time-specific factors. But in fact, both firm-and time-specific unobservable effects may exist in practice. Choice of random effect model is appropriate when unobservable effects are included in error term and variance-covariance matrix of non-spherical errors is transformed to have consistent estimates of the standard errors. But random effect estimator becomes inconsistent when unobservable effects included in the error term are correlated with some or all regressors. Though relatively inefficient, an alternative choice is fixed effect model which provides consistent estimates regardless of the fore mentioned correlation.

III. FINDINGS

First we test the evidence of cross section and period effects and then we identify whether they are correlated with the regressors. Our tests show that there is strong evidence of period and cross-section random and fixed effects. We use fixed effect specification which includes the variables that vary across firms and over time, cross-section and period dummy variables. We test joint significance of the cross-section and period dummy variables. Our results reveal that both cross-section and period fixed effects are significant at 5 percent level (Annexure 3-A). We also estimate random effect model and Hausman (1978) test rejects the exogeneity in the random effects model and the variance between the coefficients of random and fixed effect model is non-zero which restricts us to rely on fixed effect model. Cross-section fixed effects are reported in Annexure 4-A. We present results of cross-section fixed effects model in Table 2.

Negative sign with the composite measure of profitability and efficiency[2] indicates that banks fund inefficient and unprofitable firms. This also implies that profitable and efficient firms relatively borrow less. Past profits and efficiency predict future profitability[3] therefore profitable and efficient firms prefer use of internal funds.[4] This

[2]Most of the previous studies use return on asset as measure of profitability though it is composite measure of profitability and efficiency.

[3]See Gaud, *et al*. (2005).

[4]See Myers and Majluf (1984) and Myers (1984).

Table 2

Regression Results

Dependent Variable: GR				
Method: Panel EGLS (Cross-section weights)				
Total panel (balanced) observations: 675				
Linear estimation after one-step weighting matrix				
White diagonal standard errors and covariance (no d.f. correction)				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C: Constant	–2.2507	6.6063	–0.3407	0.7335
ROA: Profitability and Efficiency	–0.1883	0.0603	–3.1220	0.0019
GR(-1): Lag of Gearing Ratio	0.5266	0.0333	15.8114	0.0000
TA: Size	–0.0002	0.0002	–1.2502	0.2117
LOG(GS): Firms' Growth	1.9150	0.9087	2.1074	0.0355
PFA: Collateral	0.0875	0.0307	2.8473	0.0046
EV: Risk	–0.0001	0.0000	–3.2320	0.0013
D(KGI): Equity Market Environment	–0.0006	0.0003	–2.0847	0.0375
I: Cost of Debt	–0.3504	0.2125	–1.6491	0.0997
GDPG: Overall Macroeconomic Environment	0.8715	0.2121	4.1095	0.0000
	Effects Specification			
Cross-section Fixed (dummy variables)				
	Weighted Statistics			
R-squared	0.775247			
Adjusted R-squared	0.743683			
Durbin-Watson stat	1.978962			
	Un-weighted Statistics			
R-squared	0.621221			
Durbin-Watson stat	1.967496			

conforms to signalling and pecking order theory. This is also consistent with the findings of Shah and Hijazi (2004), Tariq and Hijazi (2006), Rafiq, *et al.* (2008). This contradicts the trade-off model which predicts that profitable firms with high tax burden and low probability and costs of bankruptcy employ more debt.[5]

Consistent with pecking order theory, positive sign with growth reflects growing firms when deplete their internal funds during growth process ultimately satisfy their funds need from debt.[6] This is consistent with the findings of Rafiq, *et al.* (2008) and Tariq and Khan (2006) and contradicts with those of Shah and Hijazi (2004). Positive sign with growth also implies that banks prefer to lend to growing firms because growing firms have relatively stable cash flows to repay their debt. If growing firms have limited access to equity market, they would tend to rely on debt choice for funding their growth process. This would be true for the countries where equity markets are underdeveloped or there are legal complications in floating equity. This may also apply in case of Pakistan.

Sufficient internal funds on account of large scale economies and relatively better access to equity market motivates firms to rely on equity rather than debt.[7] This explains the negative sign with size.

[5]See Sayilgan, *et al.* (2006).
[6]See Shuetrim, Lowe, and Morling (1993); Drobetz and Fix (2003).
[7]See Chen (2003).

Consistent with trade-off model, positive sign with collateral also represents higher debt capacity of the firms and better access to credit market by providing real guarantees to creditors[8] and firms will find more willing lenders to supply loans.[9] This motivates the firms to use more long term debt in their capital structure. This is also consistent with the findings of Shah and Hijazi (2004), Tariq and Hijazi (2006), Rafiq, *et al.* (2008).

Negative sign with risk shows that riskier firms borrow less because corporate managers are not confident about repayment of debt due to volatility of operating cash flows in particular. In addition to this, riskier firms have relatively high probability and cost of bankruptcy,[10] therefore, will have poor access to credit market and face unfavourable credit terms which discourage use of debt. Negative sign with risk in our finding contradicts the findings in Rafiq, *et al.* (2008) and Shah and Khan (2007). Rafiq, *et al.* (2008) show positive sign with risk while Shah and Khan (2007) show no impact of risk on debt choice and find it highly insignificant.

Higher interest rates discourage use of debt finance therefore, consistent with the trade-off theory, our results show negative sign with cost of det. Overall macroeconomic environment points towards future prospects for the firms' business. Higher GDP growth represents relatively better prospects for business which become a basis for positive expectations and future expansion plans for corporate managers. To realise these plans firms need initially internal and then external sources of finance if their internal funds are depleted. Negative sign with equity market environment indicates that improvement in stock market index reflects relatively easy and better access and opportunities for firms to raise long term finances by issuing new equity because current situation in equity market signals future prospects for investors.

IV. CONCLUSION AND POLICY IMPLICATIONS

Given the low reliance of firms on equity finance in Pakistan and low bankruptcy costs due to long court procedures, easy credit policy of Shoukat Aziz's government to encourage gearing was quite unwise and inappropriate. High economic growth, extremely low nominal interest rate and negative real interest rate gave a boost to financial leverage (gearing ratio) of the textile sector to its peak in 2005. Firms are now facing the consequence of high gearing. An explosion in their financing costs along with removal of textile quota from 2005 onwards and later on acute energy crisis hampered their profitability and ability to repay their debt. This in turn contributed to non-performing loans which is now likely to pose a big challenge for financial sector and push economy into another crisis.

Therefore, we recommend that debt should be immediately rescheduled to take textile sector out of debt trap and energy crisis should be resolved on urgent basis to remove operational constraint of the industry. There is also strong need for extensive efforts to explore access to foreign markets.

Findings of this paper prove that all firm specific determinants including profitability and efficiency, growth, risk and collateral, excluding size and all macroeconomic and institutional variables including overall macroeconomic

[8]See Padron, *et al*. (2005).
[9]See Rajan and Zingales (1995) and Harris and Raviv (1991).
[10]See Lima (2009).

environment, equity market environment and cost of debt also significantly influence corporate financial leverage of textile industry in Pakistan.

Negative sign with the composite measure of profitability and efficiency implies that banks fund inefficient and unprofitable firms because demand for loans comes from inefficient and unprofitable firms. Positive sign with growth and negative sign with risk is indicative of the fact that banks prefer to lend to growing firms rather than riskier firms.

Findings of this paper have serious implications for the firms, banks, investors, creditors and policy makers. This model can help the individual firms to identify whether their current financial leverage is in line with the benchmark of textile sector. In view of macroeconomic and institutional changes, this paper provides a basis for the firms to adjust their financial leverage ratio.

ANNEXURE

1-A. *Summary Statistics*

	GR	ROA	GR(–1)	TA	LOG(GS)	PFA	B	D(KGI)	I	GDPG
Mean	32.99	2.03	32.45	2852.96	7.26	54.95	740.03	464.33	10.07	4.92
Median	32.60	1.90	31.80	1392.80	7.16	53.80	5.90	1049.71	9.40	4.70
Maximum	122.80	77.60	122.80	40277.30	10.08	221.50	415586.50	3050.45	14.30	9.00
Minimum	0.00	–187.70	0.00	42.30	1.44	3.90	0.00	–3712.51	7.30	1.70
Std. Dev.	21.28	11.37	21.00	4450.24	1.01	22.38	16004.08	1833.08	2.25	2.39
Observations	675	675	675	675	675	675	675	675	675	675

2-A. *Correlation Coefficients*

	GR	ROA	GR(-1)	TA	LOG(GS)	PFA	B	D(KGI)	I	GDPG
GR	1	–0.1205	0.7283	0.0603	0.2107	0.1312	–0.0389	0.0100	0.0836	0.0956
ROA	–0.1205	1	–0.0735	0.0520	0.1120	–0.0891	–0.6407	0.1087	–0.1708	0.0597
GR(-1)	**0.7283**	–0.0735	1	0.0811	0.1893	0.1361	–0.0248	–0.0309	0.1416	0.0301
TA	0.0603	0.0520	0.0811	1	0.6700	–0.2140	–0.0128	–0.0574	0.2177	0.0195
LOG(GS)	0.2107	0.1120	0.1893	**0.6700**	1	–0.3546	–0.0489	–0.0504	0.1845	–0.0028
PFA	0.1312	–0.0891	0.1361	–0.2140	–0.3546	1	–0.0064	0.0370	0.0234	0.0593
B	–0.0389	–0.6407	–0.0248	–0.0128	–0.0489	–0.0064	1	–0.0056	–0.0461	–0.0297
D(KGI)	0.0100	0.1087	–0.0309	–0.0574	–0.0504	0.0370	–0.0056	1	–0.5313	**0.7372**
I	0.0836	–0.1708	0.1416	0.2177	0.1845	0.0234	–0.0461	–0.5313	1	–0.3787
GDPG	0.0956	0.0597	0.0301	0.0195	–0.0028	0.0593	–0.0297	0.7372	–0.3787	1

3-A. *Redundant Fixed Effects Tests*

Test Cross-section and Period Fixed Effects

Effects Test	Statistic	d.f.	Prob.
Cross-section F	5.582	–74,661	0.0000
Cross-section Chi-square	364.077	74	0.0000
Period F	1.946	–9,661	0.0432
Period Chi-square	19.611	9	0.0205
Cross-Section/Period F	5.213	–83,661	0.0000
Cross-Section/Period Chi-square	377.662	83	0.0000

4-A. *Cross-Section Fixed Effects*

	Firms	Effect
1	Ahmed Hassan Textile Mills Ltd.	6.886
2	Allawasaya Textile and Finishing Mills Ltd.	–5.958441
3	Apollo Textile Mills Ltd.	6.699526
4	Artistic Denim Mills Ltd.	–7.716303
5	Aruj Garment Accessories Ltd.	–11.30891
6	Ayesha Textile Mills Ltd.	–4.178894
7	Azam Textile Mills Ltd.	–0.88299
8	Azgard Nine Ltd. (Legler-Nafees Denim Mills Ltd.)	5.592547
9	Bhanero Textile Mills Ltd.	1.143532
10	Bilal Fibres Ltd.	4.826812
11	Blessed Textiles Ltd.	4.003951
12	Chakwal Spinning Mills Ltd.	9.07585
13	Colony Mills Ltd. (Colony Textile Mills Ltd.)	10.22614
14	D.M. Textile Mills Ltd.	–3.770705
15	Dar Es Salaam Textile Mills Ltd.	5.698793
16	Dawood Lawrencepur Ltd. (Dawood Cotton Mills)	–10.03409
17	Dewan Khalid Textile Mills Ltd.	–7.22722
18	Dewan Mushtaq Textile Mills Ltd.	1.358755
19	Dewan Textile Mills Ltd.	4.967196
20	Din Textile Mills Ltd.	–3.503656
21	Ellcot Spinning Mills Ltd.	8.222868
22	Faisal Spinning Mills Ltd.	3.740499
23	Fateh Textile Mills Ltd.	5.513969
24	Fawad Textile Mills Ltd.	–2.875707
25	Fazal Cloth Mills Ltd.	5.04144
26	Gadoon Textile Mills Ltd.	–7.882432
27	Ghazi Fabrics International Ltd.	7.654191
28	Gul Ahmed Textile Mills Ltd.	3.701456
29	Gulistan Spinning Mills Ltd.	–1.581796
30	Gulistan Textile Mills Ltd.	–1.315367
31	Gulshan Spinning Mills Ltd.	–0.118932
32	Haji Mohammad Ismail Mills Ltd.	–6.099639
33	Husein Industries Ltd.	–4.176179
34	ICC Textiles Ltd.	–1.298544
35	Ideal Spinning Mills Ltd.	10.55645
36	Idrees Textile Mills Ltd.	–3.965902
37	Indus Dyeing and Manufacturing Co. Ltd.	1.084043
38	Ishaq Textile Mills Ltd.	1.994372
39	Island Textile Mills Ltd.	3.997519
40	J.K. Spinning Mills Ltd.	–7.265255
41	Janana De Malucho Textile Mills Ltd	–6.02521
42	Khalid Siraj Textile Mills Ltd.	–18.34995

Continued—

A 4—(*Continued*)

43	Kohinoor Mills Ltd.	0.821704
44	Kohinoor Spinning Mills Ltd.	2.356124
45	Kohinoor Textile Mills Ltd.	0.238897
46	Mahmood Textile Mills Ltd.	–5.806772
47	Maqbool Textile Mills Ltd.	0.009652
48	Masood Textile Mills Ltd.	7.279389
49	Mian Textile Industries Ltd.	13.1299
50	Mohammad Farooq Textile Mills Ltd.	–4.629541
51	N.P. Spinning Mills Ltd.	–10.03802
52	Nadeem Textile Mills Ltd.	–6.51514
53	Nakshbandi Industries Ltd.	6.154592
54	Nina Industries Ltd.	2.552844
55	Nishat (Chunian) Ltd.	4.816083
56	Nishat Mills Ltd.	–5.153247
57	Olympia Spinning and Weaving Mills Ltd.	0.208376
58	Paramount Spinning Mills Ltd.	0.322807
59	Premium Textile Mills Ltd.	6.603837
60	Prosperity Weaving Mills Ltd.	9.325779
61	Quality Textile Mills Ltd.	–6.746521
62	Quetta Textile Mills Ltd.	16.71987
63	Ravi Textile Mills Ltd.	3.616668
64	Reliance Cotton Spinning Mills Ltd.	–8.02911
65	Reliance Weaving Mills Ltd.	4.651127
66	Saif Textile Mills Ltd.	6.165284
67	Sajjad Textile Mills Ltd.	–2.215353
68	Salfi Textile Mills Ltd.	–2.943558
69	Salman Noman Enterprises Ltd.	–3.105576
70	Samin Textiles Ltd.	–2.683712
71	Sana Industries Ltd.	–9.300274
72	Sapphire Fibres Ltd.	–8.95482
73	Sapphire Textile Mills Ltd.	–8.112624
74	Sargodha Spinning Mills Ltd.	–2.579557
75	Saritow Spinning Mills Ltd.	5.391103

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Determinants of Exports of Pakistan: A Country-wise Disaggregated Analysis

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1. BACKGROUND

Exports are believed to be the engine of economic growth. A nation can win friends through trade relations and ensure an optimal allocation of the available resources. Following the comparative advantage principle, each country is likely to export those goods which can be produced at relatively low costs. The returns from trade depend on enhancing domestic production, ensuring international standards and exploring new markets for exports. The export performance of a country is determined by many factors, which can be categorised in terms of demand and supply side determinants. The demand side factors include capacity of the trading partners, the prices of exportable goods, the prices of competing/substitute goods in the world market and the exchange rate etc. However the political and social factors also play a very crucial role in this regards. The supply side factors include domestic productive capacity, exchange rate, relative prices (prices of exports relative to prices of competing goods), wage rate and import of inputs etc. On the demand side, the world price and world income have an important role in explaining export performance, whereas on the supply side, the domestic productive capacity and the availability of inputs are important.

Some researchers emphasise on significance of the demand side determinants while others attribute more importance to the factors on supply side. In this context, the magnitudes of price and income elasticities on demand side need due consideration. Muscatelli (1992) finds the income and price elasticities of export demand to be significant but finite; whereas Reidel (1988) considers these elasticities to be significant and infinite. Apart from income and relative price responsiveness to exports, the predominant views indicate the importance of supply side and other related constraints. For instance, Khan and Knight (1985) show that import of inputs have significant influence on export performance in the long run. Sinha Roy (2002, 2007) and Muscatelli (1992, 1995) consider the relative prices (foreign prices of exportable goods relative to the domestic prices) to play a significant role in this context. Majeed and Eatzaz (2006) also highlight the importance of some supply side determinants. Given the differences in

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views of researchers, there is sufficient rationale to examine the relative importance of the demand and supply side determinants simultaneously so as to arrive at some meaningful conclusions

2. RATIONALE/RELEVANCE OF THE STUDY

Numerous empirical studies on exports are available with reference to Pakistan, following different estimation approaches and methodologies. Most of these studies have relied on single equation models, incorporating both the demand and supply side determinants of exports mixed together. This approach has often led to misleading results due to the aggregation of different classes of variables. The robust and precise estimates can be obtained only if the demand and supply side equations are carefully specified with appropriate variables. Since there are two endogenous variables in export function, i.e., quantity and the price of exports, these have to be determined simultaneously. This may lead to simultaneous equations bias and yield misleading results if not handle properly.

This study is the first of its kinds that attempts to rely on the country-wise disaggregated export analysis since no study is available on this pattern. Keeping in view the share of each partner in our exports and availability of the data on the variables concerned, a moderate sample of eleven countries is selected for the purpose. This includes USA, UK, Germany, France, Korea, Kuwait, Mauritius, Malaysia, Canada, Bangladesh and Saudi Arabia. A significant contribution of this study is incorporation of the import of inputs in the supply side equation. We intend to test the hypothesis that import of inputs (industrial raw material and capital goods) increases the export potential of the country and lead to favourable balance of trade. The study also examines the impact of Kuwait-Iraq war (1991) and Afghanistan war (2001-02) on our exports performance. It is generally argued that the flow of Pakistan's exports to European and NAFTA regions has been adversely affected due to these wars. Another contribution of this study is the application of the Empirical Bayesian technique to test the reliability of the ordinary estimates.

3. OBJECTIVES OF THE STUDY

The research is intended to achieve the following objectives.

(1) The foremost objective of this study is to determine the nature of relationship between exports and their determinants, taking into consideration both the demand and supply sides.

(2) After having studied a vast literature, it is revealed that most studies have relied on demand side determinants of exports since they assume the supply side to be infinitely elastic. Several other justify significance of the supply side determinants. An associative objective is to see the relative importance of the demand and supply side determinants in explaining export performance of Pakistan.

(3) Many developing countries including Pakistan are facing persistent deficit in balance of payments due to heavy import bill. They have adopted commercial policies to suppress imports and to get rid of the resulting deficit in trade account. But this could be at the cost of reduction in country's

potential for exports, since the import of raw material and equipments is believed to be critical for export production. This may deepen further the deficit in BOP. Thus one of the objectives is to evaluate the importance of import of inputs in explaining exports behaviour.

(4) The recently fought American-led two wars i.e., the Kuwait-Iraq war (1991) and Afghanistan war (2001) are considered to have seriously affected the trade relations among countries with in the region and off the region. The export destination and export flows have been adversely affected. Therefore another objective of the study is to see the impact of these wars on our export performance.

4. REVIEW OF LITERATURE

Several studies have been conducted by different people to pinpoint the determinants of exports and to analyse their impact on export performance. Most of the researchers have used single equation export models, incorporating both the demand and supply side determinants. Many others adopted the simultaneous equation framework, in which the demand and supply side functions are specified with appropriate variables. However there is seldom consensus in their views about the demand and supply side influences. Some studies establish the importance of demand side determinants while others attribute more importance to the supply side factors. Some of the studies on exports determinants are briefly discussed below.

Khan and Night (1985) have employed the Two Stage Least Square (2SLS) to examine the relationship between import of inputs and export performance for a sample of 34 of developing countries, using time series data over the period 1971-80. The export demand and supply functions were specified with income and relative prices with the addition of import of inputs in the supply side equation. Likewise the import demand function was specified with income, relative prices (price of imports relative to domestic prices) and the foreign exchange availability. The findings revealed that import of inputs had a positive and significant impact on export performance whereas the foreign exchange reserves had a negative but relatively less significant impact on imports.

Reidel (1988) used the simultaneous equations approach to examine the demand and supply side determinants of exports quarterly time series data over the period 1972-1984. Export prices, price of competing goods in world market and world demand were used as exogenous variables in the demand side equation while the domestic price of exports, price of raw material, industrial inputs and time trend were used as independent variables in the supply side equation. The results showed infinite price and income elasticities of exports demand, which supported the small country hypothesis. All the parameters of the wage as well as supply side export equations appeared with correct signs and significant magnitudes except the time trend variable ‘t’ which carried insignificant coefficient, although correctly signed.

Funk and Holly (1992) have employed the Full Information Maximum Likelihood method to estimate the demand and supply side export functions for three different categories of exports i.e., the total manufactured exports, mechanical engineering and motor vehicle exports of the West Germany. The quarterly time series data was applied over the period 1961-1987. The demand equation was specified with the prices of exports, prices of competing/substitute goods at world market, world demand (proxied by the OECD's exports). The supply side equation was specified with domestic price of exportable goods, foreign prices of exports, total costs and capital stock. All the demand and supply side elasticities carried significant magnitudes across the categories except the price elasticity of export demand which was found to be insignificant for the total manufactured and mechanical engineering goods exports.

Muscatelli, *et al.* (1992) have employed the Modified OLS to examine the determinants of the Hong Kong's exports, using quarterly time series data over the period 1972-1984. The export demand equation has been specified with prices of exports, prices of competing goods and world income, while the prices of exports, the prices of raw materials and unit labour costs have been used as exogenous variables in the supply side equation. The findings suggest significant but relatively small price elasticity and significant but relatively high income elasticity of export demand. On the supply side, only the wage rate turned out to be insignificant.

Reidel, *et al.* (1994) have examined the determinants of exports of Hong Kong to test the small country hypothesis, using quarterly time series data ranging from 1977:1 to 1984:4. The price dependent export demand equation has been specified with volume of exports, prices of competing goods at world market and world income as independent variables. The results showed significant and infinite income and price elasticities of export demand, implying that Hong Kong is a small price taker economy.

Muscatelli, *et al.* (1995) have examined the determinants of exports of the newly industrialised Asian economies, including Hong Kong, Korea, Taiwan, Singapore, Malaysia and Thailand, using a time series data over the period 1967-1987 and employed the Full Information Maximum Likelihood method for estimation. The results suggest significant income and price elasticities of exports demand for all the countries, thus rejecting the small country hypothesis that world demand is irrelevant in explaining export behaviour of the newly industrialised economies.

Roy (2002) has employed Full Information Maximum Likelihood method to estimate the demand and supply side exports equations for India over the period 1960-2000. The dynamic error correction model was estimated in which the error correction representation in the demand side equation carried significant and lager magnitude, indicated that the demand side factors significantly explain the short run dynamics of the export performance. All other variables in the model were found to be significant except the scale variable of the supply side, which was insignificant although correctly signed.

Atique and Ahmed (2003) have empirically analysed the determinants of exports of Pakistan. The export demand and supply functions were specified and estimated separately. The explanatory variables comprised world economic activity and real exchange rate in the export demand function while relative prices, domestic GDP and wage rate per worker were employed to explain the export supply function. REER and industrial production index (proxy for world economic activity) were found to be significant in the long run, although current and lagged values of REER were found to be insignificant. On the supply side, the cumulative effect of wage rate was found to be significant but not so at individual level. The domestic production capacity on the supply side appeared with positive and significant coefficient.

Afia (2004) has examined the determinants of textile and clothing exports of Pakistan, using a time series data over the period 1960-200. The demand and supply side exports equation were estimated in a simultaneous equation frame-work. The coefficient on the price of textile exports and world income appeared with correct signs but turned out to be insignificant. All the coefficients on the supply side were found to be statistically significant with correct sign.

Roy (2007) has estimated the demand and supply functions of the manufactured exports for India, using a time series data over the period 1960-2004. The FIML has been used to estimate the demand and supply side exports for six different categories of manufactured exports including cloth and garments, chemicals and machinery, transport equipments, steel and iron, and the leather manufactures. The findings suggest importance of all demand side factors for exports performance. On the supply side, the variables produced mix results in terms of significance and some variables like world GDP and exports volume turned out to be insignificant for textile and iron-steel exports respectively.

Keeping in view the above discussion, it is evident that studies regarding the determinants of exports in Pakistan are very rare. The available studies like Atique and Ahmed (2003), Afia (2004) and Afzal (2005) etc. are not comprehensive and suffer from methodological and estimation weaknesses. In contrast, there are only few international studies that have followed comprehensive approach in specification of both demand and supply side. The present study is intended to fill up the gaps in specification and estimation. We develop a simultaneous equation framework and test the demand for and supply of export functions separately for a number of export partners of Pakistan. Another distinction is the way we attempt to estimate the concerned equations. We employ the GMM technique in the first step and use the information in the second step of Bayesian estimation framework. The estimates so obtained are likely to be more consistent and reliable.

5. MODEL SPECIFICATION AND METHODOLOGY

The foreign trade models are specified by different researchers following different approaches. However there is a general consensus in literature about the empirical form of demand for and supply functions of exports. The standard approach is the “imperfect substitute model”, which assumes that neither imports nor exports are perfect substitutes of domestic goods.[1] Keeping this in view, the consumers in the trading partners’ economies are assumed to maximise their utility subject to budget constraint. The resulting demand function depends on the level of income in the economies concerned, the price of exports and price of substitute goods in the world market.[2] The specification of supply-side export equation is also straightforward within the ‘imperfect substitute model’. The producers in the domestic economy are assumed to maximise their profits subject to cost constraint. This yields export supply function, depending on the productive capacity and relative prices i.e. foreign prices of exports relative to the domestic prices of exportable goods.

[1]See Stein and Khan (1985).

[2]It is equivalent to say that the demand for exports depends on the level of foreign economic activity and the Real Exchange Rate. Because the RER is calculate in terms of price of exports and price of competing goods at world market.

We follow Stein and Khan (1985) and specify the export demand and supply functions with two necessary extensions. First, we introduce two dummies in the demand side equation to examine the impact of US-Iraq war (1991) and US-led Afghanistan war (2001). Second, we include the import of inputs in the supply side equation to see their impact on export performance of Pakistan. The demand and supply side equations in the extended form are specified as follows;

5.1. The Standard Export Model

$$\text{Export Demand Equation} \quad X^d_t = \alpha_0 + \alpha_1 RER_t + \alpha_2 Y^w_t + \alpha_3 D + U_t \qquad \ldots \quad (5.1)$$

$$\text{Export Supply Equation} \quad X^s_t = \beta_0 + \beta_1 RP_t + \beta_2 Y^d_t + \beta_3 M_t + V_t \qquad \ldots \quad (5.2)$$

X^d—the quantity of export demanded, *RER*- real exchange rate and is written as; $RER = P^x/eP^w$, where 'P^x' is the foreign price of exports, 'P^w' is the price of competing/substitute goods and 'e' is the nominal exchange rate of domestic economy with respect to the trading partners' economies. We use the export unit value of Pakistan and the import unit values of our trade partners to measure 'P^x' and 'P^w' respectively.[3] 'Y^w' is the world demand for domestic exports which is approximated by Gross Domestic Product (GDP) of our trading partners.[4] 'D' *is* the dummy variable that captures the impact Kuwait-Iraq war (1991) and the US-led Afghanistan war (2001) on our exports behaviour. 'X^s' in (2) is the supply of exports. 'RP' is the relative price of exports i.e., the price of exports relative to the domestic price of exports, that is 'RP' = $\frac{P^x}{P^d}$. 'P^x' is the price of exports at world market. 'P^d' is the domestic price of exportable and is proxied by the 'whole price index' *(WPI)* of Pakistan.[5] 'Y^d' is the supply side scale variable which is proxied by Gross Domestic Product of Pakistan (GDP). 'M' is the imports of inputs. We take the log transformation and rewrite the demand and supply function as follows;

$$logX^d_t = \alpha_0 + \alpha_1 \log P^x_t + \alpha_2 \log e.P^w_t + \alpha_3 \log Y^w_t + \alpha_4 D_{91} + \alpha_5 D_{01} + u_t \quad \ldots \quad (5.3)$$

$$logX^s_t = \beta_0 + \beta_1 \log P^x_t + \beta_2 \log P^d_t + \beta_3 \log Y^d_t + \beta_4 \log M_t + v_t \qquad \ldots \quad (5.4)$$

The coefficients α_i and β_i are elasticities with respect to the variables concerned. The coefficients 'α_2', 'α_3', 'β_1' β_3 and β_4 are expected to appear with positive signs; that is α_2, α_3, β_1, β_3, $\beta_4 > 0$, while α_1, α_4, and β_2 are expected to carry negative signs; that is α_2, α_3, $\beta_1 < 0$. This model is an equilibrium model and there are two endogenous variables in it, i.e., export quantity and exports prices which have to be jointly determined.

5.2. Normalising the Demand and Supply Functions;

Estimation of simultaneous equation model needs the equations to be normalised i.e., restricting the coefficient of one of the variable to '1'. The normalisation procedure is

[3]Stein and Khan (1978), Mscatelli (1992) and Roy (2002) have used the export unit value for the price of exports and import unit value of the trading partners to measure the price of the foreign substitute.

[4]Stein and Khan (1988) have used the real GDP of the trading partners to measure the world demand. Reidel (1988) has used real GNP. Muscatelli, *et al.* (1992) have used the real GDP while Roy (2002, 2007) has used the aggregate imports of the trading partners to measure the world demand for exports.

[5]Stein and Khan (1985) have used CPI, while Muscatelli, *et al.* (1992), Funk and Holly (1992) and Sinha Roy have used 'WPI' to measure the domestic price of exports.

found different in different studies. Reidel (1988) has normalised the export demand function with export price and export supply function with export quantity.[6] Muscatelli (1992), Roy (2002, 2007) and Funk and Holly (1992) used the opposite type of normalisation i.e. the export demand equation by quantity and export supply equation by price. We normalise the demand and supply functions, using the second approach i.e. the demand function by export quantity and supply equation by export price. The quantity dependent export demand equation and the price dependent export supply function or the inverse supply functions are written as follows;

$$log\, X_t^d = \alpha_0 + \alpha_1 log\ P_t^x + \alpha_2\, log\, e\,.P_t^w + \alpha_3\, logY_t^w + \alpha_4 D_{91} + \alpha_5 D_{01} + u_t, \quad (5.5)$$

$$log\, P_t^x = \gamma_0 + \gamma_1\, log\, X_t^s + \gamma_2\, log\, P_t^d + \gamma_3 log\, Y_t^d + \gamma_4\, log\, M_t + v_t \quad \ldots (5.6)$$

Equation (5.5) is a volume adjustment equation and Equation (5.6) is a price adjustment equation. X^d is seen as dependent variable in Equation (5.5) and P^x is seen as dependent variable in Equation (5.6). X^d and P^x are said to be the two endogenous variables in the system which have to be determined simultaneously. This means that the two equations are interdependent and none can be estimated independently. To estimate this type of model, the reduced form of the model is obtained which is estimated via Indirect Least Square to avoid the possible simultaneity problem. The second approach is to estimate the demand and supply functions in the simultaneous equations framework. We avoid the reduce form approach and use the simultaneous equation approach to estimate the set of equations.

5.3. The Estimation Strategy/Methodology

Before any regression analysis on time series data, it is necessary to check the series for the order of integration or to check the series for stationarity. It is believed that most of the time series have a unit root i.e., they are non-stationary which can be transformed into stationary series through differencing. We use the Augmented Dickey Fuller test to see the order of integration among the variables concerned.

Two or more variables are said to be co-integrated if they have a long run relationship among them. If the variables do not have a long relationship, there remains no economic concern. Therefore it is necessary to check weather the variables in a regression equation are cointegrated or not. Different people have proposed different tests to check co-integration among the variables. We use the Johenson cointegration test to check co-integration among the variables.

Engel and Granger (1987) had proposed the Static OLS to estimate the system of equations like above. But this procedure suffers due to two problems as pointed out by Benergy (1989). Second: endogeneity in regressors. Phillips and Hansen (1991) have justified the use of Modified OLS which can overcome both of these problems. Roy (2002) employed the Two Stage Least Square (2SLS) to estimate the system of equations like above. The system estimation methods like Three Stage Least Square (3SLS), The

[6]Reidel (1988) argued that normalising export demand equation with price and supply equation by quantity, yield results which support the small country hypothesis. Muscatelli, *et al*. (1992) show that it does not matter, how you normalise the demand and supply function but if one employ a system estimation method rather single equation method, one would get significant income and price elasticities of export demand.

Full Information Maximum Likelihood (FIML) and Generalised Method of Movements (GMM) are among the preferred methods to estimate the system of equations. Keeping in view the small size of the sample, we use the Empirical Bayesian procedure to estimate the system of equations. The Empirical Bayesian procedure is believed to provide efficient and much precise estimates than all of the above.[7] But before employing the empirical Bayesian technique, we use the GMM to estimate the set of equations and the estimates obtained are then utilised to develop the Empirical Bayesian formula. Both of these techniques are discussed below.

5.3.1. *The Generalised Method of Movements*

The Generalised Method of Moments is believed to be efficient among other estimators as it can overcome many problems like endogeneity in regressors etc. This procedure is widely used by the researchers but in small samples, it yields misleading results. We do not purely rely on the GMM; therefore we do not go into detail. Our main focus is on the performance of the Empirical Bayesian technique but we employ the GMM so that the results might be utilised to develop the Empirical Bayesian formula.

5.3.2. *The Empirical Bayesian Estimator*

The Empirical Bayesian Procedure is believed to be efficient over a class of other estimators especially in small samples. It has several advantages over other estimators that lead to much precise and reliable estimates. This assumes that the priori information about the unknown parameters to be represented in the form of a density function;

$$\hat{\beta}_i \,/\, \beta_i \sim N(\beta_i\,, \Lambda_i), \qquad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (5.7)$$

'$\hat{\beta}_i$' is the estimated elasticities whereas 'β_i' is the true values of the elasticities. Equation (5.7) states that the 'estimated values' of the parameters has a normal distribution with mean β_i, and variance 'Λ_i' given the true values of the parameters. The Empirical Bayesian Estimator is obtained by assuming that 'β_i' has a normal prior distribution of the form;

$$[\, \beta_i |\, \mu,\ \Omega\,] \sim \quad N(\mu,\ \Omega) \qquad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (5.8)$$

This implies that β_i has normal distribution with mean 'μ' and variance 'Ω'. Where, 'Ω' is the variance of the prior density which has been calculated from the GMM results. That is;

$$\Omega = \left[\ \sum_{i=1}^{n},\ \Lambda_i^{\,-1}\ \right]^{-1} \qquad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (5.9)$$

The variance of the prior density 'Ω' is simply the weighted average of the variance covariance matrices of the GMM estimates.[8] We follow Corrington and Zaman (1994) to calculate the variance covariance matrices of the parameters using the estimated standard errors of the GMM estimates obtained in the first stage, restricting the off-

[7]This is due to the additional information that is added to model which allow getting reliable and precise estimates of the variables.

[8]The inverse of the variance covariance matrix is also called the precision of matrix in Bayesian calculation. See the "Statistical Foundation for Econometric Techniques" by Asad Zaman, pp. 44.

diagonal element of the covariance matrix to be zero and assuming no prior covariance across the coefficients. 'μ' in (5.8) is mean of the prior density and is given as;

$$\mu = \Omega^{-1}\left[\ \sum_{i=1}^{n} \Lambda_i^{-1}\ \hat{\beta}_i\ \right] \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots (5.10)$$

Equation (5.10) implies that utilising the GMM results and the variance of the prior density, we arrive at the mean of the prior density. Once we obtain the mean and variance of the prior density, we proceed to find the mean and variance of the posterior density to arrive at the Empirical Bayesian formula. The posterior density of the data is given by

$$\beta_i\ /\ \hat{\beta}_i = \sim N\ (\text{m},\ \text{V}) \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots (5.11)$$

'm' and 'V' in (5.11) are respectively the mean and variance of posterior density. The variance 'V' is simply calculated from the variance covariance matrices 'Λ_i' and variance of the prior density 'Ω''. That is;

$$\text{V} = (\ \Lambda_i^{-1} +\ \Omega^{-1})^{-1} \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots (5.12)$$

Having obtained the variance of the posterior density, we can estimate the mean of this density by using 'V' and parameters of the prior density as under;

$$\text{m} = V\left(\ \Lambda_i^{-1}\hat{\beta}_i\ +\ \Omega^{-1}\mu\right) \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots (5.13)$$

In Equation (5.13) '$\hat{\beta}_i$' are the GMM estimates and μ and V are the mean and variance of the prior density respectively. It is evident that the posterior density utilises the data information and the prior information in the form of prior density. The Empirical Bayesian estimator, which is obtained from the posterior density, is given by;

$$\hat{\beta}^{EB} =\ \text{V}\left(\ \Lambda_i^{-1}\hat{\beta}_i\ +\ \Omega^{-1}\mu\right) \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots (5.14)$$

Equation (5.14) is the Empirical Bayesian formula of the parameters estimates. The standard errors of the estimates are obtained from the variance of the posterior density 'V'.

5.4. Sample Size and the Data

Annual data for the period 1975-2008 has been considered for the analysis over a sample of 11 countries. Data on Pakistan's imports and exports to the trading partners has been taken from different issues of the Statistical Supplements to the Economic surveys published by the Finance Division/Ministry of Finance. Likewise data on GDP, exchange rate and imports has been taken from the world development indicator (WDI). Data on the import unit value, export unit value, CPI and WPI have been obtained from International Financial Statistics (IFS).

6. RESULTS AND DISCUSSION

In this section we compare and analyse the results of the two estimation techniques i.e. GMM and the Empirical Bayesian technique. Before employing these techniques, we have employed the Augmented Dickey Fuller test to see the order of integration among the variables concerned. All the were found to have the same order of integration i.e. $I(1)$.

We have used the Johenson Cointegration technique to test Cointegration among the variables. The results reveal that all the variables are cointegrated and they have long run equilibrium relationship among them.[9]

6.1. The GMM Estimates

'α_1' is the price elasticity of export demand, 'α_2' is the cross price elasticity 'α_3' is the elasticity of demand with respect to the GDP of our trading partners. Likewise 'β_1', 'β_2' and 'β_3' are the prices and income elasticities of exports supply. 'β_4' is the elasticity of export supply with respect the imports of 'inputs'. The country-wise disaggregated structural demand and supply side export functions have been estimated initially with Generalised Method of Movements (GMM) and the results are reported in Table 1.

Table 1

GMM Results of the Demand and Supply Export Functions

Trade Partner	$X^d_t = \alpha_0 + \alpha_1 P^x_t + \alpha_2\, e\,.P^w_t + \alpha_3 Y^w_3 + \alpha_4 D_{91} + \alpha_5 D_{01}$ Export Demand Function						$X^s_t = \beta_0 + \beta_1 P^x_t + \beta_2 P^d_t + \beta_3 Y^d t + \beta_4 M_t$ Exports Supply Function				
Coeff:	α_0	α_1	α_2	α_3	D_{91}	D_{01}	β_0	β_1	β_2	β_3	β_4
United State	–12.10*	– 1.10*	0.67*	2.13*	–	–0.33**	–0.81***	0.02	– 0.96	1.71**	–0.46**
	(–10.41)	(–4.35)	(6.70)	(10.4)		(2.5)	(–1.76)	(0.05)	(–0.79)	(2.76)	(–2.42)
		R^2 = 0.99		D.W statistics = 1.60				R^2 = 0.98		D.W statistics = 1.68	
France	–1.24	– 1.21*	0.35*	0.53*	–	–	0.52**	0.63*	1.95*	– 0.54*	– 0.16
	(–1.43)	(–3.67)	(4.20)	(5.30)			(2.48)	(4.20)	(6.10)	(–3.00)	(–1.60)
		R^2 = 0.98		D.W statistics = 1.62				R^2 = 0.99		D.W statistics = 1.97	
UK	0.95	– 2.17**	1.39**	0.10	–	–	0.29	0.26	–1.63**	1.01**	0.19
	(0.65)	(–2.36)	(2.62)	(0.32)			(0.72)	(0.68)	(–2.12)	(2.73)	(–1.27)
		R^2 = 0.88		D.W statistics = 1.82				R^2 = 0.97		D.W statistics = 2.50	
Canada	9.71***	– 1.58**	0.78	–1.14**	–	–	–0.81**	1.48*	–2.96*	0.68***	0.27**
	(1.80)	(–2.82)	(1.11)	(–2.38)			(–2.70)	(4.84)	(–4.10)	(1.89)	(2.25)
		= 0.97		D.W statistics = 1.47				R^2 = 0.97		D.W statistics = 2.32	
Korea	–12.95**	–0.20	1.99**	1.54***	–	–	–3.36**	4.64**	–3.42**	0.87	1.10**
	(–2.10)	(–0.21)	(1.79)	(1.90)			(–2.51)	(2.27)	(–2.25)	(1.24)	(2.56)
		R^2 = 0.85		D.W statistics = 1.49				R^2 = 0.88		D.W statistics = 2.02	
Kuwait	–2.14*	–0.59***	0.42	0.90*	–0.89**	–	0.22	–1.83**	–0.68	1.69	0.11
	(–3.40)	(–1.69)	(1.24)	(6.24)	(2.38)		(0.26)	(2.76)	(–0.32)	(1.67)	(0.38)
		R^2 = 0.58		D.W statistics = 1.98				R^2 = 0.47		D.W statistics = 2.04	
Malaysia	–3.46	–1.49	3.10	– 0.35	–	–	–2.80*	3.15*	–6.10*	1.71**	0.74**
	(–1.20)	(–0.71)	(1.15)	(–0.27)			(–3.32)	(3.54)	(–3.37)	(2.19)	(2.31)
		R^2 = 0.91		D.W statistics = 1.89				R^2 = 0.85		D.W statistics = 2.17	
Mauritius	–6.18*	–1.04***	1.03**	2.14*	–	–	–2.35*	2.31**	–5.74*	2.56*	0.31**
	(–5.62)	(–1.96)	(2.34)	(4.86)			(–3.18)	(2.52)	(–3.51)	(4.27)	(1.99)
		R^2 = 0.78		D.W statistics = 2.06				R^2 = 0.75		D.W statistics = 1.90	
Germany	3.13	– 0.86*	– 0.32	0.32	–	–	18.75**	–0.21	0.40	–3.45*	0.16
	(1.01)	(–3.74)	(–0.67)	(0.91)			(2.32)	(–0.53)	(0.28)	(2.83)	(0.60)
		R^2 = 0.97		D.W statistics = 1.74				R^2 = 0.95		D.W statistics = 2.35	
Bangladesh	–4.68*	– 0.50	0.01	1.62*	–	–	–3.28*	2.54*	–4.42*	1.03*	1.30*
	(–3.66)	(–1.19)	(0.05)	(4.15)			(9.94)	(6.20)	(5.10)	3.10	(11.80)
		R^2 = 0.81		D.W statistics = 2.61				R^2 = 0.84		D.W statistics = 2.06	
S Arabia	–1.65**	–0.80***	0.49	0.61*	–	–	–2.18*	1.64*	–1.72**	–0.35	0.85**
	(–2.47)	(–1.84)	(1.12)	(4.40)			–3.34	3.28	–1.87	–0.69	2.69
		R^2 = 1.91,		D.W statistics 1.91				R^2 = 0.59		D.W Statistics: 1.64	

The numbers in parenthesis are the estimated "t" values of the respective coefficients. (*), (**) and (***) indicate significance at 1, 5 and 10 percent respectively.

[9]The results have not been shown here, but are available from the author on demand.

6.1.1. *Analysis of the Results (GMM)—Demand Side Equation*

The first and important point to note is that the coefficient of the world GDP (GDP of the trading partners) on the demand side carries significant and correct sign in most cases except for UK, Malaysia and Germany where is insignificant. The coefficients on the income elasticity of demand appear with a wide range of values across the countries concerned i.e., the highest coefficient is 2.13 for USA and the lowest is 0.10 for UK. The income elasticity of demand in case of UK and Germany appears with correct sign but it is not significant even at 10 percent.[10]

The own price elasticity of export demand is found to be significant in most cases with correct sign and plausible magnitudes with the exception of a few cases. This parameter also differs in terms of significance and magnitudes across the countries like the income elasticity. The estimated elasticities are insignificant for Korea, Malaysia and Bangladesh. The cross price elasticity of export demand is found to be smaller in magnitude as compared to the price elasticity across all the countries under study. This means that our exports are much sensitive to changes in prices of exports in the world market as compared to the prices of competing or substitute goods at our country export market. Besides the income and price variables, two dummies (D91 and D01) have been introduced in the demand side export equation to examine the impact of Kuwait-Iraq war (1991) and Afghanistan war (2001) on our export behaviour.[11] The Dummy variable "D91" is assigned '0' before 1991 and '1' thereafter while the dummy variable "D01" takes '0' before 2001 and '1' thereafter. The coefficient of dummy "D91" carries significant magnitude and negative sign only in case of Kuwait. This implies that the Kuwait-Iraq war had a negative impact on exports flow of Pakistan to Kuwait. The coefficient of dummy "D91" is insignificant across all other countries although it carries its expected negative sign. The dummy "D01" is found to be negatively signed in almost all cases but turns out to be significant only for the United State. This indicates that the Afghanistan war (2001) has a negative impact on our exports flow to the United States.

6.1.2. *Analysis of the Results (GMM)—Supply Side Equation*

The concerned elasticities have been calculated from the supply function (4.7).[12] The income elasticity of exports supply appears to have correct sign and significant magnitudes for all the countries except France and Germany. This is found to be greater than unity in all cases which indicates that 1 percent increase in national income brings more than 1 percent increase in export supply. The price variables in the supply side equation provide mix results in terms of sign and significance of the variables. The foreign price elasticity of export supply turns out to be significant across all the countries except for US, UK and Germany, although it differs significantly in magnitudes across

[10]The results on the income elasticities are in accordance to Khan and Night (1978), Muscatelli (1992) and Roy (2002) who find positive and significant income elasticities of demand for exports.

[11]We have not considered the dummies in other equations since they were found to be insignificant. We have re-estimated equations after the omission of the two dummies.

[12]The elasticities of export supply with respect to the variables concerned have been indirectly calculated from the supply function. It may be recalled that we have normalised the export supply function in terms price of exports. The elasticities of the supply side equation have been calculated as follows.

$\beta_0 = -\frac{\gamma 0}{\gamma 1}$, $\beta_1 = \frac{1}{\gamma 1}$, $\beta_2 = -\frac{\gamma 2}{\gamma 1}$, $\beta_3 = -\frac{\gamma 3}{\gamma 1}$, $\beta_4 = -\frac{\gamma 4}{\gamma 1}$

the countries. It appears with unexpected sign for Germany and Kuwait. The own price elasticity of exports supply carries significant and relatively high magnitudes across the countries. This implies that the export supply is much sensitive to changes in domestic prices of exports. The signs are unexpected only in case of France and Germany and the magnitudes are insignificant only for USA and Kuwait.

The import of 'industrial inputs' indicates significant magnitudes with positive signs in most cases with the exception of a few. This means that import of inputs have a positive impact on exports performance.

6.2. Empirical Bayesian Findings

The Empirical Bayesian estimates of the demand and supply functions are given in Table 2 below. The important points are discussed below.

6.2.1. *Analysis of the Results (Empirical Bayes)—Demand Side Equation*

The first column of Table 2, reports the Empirical Bayesian results of the demand side exports equation. This offers very much improvement over the GMM estimates. The foremost point to be noted, here is that the estimated standard errors are much smaller than their GMM counterparts. The improvement in precision is noticeable if we look in-to the signs of the parameters. All the demand side elasticities appear to be highly significant with correct signs for all the trading partners. This is actually due to the addition of prior information to the model. The magnitudes of the income and price elasticities are smaller than the respective GMM estimates across the countries concerned.

Table 2

Empirical Bayes Results of the Demand and Supply Functions

Trade Partners	$X^d_t = \alpha_0 + \alpha_1 P^x_t + \alpha_2 e.P^w_t + \alpha_3 Y^w_3$ Export Demand Function				$X^s_t = \beta_0 + \beta_1 P^x_t + \beta_2 P^d_t + \beta_3 Y^d_t + \beta_4 M_t$ Exports Supply Function				
Coefficients	α_0	α_1	α_2	α_3	β_0	β_1	β_2	β_3	β_4
Unite State	–3.39*	–0.98*	0.50*	0.90*	–0.49*	0.78*	–0.16	0.33**	0.24*
	(–10.60)	(–9.17)	(10.21)	(16.08)	(–4.02)	(7.38)	(–0.70)	(2.77)	(4.98)
France	–2.17*	–0.98*	0.42*	0.73*	–0.29**	0.76*	0.60*	0.02	0.20*
	(–6.99)	(–8.82)	(9.01)	(14.46)	(–2.70)	(8.61)	(3.16)	(0.24)	(4.45)
UK	–2.49*	–0.97*	0.46*	0.77*	–0.51*	0.78*	–0.26	0.35*	0.24*
	(–7.68)	(–8.29)	(8.17)	(13.47)	(–4.22)	(7.49)	(–1.15)	(3.02)	(5.09)
Canada	–2.63*	–0.98*	0.45*	0.77*	–0.63*	0.89*	–0.40***	0.32**	0.29*
	(–7.92)	(–8.47)	(8.01)	(13.26)	(–5.35)	(8.61)	(–1.78)	(2.77)	(6.21)
Korea	–2.71*	–0.94*	0.45*	0.80*	–0.62*	0.83*	–0.17	0.29**	0.30*
	(–8.14)	(–8.02)	(8.02)	(13.75)	(–4.89)	(7.70)	(–0.74)	(2.47)	(6.05)
Kuwait	–2.56*	–0.92*	0.45*	0.82*	–0.58*	0.80*	–0.14	0.30**	0.29*
	(–8.69)	(–8.16)	(8.04)	(15.89)	(–4.57)	(7.39)	(–0.59)	(2.47)	(5.77)
Malaysia	–2.68*	–0.95*	0.45*	0.79*	–0.64*	0.86*	–0.23	0.31**	0.30*
	(–8.11)	(–8.09)	(7.96)	(13.62)	(–5.11)	(7.96)	(–0.99)	(2.60)	(6.09)
Mauritius	–2.97*	–0.96*	0.46*	0.82*	–0.65*	0.84*	–0.24***	0.36**	0.29*
	(–9.31)	(–8.29)	(8.17)	(14.17)	(–5.13)	(7.83)	(–1.73)	(3.09)	(5.92)
Germany	–2.61*	–0.93*	0.44*	0.78*	–0.59*	0.75*	–0.12	0.24**	0.28*
	(–7.88)	(–8.88)	(7.81)	(13.61)	(–4.65)	(7.19)	(–0.51)	(2.00)	(5.59)
Bangladesh	–2.80*	–0.92*	0.41*	0.81*	–0.94*	0.93*	–0.43***	0.36*	0.47*
	(–8.69)	(–8.08)	(7.63)	(14.11)	(–7.93)	(8.92)	(–1.87)	(3.17)	(10.21)
S. Arabia	–2.47*	–0.94*	0.45*	0.77*	–0.65*	0.86*	–0.23	0.24**	0.31*
	(–8.29)	(–8.26)	(8.02)	(14.29)	(–5.22)	(8.12)	(–1.01)	(2.08)	(6.15)

The numbers in parenthesis are the estimated't' values of the respective coefficients, while (*), (**) and (***) indicate significance at 1, 5 and 10 percent respectively.

The own price elasticity of export demand is found to be clustered around unity which implies that 1 percent change in the price of exports cause the export demand to change nearly by the same change. The elasticity of export demand with respect to the prices of competing goods is found to be significant with correct sign. It does not differ too much in terms of magnitude across the countries when compared to the GMM estimates (where we found too much fluctuation). It lies in the range of 0.40 and 0.50 across the countries and it is smaller than the own price elasticity of export demand. This implies that export demand is less responsive to changes in the prices of competing goods in the world market as compared to changes in the own price of exports. The income elasticity of export demand has plausible magnitudes and correct signs, and is found to be less than unity for all the countries. This elasticity varies slightly across the countries which is natural. The highest income elasticity of export demand is 0.90 for USA and the smallest is 0.73 for France. For Saudi Arabia, the income elasticity of export demand is 0.77. This is another significant improvement shown by the Empirical Bayesian Estimator over the GMM estimator.

6.2.2. *Analysis of the Results (Empirical Bayes)—Supply Side Equation*

The second column of the Table 2 reports the results of the Empirical Bayesian estimates of the supply side export equation. The price elasticity of export supply with respect to the world prices of exports in case of USA is found to be 0.78 which means that a 10 percent increase in the foreign prices, export flow to United State rises only by 7.8 percent. The highest price elasticity of export supply is found to be 0.93 for Bangladesh followed by 0.89 for Canada whereas the smallest is 0.75 for Germany. The price elasticity of export supply with respect to the domestic prices of exportable goods turns out to be insignificant and carries very small magnitudes for most of the trading partners. This means that the supply of exports is not much sensitive to changes in the domestic prices of exportable goods. Likewise, the income elasticity of export supply carries reasonable magnitudes across the countries but not too high as one would expect. It is smaller in magnitude than the income elasticity of export demand across the countries. This implies that world demand is more significant than the domestic income level in explaining exports behaviour. The income elasticity of export supply is 0.36 for both Mauritius and Bangladesh whereas for USA, it is 0.33 only. As far as the import of input variable is concerned, its coefficient is highly significant even at 1 percent and appears with expected positive and reasonable magnitudes for all the trading partners. The coefficient of this variable does not vary too much across the countries like the GMM estimates and it lies between 0.20 and 0.50. The positive and significant coefficient on this variable confirms the hypothesis that import of inputs leads to improve export performance significantly in long run. Alternatively, its negative impact on export flow is of transitory nature and can be found only in the short run.

6.3. The Composite Elasticities

In this section, we attempt to estimate the composite elasticities or equivalently the elasticities of export demand and supply as a whole. So far we have analysed the determinants of exports at country-wise disaggregated level and we have found different elasticities across the countries, i.e., the responsiveness of export demand and supply to a change in any one determinant differs among the countries. Thus keeping in view this situation, we can not correctly specify the relative importance of each determinant in export performance. However, the composite elasticities will depict the over all picture of export behaviour and will help in determining the relative importance of each factor in explaining exports behaviour. These are simply the weighted averages of the individual elasticities across the trading partners. The shares of each trading partner in our exports have been interpreted as weights. The weights have been multiplied with concerned elasticities and the sum of these products across the countries has been divided by the sum of weights to get the composite elasticity. More specifically, we have used the following formula to calculate the composite elasticities of export demand and supply.

$$\eta_i = \frac{\sum_j^n W_j * C_j}{\sum_j^n W_j} \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (6.1)$$

Where, 'η_i' is the elasticity of export demand and supply with respect to the '*i*th' determinant i.e., price and income etc. 'W_j' is weight or share of the *j*th trading partner in our exports. 'C' is the elasticity of exports with respect to the *ith* determinant i.e., price and income etc for the *jth* country. 'n' is the total number of trading partners, concerned. Equation (6.1) implies that to calculate the composite elasticity of export demand and supply for the *ith* determinant, the product of weight/share of the *jth* trading partner in our exports and the individual elasticity of that *ith* determinant for the trading partner is added across the 'n' trading partners and then divided by the sum of weights/shares. That is;

$$\eta_i = \frac{W_1 * C_1 + W_2 * C_2 + W_3 * C_3 + \ldots\ldots\ldots\ldots + W_j * C_i}{\sum_j^n W} \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (6.2)$$

We have obtained the following composite elasticities of the export demand and supply, using the above specification.

Export Demand Function: $X_t^d = -2.85 - 0.96\, P_t^x + 0.46\, P_t^w + 0.82\, Y_t^w$

Export Supply Function: $X_t^s = -0.55 + 0.79\, P_t^x - 0.23\, P_t^d + 0.31\, Y_t^d + 0.26\, M_t$

The composite price elasticity of export demand or equivalently the own price elasticity of export demand carries plausible magnitude, which is 0.96. This implies that a 10 percent increase in price of exports leads the demand for exports to decline by 9.6 percent. Likewise, the cross price elasticity or elasticity of export demand with respect to the price of competing/substitute goods in the world market is only 0.46, which is smaller than the own price elasticity. This means that export demand is much sensitive to changes in the price of exports as compared to the price of competing/substitute goods. The income elasticity of export demand carries relatively high magnitude of 0.82, which means that a 10 percent increase in the world income leads the demand for export to increase by 8.2 percent.

On the supply-side, all the parameters carried meaningful magnitudes but smaller than the demand side elasticities. For instance, the own price elasticity of export supply is 0.79, which is smaller than the own price elasticity of export demand. Likewise, the price elasticity of export supply is only 0.23, which implies that a 10 percent increase in domestic price of exportable goods leads the export supply to decrease by 2.3 percent only. This indicates that the domestic prices of exportable goods have not that much concern in determining exports supply. The income elasticity of export supply is o.31, whereas the coefficient of import of inputs is 0.26. Once again this confirms the fact that import of inputs (machinery, equipments and raw material etc.) enhances the country potential to export.

7. SUMMARY

Most of the elasticities of the Empirical Bayesian technique have appeared with correct signs and statistically significant. In contrast, the GMM technique provided mix results and some of the parameters appeared with unbelievable signs and insignificant magnitudes across the countries. The price elasticity of export demand appeared to be statistically significant with correct sign in all cases. In most cases it is around unity which means that a 'given percentage change' in the price of exports brings about an equivalent change in export demand. In other words, our exports are unit elastic in own prices.

The cross price elasticity of export demand carried statistically significant magnitude with correct signs for all the trading partners which indicated that export demand is positively related to changes in the price of competing goods at world market. The income elasticity of export demand was also statistically significant with expected sign, indicating that the world income has a positive impact on our export behaviour.

Both of the two dummies i.e. 'D91' and 'D01' in the demand side export equations turned out to be insignificant in most cases although they carried their expected sign. However, these variables were significant and negatively related to our exports only for Kuwait and USA respectively.

The own price elasticity of export supply appeared with correct sign and significant magnitudes except for Bangladesh. The positive and relatively high magnitudes of the price elasticity indicate the sensitivity of our exports to changes in the price level at world market. The price elasticity of exports supply with respect to the domestic price of exportable goods turned out to be insignificant in most cases although it carried the expected sign.

The income elasticity of exports supply was found to be significant across all the countries except for France. This means that GDP has a critical role in explaining exports performance. The import of inputs appeared with correct sign and reasonable magnitudes in all cases, which strongly supports the hypothesis that import of inputs (machinery, equipments and raw material) has a positive and significant impact on export performance.

As we have already described that the Empirical Bayesian technique is an efficient and attractive devise which allow getting consistent and precise estimates. We have used the Empirical Bayesian technique to estimate the demand and supply functions. This has shown considerable improvement over the GMM results although it is not widely used by this research motivates the researchers to use it wherever it is applicable.

8. CONCLUSIONS

Our main objective was to determine the relative importance of the demand and supply side determinants of exports. The findings establish the importance of demand side factors in explaining export performance as indicated by highly significant magnitudes of the demand side price and income elasticities. The positive and significant coefficient of the world demand can be interpreted as that the Pakistani exporters have achieved up to some extent, the skills and capabilities to meet the global demand for the sophisticated products, i.e. the cotton manufactures like ready made garments and synthetic textiles etc. In addition, the significance of the price of exports on the supply side implies that the price incentives have sufficient concern for the domestic producers to increase supply. A significant finding of the study is the relatively high magnitude of the own price of exports on the demand side. This suggests depreciation of the domestic currency, which makes domestic goods cheaper in the world market relative to the substitute/competing goods to capture the world demand. Still another important finding is the positive and significant coefficient of import of inputs, which confirms the fact that import of inputs is critical for production of goods meant for exports. This strongly rejects the import compression policy, specifically for import of machinery, equipment and raw material etc.

The high income and price elasticity of demand indicates a high demand from the countries in European Union and NAFTA region. That’s why Pakistan has persistently concentrated in these markets, although our exports have been seriously affected due to the war on terror.

9. POLICY IMPLICATIONS/RECOMMENDATION

It is evident that commodity composition of the Pakistan’s exports has changed significantly over the study period with an increase in the share of manufactures and a fall in the share of primary goods which is a healthy sign. No single factor or determinant can therefore explain this long run changing behaviour of exports. In other words, a number of demand and supply side factors have a significant role in explaining the long run behaviour of exports, most important being the ‘price measures’ and the ‘world demand’. This means that more consideration should be given to demand side determinants as compared to relying purely on the removal of supply-side constraints while devising a viable strategy towards exports growth.

Further is the question of effectiveness of the relative prices (prices of exports relative to the domestic prices of exportable goods) and the world demand. The findings reveal that the world demand i.e., income level of the trading partners is much significant in explaining exports performance as compared to other factors. Although the world demand has grown over the period but due to the poor market access and other restrictions, the growth in exports has not yet matched with this trend. Thus for a sustainable export growth, better market access has to be ensured in addition to diversification.

On the other hand the supply side determinants are relatively not that much important in explaining export performance. This leaves enough room to enhance the share of the value-added goods along with technology up-gradation. In particular, the import of industrial inputs should be facilitated as they provide the very basis for our exports.

The desirable strategy should be diversification of export market with emphasis on the NAFTA, EU and Middle East regions where the demand for Pakistani exports is sufficiently large. The study also recommends particular concentration on the African countries, keeping in view the increasing demand from these countries.

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A Strategic Framework of Liberalising Trade in Services for Pakistan

AHMED GULZAR

1. INTRODUCTION

For a long time, services were considered non-tradable in the literature of international economics. However, the sector has emerged with profound importance on the basis of strong underpinnings. Technological advancement, financial constraints and limited options, and regulatory changes have greatly expanded the range and scope of trade in services especially in the context of increasing share of knowledge intensive products at the world market. They, in the era of globalisation, have eliminated natural monopolies (telecommunications, energy) in international trade and opened up new avenues for the developing countries to match up with the developed countries in the shortest possible span of time. They are contributing a lot in creating cross-border trade and have increased private sector participation in services where, in many countries, the public sector had traditionally played a major role (health, education, environmental services). The growth in services trade has made widespread liberalisation in terms of FDI and cross-border mobility of factors of production (especially skilled labour) over the past decade.

Now, the rapid expansion of trade in services contributes significantly to economic growth, both in developed and in developing economies [OECD (2003)]. Growth in services trade are initiated and stimulated by various factors including liberalisation of merchandise trade, deregulation of service operators and advances in information and communication technologies.

The services sector has been the vehicle of economic growth in Pakistan's economy over the decades. Its share to overall GDP has reached to 53.3 percent in 2010-11, which shows a clear and continuous structural shift in the economy. In the previous fiscal year, services sector made contribution of 90 percent to the overall GDP growth. The growth trends in the services sector show relatively stable condition in the sector.

Pakistan is heading towards liberalisation of trade in services through unilateral, bilateral, multi-lateral agreements under the broad framework of WTO. Recently, in the wake of trade liberalisation in EBOPS services among Pakistan's partner countries,

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Pakistan has received request lists from its partner countries in the context of national treatment and market access under four modes of cross-border supply of WTO framework. Burki, *et al.* (2007) explains that the opportunities as well as risks associated with trade liberalisation depend primarily on the relative competitiveness among the trading partners. It is, therefore, essential for the policy-makers to design such a trade policy which not only helps promoting domestic services industries but also open up new opportunities of employment generation and economic growth and development with a guarantee of peace and stability within and across its neighbouring countries. In this connection, this research paper comprises the following components to develop a strategic framework of liberalising trade in services[1] for Pakistan with its selected 26 trading partners;[2]

- Analysing the relative contribution of trade in services to overall GDP in developing and developed countries across the world since 1981 to 2010.
- Analysing the growth of export, import and overall trade in services in Pakistan over the period 1981-2010.
- Examining the untapped potential of trade in services of Pakistan with its partner countries by category of service.
- Estimating the Trade Intensity Indices (Both Export and Import) by category of services with each selected partner country.
- Estimating Complementarity and Country Bias indices (Both Export and Import) by category of service with each selected partner country.
- Estimating Revealed Comparative Advantage Indices (Both Export and Import) by category of service with each selected partner country.
- Analysing the major determinants of Revealed Comparative Advantage.
- Estimating the price and income elasticities by category of service with selected partner countries to examine the demand and supply potential and TOT situation in services sector.
- On the basis of above analyses, to develop a strategic framework of liberalising trade in services for Pakistan.

2. REVIEW OF RELEVANT LITERATURE

Hoekman and Mattoo (2000) analysed the welfare and efficiency gains along with the growth through services liberalisation by adopting general equilibrium (GE) model approach. They showed that services liberalisation can stimulate economic welfare and in some cases more than that from goods liberalisation.

Li, *et al*. (2003) is used to analyse the impact of trade in services and merchandise trade on growth separately along with the indicator of government regulations (i.e. days to start a new business) and gross domestic investment. These variables in the recent literature have the central importance in estimating the core growth models and used by Levine and Renelt (1992) and Sala-i-Martin (1997). The gravity equation after the work

[1]Services include; Total services, Transport, Travel, Communication, Construction, Insurance, Financial, Royalties and License fee, Other Business Services, Personal, Cultural and Recreational Services, Government Services.

[2]The list of names of trading partners is given in the annexure.

of Tinbergen (1962) and Poyhonen (1963) has been a common formulation for the analysis of bilateral trade potentials between the trading partners by keeping in view the origin-specific, destination-specific and bilateral-specific components and determinants. Brandicourt, *et al.* (2008) explain that a gravity model with two-stage least square has the advantage of minimising the omitted variable bias given the data limitations for services trade.

Balassa (1965, 1979) by introducing his famous RCA index argued that the comparative advantage model is "revealed" by observing the commodity pattern of trade which explains the relative costs and differences in non-price factors. Later, this index is found extensively in the economic literature to identify the areas for specialisation of a country. Sapir and Lutz (1981) asserted that the principle of comparative advantage and the factor endowment model is consistent with the international trade in services. The structural and institutional factors of Revealed Comparative Advantage, across countries over period were identified for the identification of policy tools in a preference order.

Since there is difference in nature of goods and services, therefore the available elasticity estimates for trade in goods may not be used directly to understand the behavioural pattern of trade in services. The scope of differentiation in services is much greater than in goods (e.g. transport, medical, financial, insurance services etc.). These differentiations in services have significant impact on relative elasticities. Marquez (2002) estimated income and price elasticities for exports and imports of USA in four categories which include travel, fares, transportation, and other private services. He further assessed simultaneity biases by comparing estimates from three estimation methods namely OLS, IV and FIML. Saeed, *et al.* (2005) worked on services trade by modes of supply, operational constraints and export capacity in five service sectors of Pakistan including IT; financial services; construction and architectural services; professional services; and medical and health services. They analysed the forward and backward linkages between the services sector and the major commodity producing sectors. They concluded that there is significant on-going trade in services and scope in the export markets in all modes of supply in the selected sectors. However, the potential impact of liberalising trade in services in the current scenario is absent in their paper. Rehan (2008) studied the pattern of growth of services sector in all five South Asian countries for last three decades. He analysed that under GATS; these countries have liberalised many of their services sectors but due to weak domestic preparedness before opening up are likely to be associated with unsatisfactory and undesirable outcomes of liberalisation.

3. METHODOLOGICAL SETUP

We first check the relative contribution of Trade in Services to Overall GDP with the following specifications;

$$\frac{RCit}{T} = ARC_{it} \quad \dots \quad \dots \quad \dots \quad \dots \quad \dots \quad \dots \quad \dots \quad (1)$$

$$\frac{d\ln\left(\frac{Xit}{GDPit}\right)}{\frac{Xit}{GDPit}} = RC_{it} \quad \dots \quad \dots \quad \dots \quad \dots \quad \dots \quad \dots \quad (2)$$

Where;

$RCit = Relative\ contribution\ of\ country\ i\ in\ period\ t$
$T = 5\ years$
$ARCit = Avg. Relative\ contribution\ of\ country\ i\ in\ period\ t$
$\left(\frac{Xit}{GDPit}\right) = Tradein\ services\ of\ country\ i\ given\ the\ size\ of\ overall\ GDP\ in\ period\ t$

There are generally two approaches adopted to analyse the impact of trade and trade spillover on economic growth. A strand of literature has used the contribution of R&D spillovers to TFP growth. The alternative is an output growth equation. The second method has the advantage over the first in terms of eliminating any expected error in calculating the Total factor productivity. In this study, production function estimation approach consistent with Li, *et al*. (2003) is used to analyse the impact of trade in services and merchandize trade on growth separately along with the indicator of government regulations (i.e. days to start a new business) and gross domestic investment. These variables in the recent literature have the central importance in estimating the core growth models through either of the approaches mentioned above and also used by Levine and Renelt (1992) and Sala-i-Martin (1997). The parsimonious specification is as follows;

$$LogY_{it} = \phi_o + \phi_1 LogGDI_{it} + \phi_2 Mg_{it} + \phi_3 Sg_{it} + \phi_4 Bd_{it} + \mu \quad \ldots \quad (3)$$

Here $\phi_1 > 0, \phi_2 > 0, \phi_3 > 0, \phi_4 < 0$

Equation 3 explains the production function in general form.
Where,

$Y_{it} = Per\ capita\ income\ of\ country\ i\ in\ period\ t$
$GDI_{it} = Gross\ domestic\ Investment\ of\ country\ i\ in\ period\ t$
$Mg_{it} = Merchandize\ trade\ as\ percentage\ GDP\ of\ country\ i\ in\ period\ t$
$Sg_{it} = Trade\ in\ services\ as\ percentage\ of\ GDP\ of\ country\ i\ in\ period\ t$
$Bd_{it} = Days\ to\ start\ a\ new\ business\ in\ country\ i\ in\ period\ t$

The gravity equation after the work of Tinbergen (1962) and Poyhonen (1963) has been a common formulation for the analysis of bilateral trade potentials between the trading partners by keeping in view the origin-specific, destination-specific and bilateral-specific components and determinants. Brandicourt, *et al.* (2008) explains that a gravity model with two-stage least square has the advantage of minimising the omitted variable bias given the data limitations for services trade. In this study, a gravity model with two-stage pooled least square method is used to analyse the trade potential with the selected trading partners in relative terms. At first stage, we will estimate the specification 4 and at second stage we estimate the specification 5 given below. The underlying purpose of the second-stage regression is to compare country-partner trade volumes (γ_{ij}) with the volumes ($\hat{\gamma}_{ij}$) predicted by observed country-specific variables. The predicted volume is considered as a country's trade potential. In this ways, it estimates a country's services exports predicted by its observable characteristics. It explains that if the term {(γ_{ij}) - ($\hat{\gamma}_{ij}$)} takes negative sign. It means that the country has untapped potential with its partner in the given time t. Conversely the positive residual is an indicative of over-performance with a trading partner in comparison with other trading partners. The explanatory variables used in specification 4 and 5 have been extensively found in the existing literature.

First Stage

$$LnX_{ijt} = \theta_o + \theta_1 LnDist_{ij} + \theta_2 LnCl_{ij} + \theta_3 LnCb_{ij} + \gamma_{ij} + \varepsilon_{ijt} \quad \ldots \quad (4)$$

Here $\theta_1 < 0, \quad \theta_2 , \theta_3 > 0 , \gamma_{ijt} > 0 \; or \; \gamma_{ijt} < 0$

Where,

$X_{ijt} = Exports\ of\ services\ of\ country\ i\ to\ partner\ country\ j\ in\ peorid\ t$
$Dist_{ij} = Distance\ bewtween\ capitals\ of\ country\ i\ and\ country\ j$
$Cl_{ij} = Common\ language\ of\ country\ i\ and\ country\ j$
$Cb_{ij} = Common\ boarder\ of\ country\ i\ and\ j$
$\gamma_{ij} = Cross\ section\ fixed\ effect$

And

Second Stage

$$\gamma_{ij} = \Omega_o + \Omega_1 LnPOP_j + \Omega_2 Y_j + \Omega_3 MO_{ij} + \Omega_4 MR_j + \varepsilon_{ij} \quad \ldots \quad \ldots \quad (5)$$

Here

$\gamma_{ij} = cross\ section\ fixed\ effect\ in\ a\ given\ period\ estimated\ in\ specification$ 4
$POP_j = Population\ of\ country\ j\ in\ given\ period$
$Y_j = Per\ capita\ income\ of\ country\ j\ in\ given\ period$
$MO_{ij} = Multilateral\ openess\ term\ of\ country\ i\ in\ given\ period$
$MR_j = Market\ Regulation\ Indicator$

Trade-intensity index measures the extent to which a country’s share in another country’s exports (imports) is larger or smaller in relation to the former country’s share in world trade. The value of more (or less) than unity of this index indicates that a country is exporting more (or less) to another country than might be expected from the country’s share in world trade. The trade-intensity index has been decomposed into two indices, “complementary” and “country bias”, in order to assess the contribution of Complementarity and other factors influencing the intensity of trade. The “Complementarity index” measures the extent to which one country’s export pattern matches another country’s import pattern more closely than it matches that country’s import pattern for world imports. The “country bias” index measures that extent to which one country’s exports have more or less favourable access to another country’s market than might be expected from both countries’ share in world trade. The revealed comparative advantage (RCA) index, which shows the comparative advantage in terms of the share of a particular industry in a country’s total exports relative to the industry’s share in total world exports has been calculated in order to assess the dimension of comparative advantage among the service groups of member countries and to infer the degree of potential Complementarity of the countries as well as the degree of potential Complementarity of the countries in international trade. The RCAX and RCAM explain the advantage / disadvantage in labour-intensive and capital-intensive services.

The formulae to measure the Trade-intensity indices (Export and Import), the Complementarity indices (Export and Import), the country-bias index, RCA are given below;

$$IE_{ij} = \frac{X_{ij}}{X_i} \Big/ \frac{M_j}{M_w - M_i} \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (6)$$

$$IM_{ij} = \frac{M_{ij}}{M_i} \Big/ \frac{X_j}{X_w - X_i} \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (7)$$

$$CI_{ij} = \left(\frac{X_j^k}{X_j}\right)\left(\frac{M_w - M_i}{M_w^k - M_i^k}\right)\left(\frac{M_j^k}{M_j}\right) \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (8)$$

$$CM_{ij} = \left(\frac{M_j^k}{M_j}\right)\left(\frac{X_w - X_i}{X_w^k - X_i^k}\right)\left(\frac{X_j^k}{X_j}\right) \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (9)$$

$$BI_{ij} = X_{ij} \left(\frac{M_w^k - M_i^k}{X_i^k - M_j^k}\right) \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (10)$$

$$BM_{ij} = M_{ij} \left(\frac{X_w^k - X_i^k}{M_i^k - X_j^k}\right) \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (11)$$

$$RCAX = \left(\frac{X_i^k}{X_i}\right) \Big/ \left(\frac{X_w^k}{X_w}\right) \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (12)$$

$$RCAM = \left(\frac{M_i^k}{M_i}\right) \Big/ \left(\frac{M_w^k}{M_w}\right) \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (13)$$

$where;$

$IE_{ij} \quad = Export - intesity\ index\ (EII)\ of\ country\ i\ with\ country\ j$

$IM_{ij} \quad = Import - intesity\ index\ (EII)\ of\ country\ i\ with\ country\ j$

$X_{ij} \quad = Export\ of\ country\ i\ to\ country\ j$

$X_i \quad = Total\ export\ of\ country\ i$

$M_j \quad = Total\ import\ of\ country\ j$

$M_w \quad = Total\ world\ import$

$M_i \quad = Total\ import\ country\ j$

$CE_{ij} = Export\ Complementarity - index$

$CM_{ij} = Import\ Complementarity - index$

$X_i^k = Country\ i's\ export\ of\ commodity\ k$

$M_w^k = World\ imports\ of\ commodity\ k$

$M_i^k = Country\ i's\ import\ of\ commodity\ k$

$M_j^k = Country\ j's\ import\ of\ commodity\ k$

$BX_{ij} = Export\ Country - bias\ index\ for\ country\ i's\ export\ to\ country\ j$

$BM_{ij} = Import\ Country - bias\ index\ for\ country\ i's\ export\ to\ country\ j$

$RCAX = Revealed\ Comparative\ Advantage\ of\ exports\ of\ commodity\ k\ for\ country\ i$

$X_w^k = World\ exports\ of\ commodity\ k$

$X_w = Total\ world\ exports$

$RCAM = Revealed\ Comparative\ Advantage\ of\ imports\ of\ commodity\ k\ for\ country\ i$

Balassa (1965, 1979) by introducing his famous RCA index argued that the comparative advantage model is "revealed" by observing the commodity pattern of trade which explains the relative costs and differences in non-price factors. Later, this index is found extensively in the economic literature to identify the areas for specialization of a country. Sapir and Lutz (1981) asserted that the principle of comparative advantage and the factor endowment model is consistent with the international trade in services. The structural and institutional factors of Revealed Comparative Advantage, across countries over period were identified for the identification of policy tools in a preference order. The model used in this study is consistent on theoretical underpinnings with a strand of relevant literature [Leontief (1953); Kenen (1965); Bhagwati (1967); Keesing (1967); Hufbauer (1970); Baldwin (1971); Branson and Junz (1971); Harkness and Kyle (1975); Balassa (1979); Stern and Maskus (1981); Sapir and Lutz (1981); Sveikaukas (1983); Leamer (1987); Debebedictis and Tamberi (2001); Clarks, Sawyer, and Sprinkle (2005); Karmakar (2007); Nyahoho (2010)]. The specification is as follows;

$$RX_{it} = \varphi_o + \varphi_1 En_{it} + \varphi_2 GDP_{it} + \varphi_3 \left(\frac{K}{L}\right)_{it} + \varphi_4 LI_{it} + \varphi_5 LPR_{it} + \varphi_6 Pop_{it} + \varphi_7 Sg_{it} + \varphi_8 Mg_{it} + \varphi_9 MR_{it} + \varepsilon_{it} \quad \dots \quad \dots \quad (14)$$

Here $\varphi_1, \varphi_2, \varphi_3, \varphi_4, \varphi_5, \varphi_6, \varphi_7, \varphi_8, \varphi_9 > 0$ and $\varphi_3, \varphi_4, \varphi_5 < 0$

where;

$RX_{it} = \textit{Revealed Comparative Advantage Index of Exports}$ of country i in period t
$En_{it} = \textit{Enrolment ratio in country i in period t}$
$GDP_{it} = \textit{Per capita income of country i in period t}$
$\left(\frac{K}{L}\right)_{it} = \textit{Capital Labour ratio of country i in period t}$
$LI_{it} = \textit{Logistic Indicator of country i in period t}$
$LPR_{it} = \textit{Labour particitpation rate in country i in period t}$
$POP_{it} = \textit{Population of country i in given period}$
$Sg_{it} = \textit{Trade in services as percentage of GDP in country i}$
$Mg_{it} = \textit{Goods trade as percentage of GDP of country i}$
$MR_{it} = \textit{Market Regulation Indicator}$

To assess the stable demand of tradable goods and services especially keeping in view the effect of depreciation of the real exchange rate trade balance, price elasticities of imports and exports are calculated and found in the literature. It is also found that a real depreciation generally lead to an improvement in the trade balance. This criterion is also known as the Marshall-Lerner condition. This condition requires the sum of the absolute values of import and export price elasticities must be greater than 1. This condition and the stability of the trade elasticities are useful tools for analysing the potential demand in the partner country and at the same time the potential effect of a change in the real exchange rate on an economy's trade balance. Keeping this in view, the intuition of empirical formulation consistent with the methodologies adopted by Hooper, Johnson, and Marquez (2000); Chinn (2005) Li–gang Lu (2007), is based on the imperfect substitute model in which movements in the logarithm of trade are explained in terms of movements in the logarithms of relative prices.[3] It is assumed here that there is no lag impact due to services contract etc.

[3]The most common formulation in this area is the log-linear one; see Goldstein and Khan (1985) and Marquez (2002).

The specification is as follows;

$$\ln x_{ijkt} = \alpha_o + \beta \ln REER_{it}^{T} + d + u \quad \ldots\ldots\ldots (15) \qquad u \sim IN(0, \sigma^2), \; B < 0$$

$$\ln m_{ijkt} = \alpha_o + \beta_1 \ln REER_{it}^{T} + d + u_1 \quad \ldots\ldots\ldots (16) \qquad u_1 \sim IN(0, \sigma^2), \; B_1 < 0$$

Here
Where

X_{ijkt} = exports of contry i of service of category k with country j in period t
α_o = constant term
β = Coefficient of Price elasticity for export demand (ε_{ij})
β_1 = Coefficient of Price elasticity for import demand (η_{ij})
$REER_{it}^{T}$ = Trade wieghted real effective exchange rate

The following specifications were used to estimate the price and income elasticities of import and export by category of service and by partner country to analyse the demand and supply potential and TOT situations. Theses specification were estimated based on the foresaid assumptions

$$\ln x_i = \alpha_o + \beta \ln p_i + d + u \quad \ldots\ldots\ldots (17) \qquad u \sim IN(0, \sigma^2), \; \beta < 0$$

$$\ln m_i = \alpha_o + \beta_1 \ln p_i + d + u_1 \quad \ldots\ldots\ldots (18) \qquad u_1 \sim IN(0, \sigma^2), \; \beta_1 < 0$$

$$\ln x_i = \alpha_o + \propto \ln I^* + d + u_3 \quad \ldots\ldots\ldots (19) \qquad u_3 \sim IN(0, \sigma^2), \; \propto > 0$$

$$\ln m_i = \alpha_o + \propto_1 \ln I + d + u_4 \quad \ldots\ldots\ldots (20) \qquad u_4 \sim IN(0, \sigma^2), \; \propto_1 > 0$$

Where

X_i = exports of ith trade service
α_o = constant term
$p_i = \frac{p^*}{e^*}$ = real export price in domestic value and
d = dummy variable
e^* = Real Exchange Rate
p^* = Foreign Price ($) = 1
β = Coefficient of Price elasticities for export demand
β_1 = Coefficient of Price elasticities for import demand
$\propto$ = Coefficient of Income elasticities for export demand
$\propto_1$ = Coefficient of Income elasticities for import demand
I^* = Foreign per capita income

4. DATA TYPE AND ESTIMATION TECHNIQUE

We used panel data on annual frequency for the variables (Real GDP, trade in services taken from World Bank online database) from 1981 to 2010 for 60 countries around the world including developed, developing and least developed economies (See detail in table in the annexure) to estimate the relative contribution of the trade in services to the overall GDP through specification 3.1 and 3.2. For specification 3.3, we used panel data on annual frequency of 26 trading partners of Pakistan and itself on the variables described above from 2006 and 2010 from world bank online database and estimated the specification 3.3 through Pooled Least Square technique with no cross-section and period fixed effects. For specification 3.4, the dependent variable has been described as the export of services of Pakistan to its 26 trading partners. These services include total services, transportation, communications, construction, travel, financial, insurance, computer and information, other business services, legal and license fees, personal and cultural, government services. We used the panel data on annual frequency from 2006 to 2010. The data was taken from UN Online database on trade in services. The data on common language variable is gathered with the methodology that if at least 20 percent of the total population of both countries can understand a common language then the dummy variable takes the value 1 otherwise 0. Dummy variable for common boarder takes the value of 1 if two countries have common boarder otherwise 0. The data on the variable of distance was measured as a straight distance between the capitals of two countries from the earth Google website. The specification was estimated through pooled least square method with cross-section fixed effect and in this way determined the value of γ_{ij} which was taken as dependent variable in specification 3.5 to estimate the potential of trade in services with a partner country relative to other partner countries. The specification 3.5 was estimated through OLS technique. In specification 3.5, the data on population and per capita income was taken from World Bank online database. The variable of 'days to start a new business' was used as proxy for market regulation as both variables have high negative correlation. If market regulation facilitates the market then it would result in decrease the days to start a new business. The data on market openness indicator was gathered with the methodology;

$$MO_{ij} = \frac{\sum_{j=1}^{J} GDP_j}{Dist_{ij}}$$

$Where\ j\ is\ the\ trading\ partner\ of\ country\ i$

From specification 6 to 13, data on all above said categories of services from 2005 to 2010 was taken from UN online database on trade in services. The data on world exports and imports were calculated by adding the total imports and exports of the sample of 26 partners of Pakistan including itself. In specification 14, the dependent variable i.e. RCAX was calculated from specification 12. The data on explanatory variables from 2006 to 2010 in specification 14 was taken from World Bank online website. In specifications 15 and 16, the data on trade weighted real effective exchange rate (REER) was taken on quarterly frequency from State Bank of Pakistan (SBP) online dataset. The data on (quarterly frequency) Imports and exports by category of service with the partner countries was calculated from datasets on trade in services by category and direction of trade given in SBP website and On-line

UN trade in services dataset. Specifications 17 to 20 were estimated using data on annual frequency from 2000 to 2011. The data was taken from UN online trade database and SBP online database.

5. RESULTS AND DISCUSSION

First, we analysed the relative contribution of trade in services to overall GDP across 60 countries combining into nine groups. Results are shown in Table 5.1. In the table, the positive figures show the increase in the contribution of services sector (in percentage) to overall GDP in comparison with other sectors' contribution in the same period, while the negative figures explain a decrease in the contribution of services sector to overall GDP in comparison with other sectors' contribution in the same period. In 1981-85, the relative contribution remained positive in all regional blocks except NAFTA and Mercosur, while it remained extra ordinarily highest in the SAARC and Pakistan also performed well in services sector. From 1986-90, the relative contribution remained negative in all regional blocks except in Mercosur. Though, it remained negative, but Pakistan again performed very well in this services sector with 7.06 percent relative contribution. From 1990-2005, the contribution remained negative in most of the regional/trading blocks. While, in the period, 2006-10 the contribution remained very high and positive in all regional/trading blocks. It confirms the importance of trade in services sector in new growth models/strategies for growth and development. It is also shown that during period, 1981-2010, the developing countries in comparison with developed countries performed well in trade in services. An important result can also be drawn from the table if analysed the contribution pattern in EU, NAFTA and SAARC at once. Since the NAFTA and EU are the major trading partners of SAARC countries and demand for service in trade is mostly the derived demand of merchandise trade. It is therefore, explicit that during the periods: 1986-90 and 1991-95, when the contribution was negative in both EU and NAFT, the contribution in SAARC countries was also negative and vice versa. Similarly, when the contribution was negative in one of the regional blocks (EU, NAFTA), the contribution sign in SAARC was determined by the relative impact of both the major trading partners (EU, NAFTA). It gives policy guidelines to the SAARC member countries to decrease the dependence on EU and NAFTA markets and look for other world markets to spread the base of major trading partners. In this regard, SAARC Free Trade Agreement on Trade in Services can increase the regional trade in services and decrease the huge dependence on EU, NAFTA markets. From Table 5.2, the growth of trade in services during the period 1980-2010 remained higher than the overall GDP growth and the growth of exports of services, on average, remained close to growth of imports during the period 1980-81 and remained very high during 2005-11. Keeping in view the consistent trend of almost positive contribution of trade in services in Pakistan during 1981-2010, and higher growth of exports of services than imports , the areas of trade in services should be focused in new growth strategy through institutional and structural development of Pakistan economy and society.

Table 5.1

Relative Contribution of Trade in Services to Overall GDP

Year	CEN SAD-10	TPSEPA	Mercosur	NAFTA	EU-15	EAEC	SAARC	PAKISTAN	APEC
1981-85	1.668	1.125	–0.35	–0.22	0.17	–	7.468	6	0.29
1986-90	–0.912	–0.195	0.095	–0.05	–0.32	–	–0.188	7.06	–0.17
1991-95	0.16	0.01	–0.125	–0.17	–2.12	–	–1.36	–0.02	–0.54
1996-00	1.668	–2.455	–0.085	0.06	–1.60	–0.944	0.608	0.68	–0.30
2001-05	–0.268	–0.26	–0.16	0.07	–1.06	–0.96	–0.568	–0.84	–0.15
2006-10	2.764	6.66	1.84	1.35	7.35	3.252	5.292	1.88	3.64

Table 5.2

Growth of Exports, Imports and Total Trade in Services of Pakistan

Year	Growth of Exports	Growth of Imports	Growth of Total Trade in Services
1980-1985	5.17	5.16	5.11
1986-1990	11.25	12.52	11.82
1990-1995	9.23	6.51	7.44
1996-2000	–6.47	–2.26	–4.23
2001-2005	21.09	27.72	23.95
2005-2011	9.42	3.89	5.28

The specification 3.3 was estimated and results are shown in Table 5.3 in the annexure. In this analysis we estimated the impact of trade in services and trade in merchandise on growth of per capita income separately. The results show that all explanatory variables are statistically significant in explaining the variation in per capita income. The results show that 1 percent increase in gross domestic investment will increase the per capita income by 0.28 percent. 1 percent increase in Trade in services (% of GDP) will increase per capita income by 0.008 percent. 1 percent increase in trade in merchandise (% of GDP) will increase per capita income by 0.002 percent. This result shows that the contribution of trade in services to the growth of per capita income is higher than that of trade in merchandise. Another important result is drawn from the table that 1 day decease in the "days to start a new business" will increase the per capita income by 0.04 percent.

Table 5.3

Method: Pooled Least Square Dependent Variable = Log (per Capita GDP)

Explanatory Variable	Coefficient	Std. Error	t-Statistic	Prob.
Constant	2.902121	0.272118	10.66495	0.000
LOG(Gross Domestic Investment)	0.286588	0.010095	28.38792	0.000
Trade in Services (% of GDP)	0.008082	0.00144	5.612526	0.000
Trade in Merchandise (% of GDP)	0.002157	0.00032	6.744159	0.000
No. of Days to Start a New Business	–0.046402	0.001026	45.21641	0.000
No. Observations	175	Akaike info criterion		1.835906
R-square	0.681388	Schwarz criterion		1.847671
S.E. of Regression	0.605321			

Specification 3.4 and 3.5 to determine the relative trade (export) potential for each category of export of service with the partner countries of Pakistan were estimated through two stages least square method. Figure 5.1 explains the trade (export) potential in transport services with the partner countries. It is shown from the figure that there is still untapped potential of export of transport services with 18 out 25 trading partners of Pakistan. These are USA, Maldevies, Saudi Arabia, Malaysia, Hongkong, Thailand, France, Denmark, Netherland, Italy, Bahrain, China, Iran, India, Nepal, Bhutan, Japan, and Switzerland. Figure 5.2 explains the trade (export) potential in travel services with the partner countries. It is shown from the figure that there is still untapped potential of export of travel services with 19 out 25 trading partners of Pakistan. These are USA, Maldevies, Saudi Arabia, Malaysia, Hongkong, Thailand, France, Denmark, Netherland, Italy, Bahrain, China, Iran, India, Nepal, Bhutan, Japan, Switzerland and UK. Figure 5.3 explains the trade (export) potential in communication services with the partner countries. It is shown from the figure that there is still untapped potential of export of communication services with 17 out 25 trading partners of Pakistan. These are USA, Bangladesh, Saudi Arabia, Germany, Hongkong, Thailand, Hongkong, Singapore, Italy, Belgium, Iran, Srilanka, Nepal, Maldives, UAE, Japan and Switzerland. Figure 5.4 explains the trade (export) potential in construction services with the partner countries. It is shown from the figure that there is still untapped potential of export of construction services with 9 out 25 trading partners of Pakistan. These are USA, Maldevies, Bangladesh, Malaysia, India, Nepal, Bhutan, UK, and Switzerland. Figure 5.5 explains the trade (export) potential in insurance services with the partner countries. It is shown from the figure that there is still untapped potential of export of insurance services with 9 out 25 trading partners of Pakistan. These are USA, Maldevies, Bangladesh, Malaysia, Denmark, Thailand, France, India, and Nepal. Figure 5.6 explains the trade (export) potential in financial services with the partner countries. It is shown from the figure that there is still untapped potential of export of financial services with 15 out 25 trading partners of Pakistan. These are USA, Bangladesh, Japan, Malaysia, Thailand, France, Hongkong, India, Netherland, Italy, Belgium, China, Srilanka, Nepal and Bhutan. Figure 5.7 explains the trade (export) potential in Computer and Information services with the partner countries. It is shown from the figure that there is still untapped potential of export of Computer & Information services with 8 out 25 trading partners of Pakistan. These are USA, Bangladesh, Saudi Arabia, Japan, Netherland, Italy, UK and Malaysia. Fig 5.8 explains the trade (export) potential in Royalties and License fee services with the partner countries. It is shown from the figure that there is still untapped potential of export of Royalties and License Fee services with 13 out 25 trading partners of Pakistan. These are USA, UK, Bangladesh, Malaysia, Hongkong, Iran, Thailand, France, Denmark, Netherland, UAE, Nepal, and Bhutan.

Fig. 5.1. Transport Services

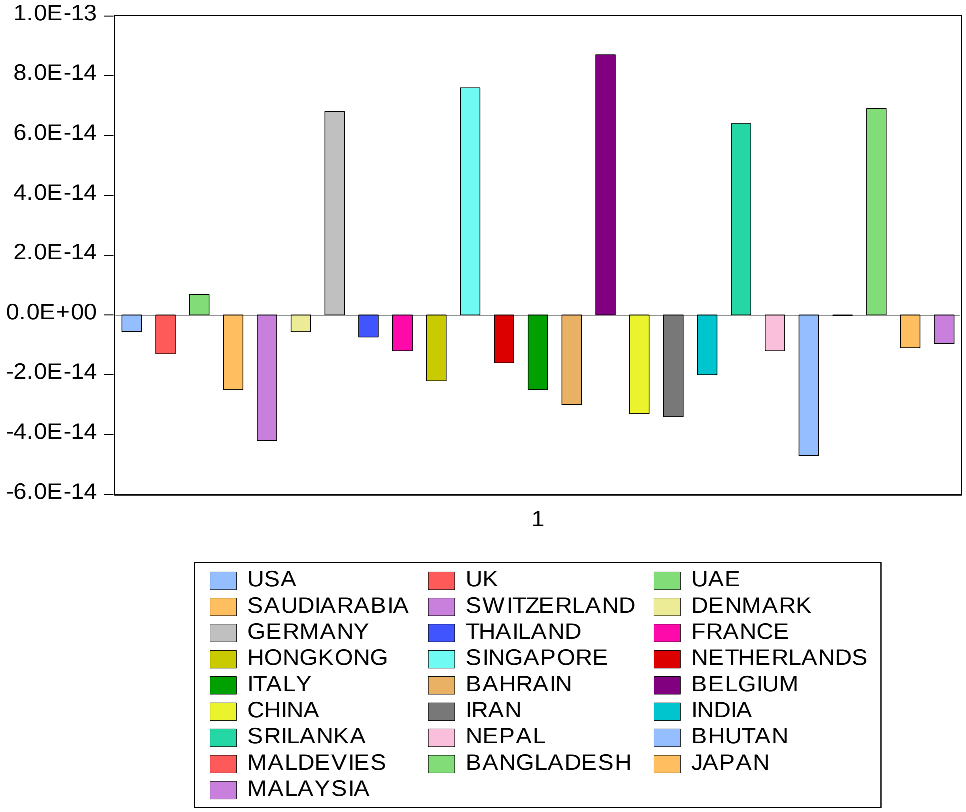


Fig. 5.2. Travel Services

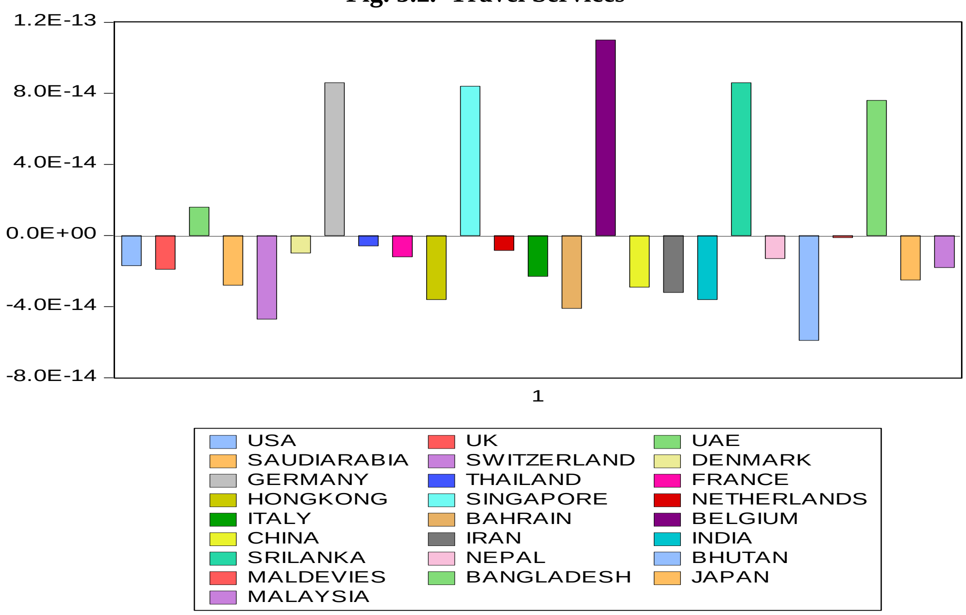


Fig. 5.3. Communication Services

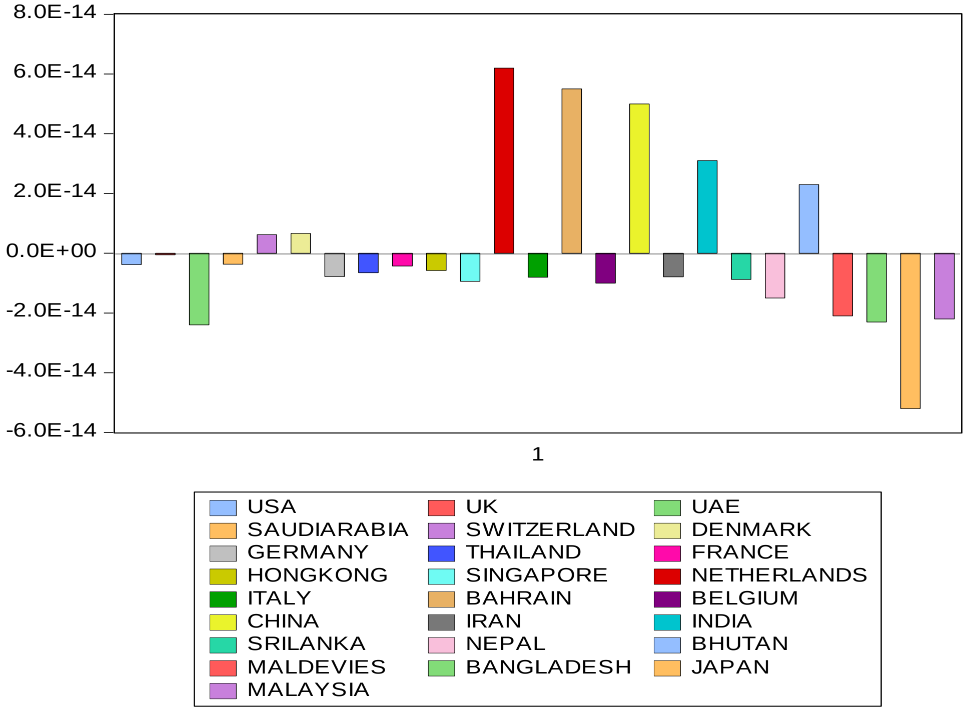


Fig. 5.4. Construction Services

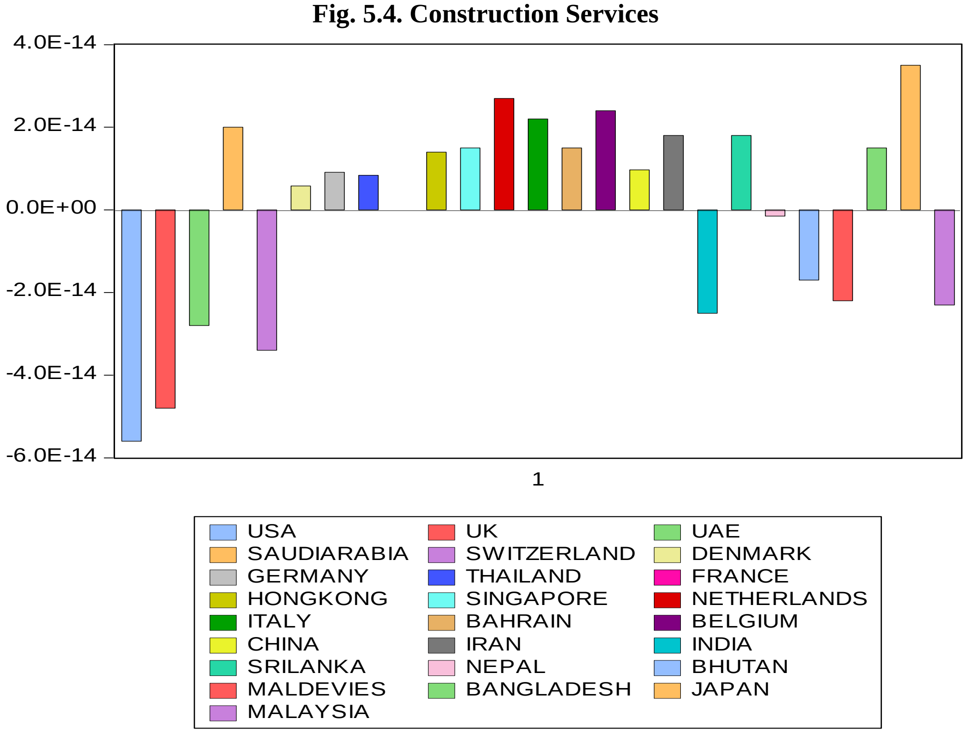


Fig. 5.5. Insurance

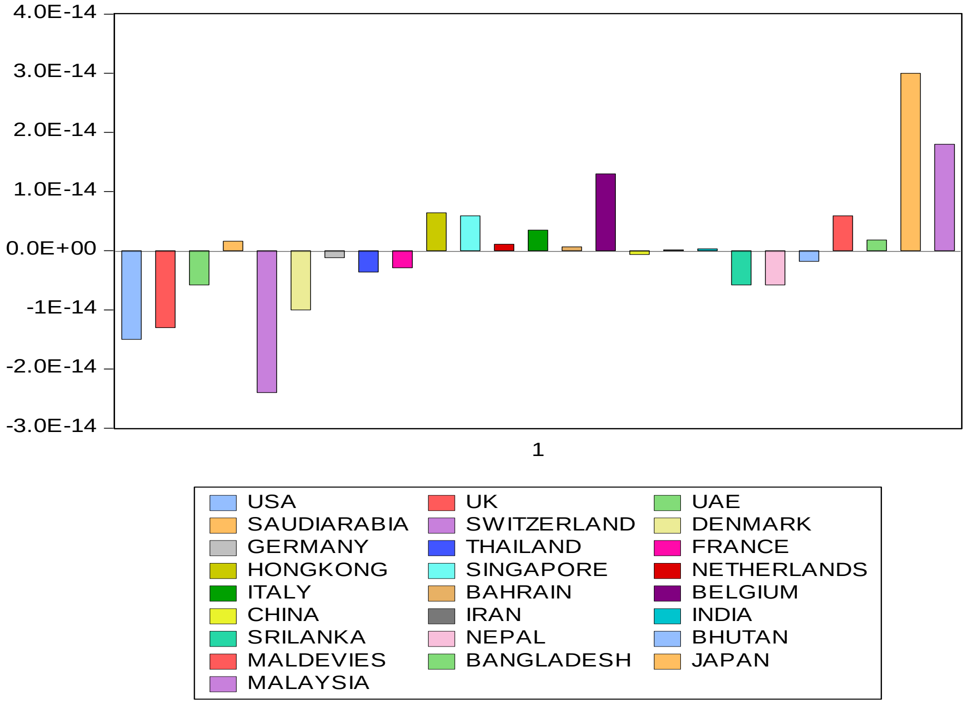


Fig. 5.6. Financial Services

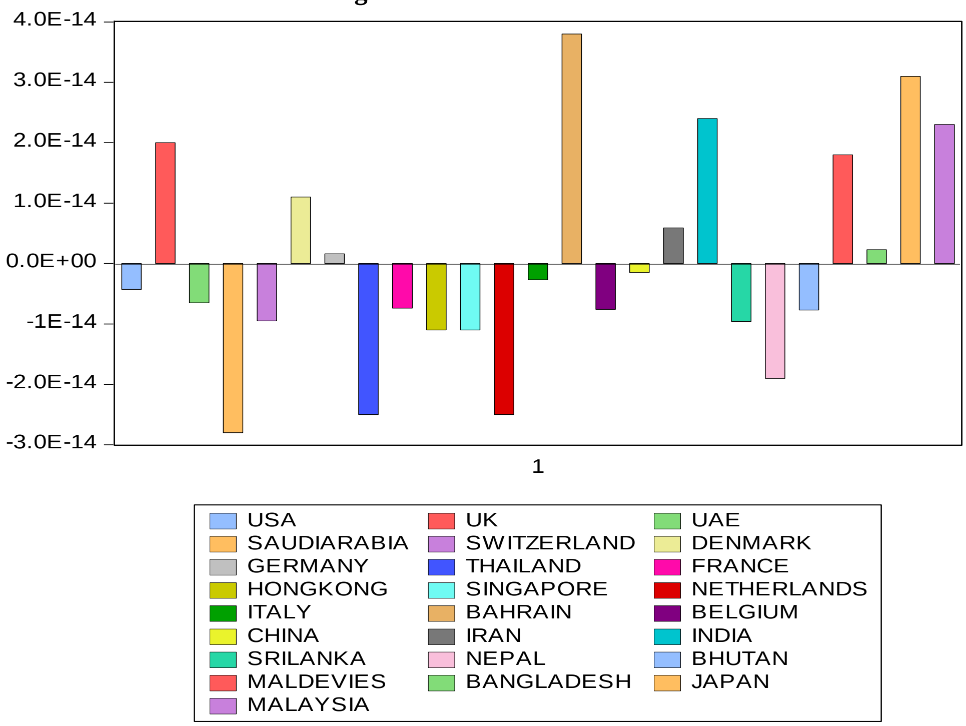


Fig. 5.7. Computer and Information Services

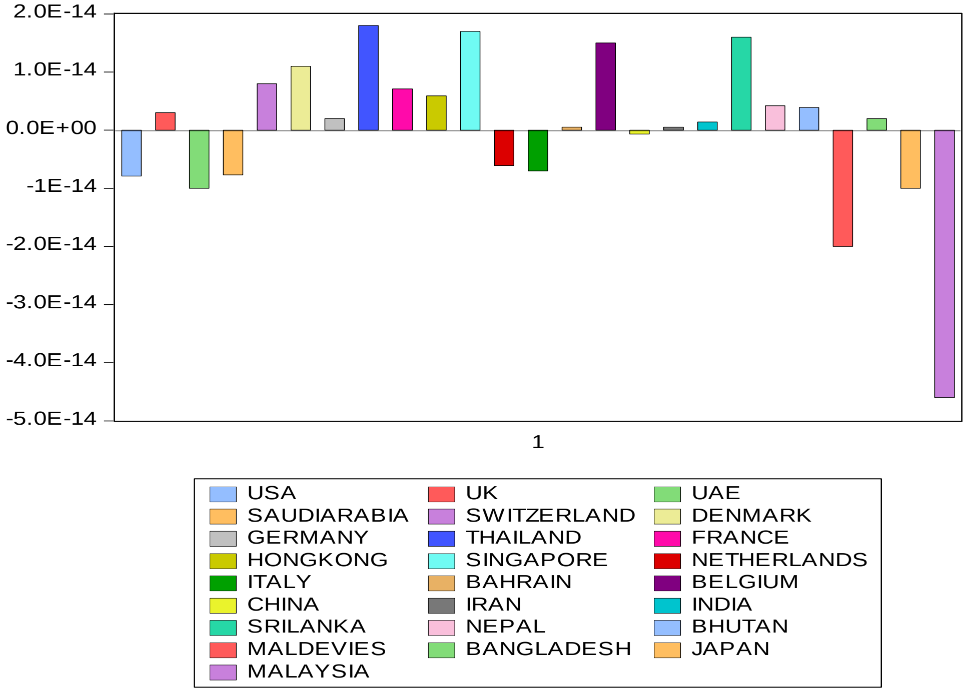


Fig. 5.8. Royalties and License Fee

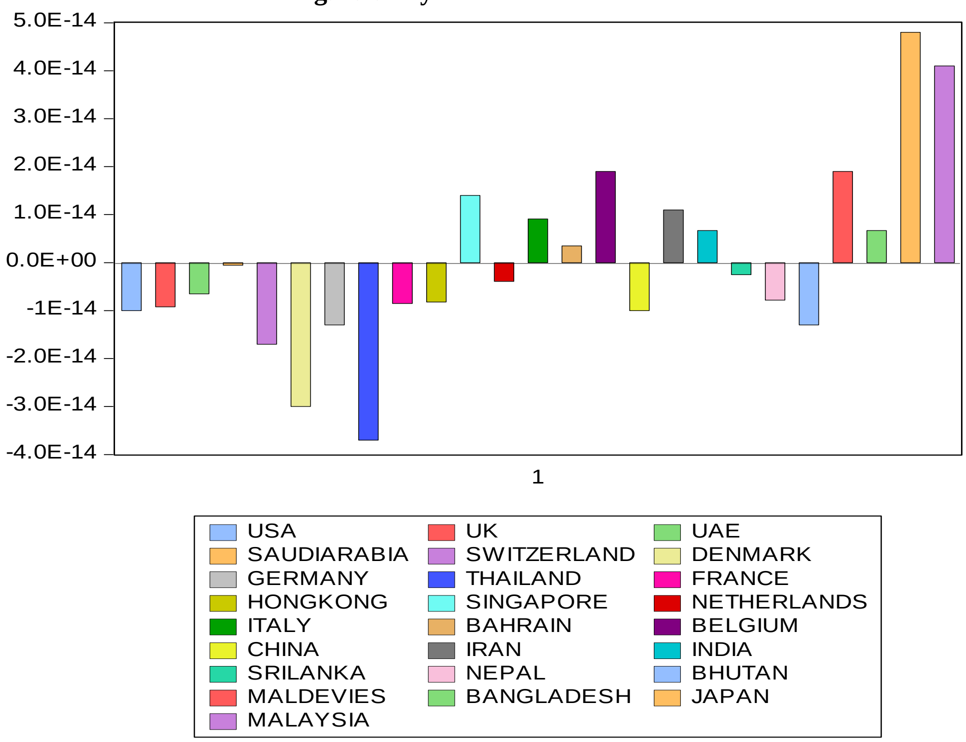


Figure 5.9 explains the trade (export) potential in Other Business services with the partner countries. It is shown from the figure that there is still untapped potential of export of Other Business services with 12 out 25 trading partners of Pakistan. These are Saudi Arabia, Malaysia, Thailand, France, India, Netherland, Italy, Belgium, Singapore, Nepal, Bhutan and Switzerland. Figure 5.10 explains the trade (export) potential in Personal, Cultural and Recreational services with the partner countries. It is shown from the figure that there is still untapped potential of export of the services with 12 out 25 trading partners of Pakistan. These are Saudi Arabia, Switzerland, Denmark, Thailand, Hongkong, Singapore, Netherland, Bahrain, China, India, Nepal and Bhutan. Fig 5.11 explains the trade (export) potential in Governmental services with the partner countries. It is shown from the figure that there is still untapped potential of export of the services with 9 out 25 trading partners of Pakistan. These are Hongkong, Netherland, Italy, Japan, Belgium, China, Iran, India, Srilanka and Bhutan. Fig 5.12 explains the trade (export) potential in each category of service from among eleven categories of services given the 25 trading partners. It is shown from the figure that there is still untapped potential of export in five areas / categories of services out of eleven areas of services. These are Travel, Insurance, Financial, Other business services, governmental services.

Fig. 5.9. Other Business Services

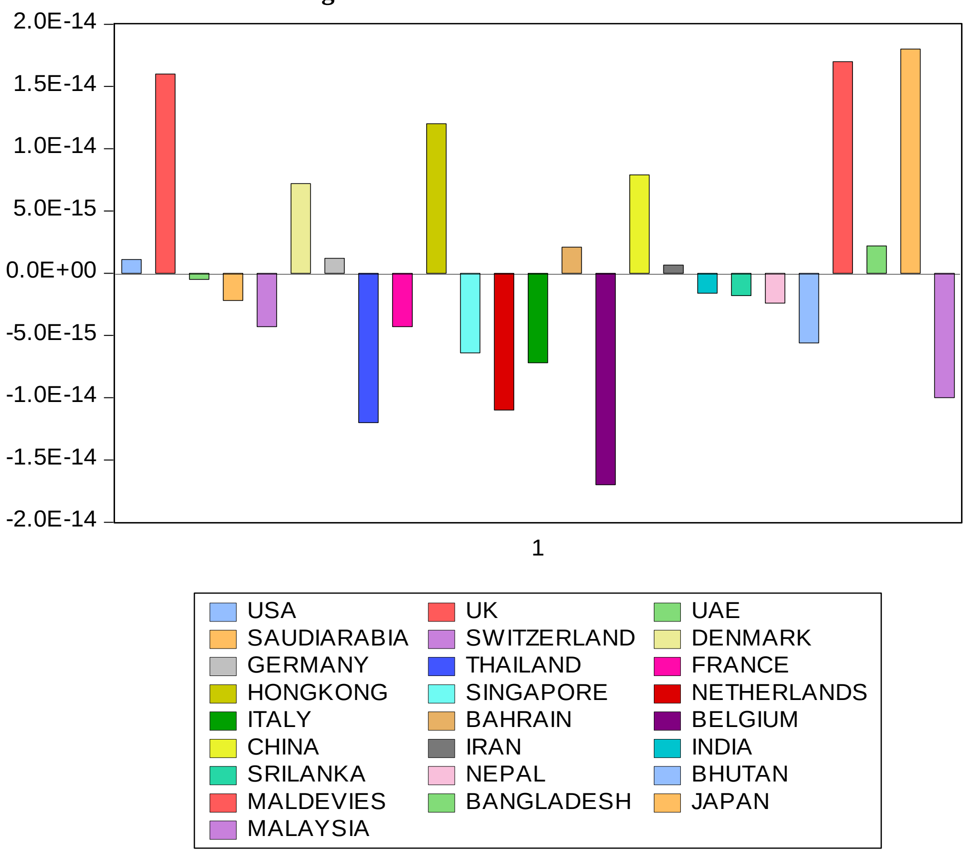


Fig. 5.10. Personal, Cultural and Recreational Services

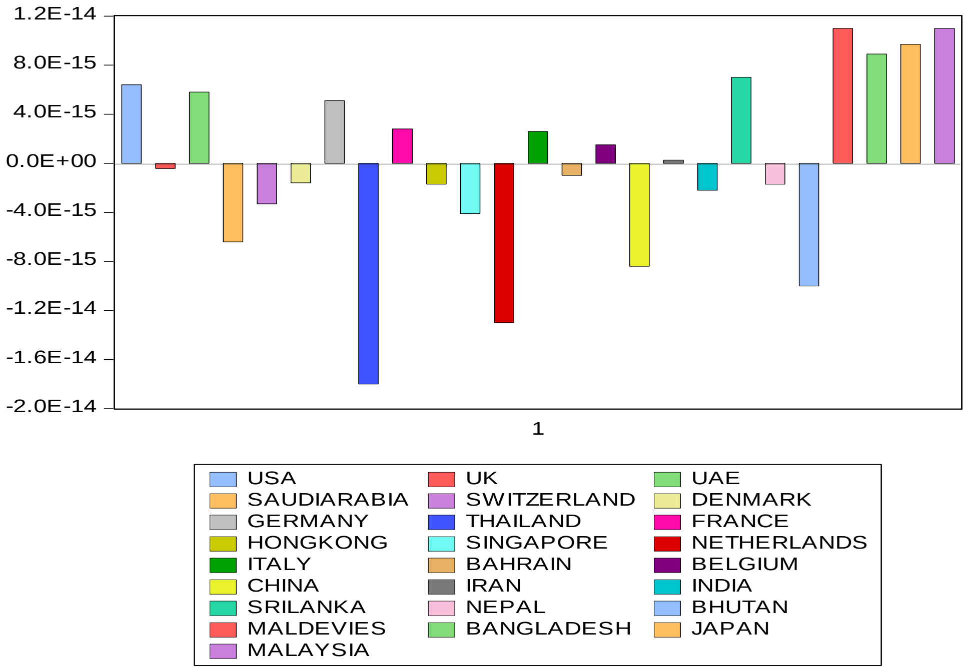


Fig. 5.11. Government Services

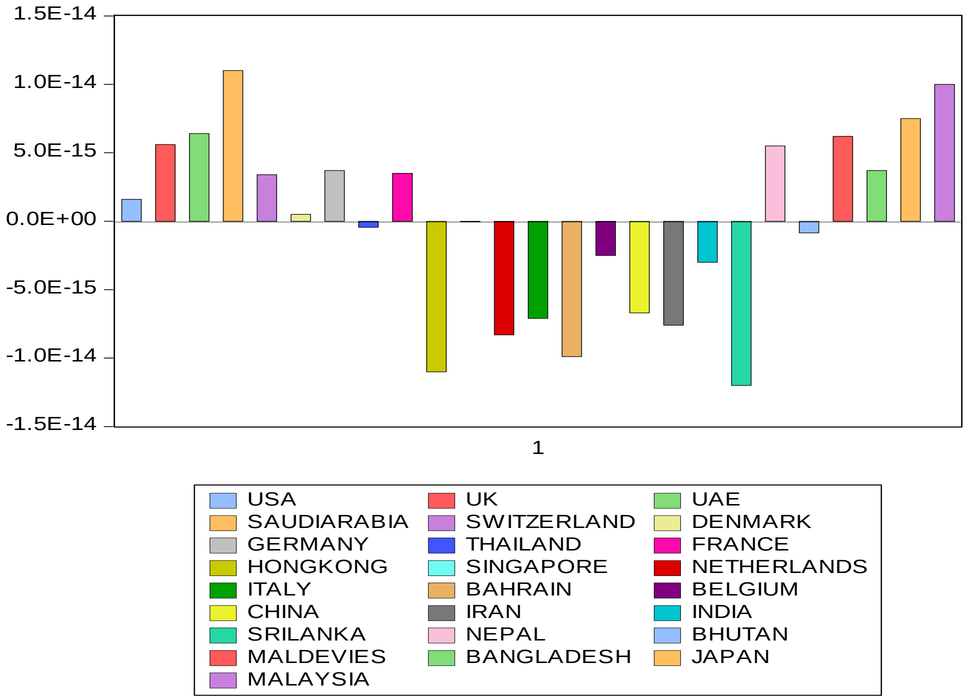
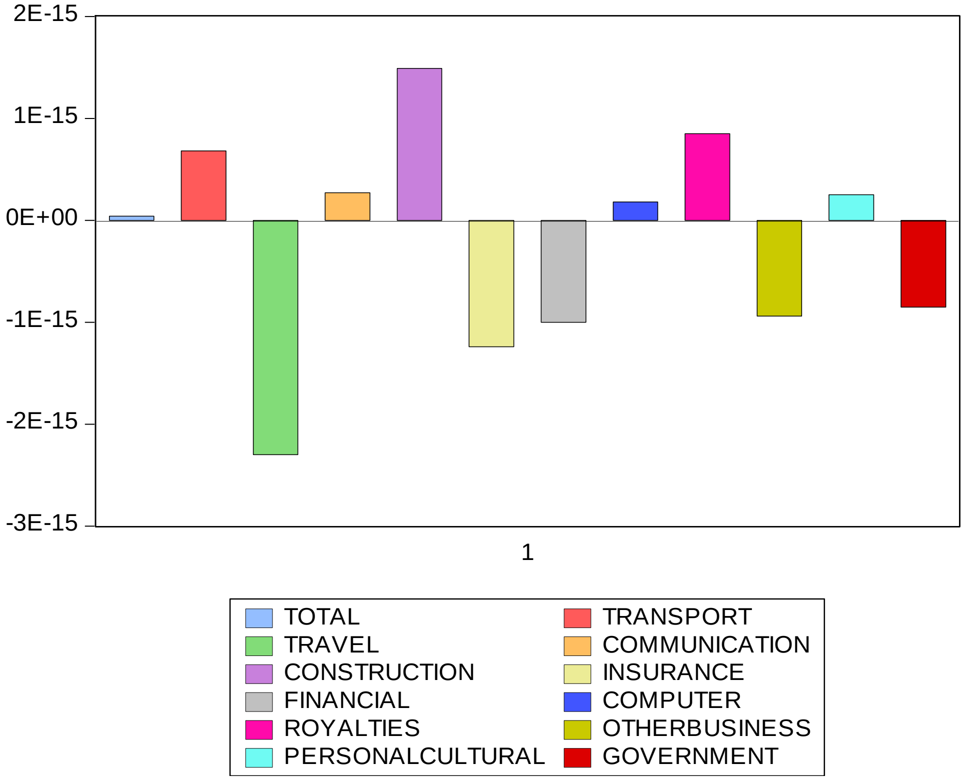


Fig. 5.12. Untapped Potential Across Service Groups



Specifications 3.6 and 3.7 were estimated to find out the bilateral trade intensity indices of export and import. The results were reported in Tables 5.4 and 5.5 in the annexure. In total services, the value of trade intensity index of export is greater than 1 with USA, UK, UAE, Saudi Arabia and Bahrain. In transport services, these countries are UK, UAE, Saudi Arabia and Bahrain. An interesting note here is that in both the foresaid categories of services, the countries except USA are the same and these countries are the first major trading partners of Pakistan in trade in services. It is therefore, shows the consistency of the results. In travel services, the value of trade intensity index of export is greater than 1 with USA and Bangladesh only. In Communication services, the countries are USA and Bahrain. In construction services, the countries are USA, UK, Singapore and Italy. In insurance services, the countries are UK, Switzerland, Germany, Hongkong, Singapore, Bahrain, India, Bangladesh and Malaysia. In financial services, the countries are USA, China and Bangladesh. In computer and information services, the countries are USA, UK and Bangladesh. In royalties and license fee, the countries are USA and Belgium. In other business services, the countries are USA, Saudi Arabia, Switzerland, Bahrain, Srilanka, Bhutan, Maldevies and Bangladesh. In personal and cultural services the countries are USA, UK, Switzerland, Hongkong, Singapore, China and India. In government services, the countries are USA, UK and Switzerland.

Table 5.4

Bilateral Trade Intensity Index of Export of Pakistan with Following Countries

	Total 1	Tran. 2	Trav. 3	Com. 4	Const. 5	Insr. 6	Fin. 7	Com., Infor. 8	Roy., Lice. Fee 9	Other Busi. 10	Pers., Cult. 11	Govt. Serv. 12
USA	**2.09**	0.95	**5.06**	**4.53**	**7.69**	0.45	**1.75**	**2.15**	**3.69**	**2.24**	**4.92**	**1.10**
UK	**1.07**	**2.15**	0.15	0.64	**1.14**	**8.84**	0.46	**1.27**	0.29	0.78	**1.79**	**1.57**
UAE	**3.73**	**15.07**	0.31	–	–	–	–	–	–	–	–	0.54
Saudiarabia	**1.55**	**8.50**	0.44	0.64	0.62	0.47	0.13	–	–	**25.68**	–	0.02
Switzerland	0.47	0.79	0.09	0.34	–	**5.31**	0.37	–	0.07	**10.22**	**7.01**	**1.43**
Denmark	0.81	**3.39**	–	0.00	–	0.38	0.19	0.27	0.06	0.11	–	0.05
Germany	0.22	0.38	0.02	0.23	0.13	**3.19**	0.41	0.04	**2.22**	0.68	0.40	0.18
Thailand	0.31	0.49	0.07	0.26	0.00	0.05	–	–	0.00	–	–	0.05
France	0.37	0.85	0.04	0.24	0.07	0.21	0.08	0.33	0.19	0.15	0.02	0.05
Hongkong	0.25	0.39	0.02	0.11	0.00	**2.13**	0.19	0.56	0.39	0.83	**5.85**	0.32
Singapore	0.49	0.83	0.16	0.15	**2.76**	**3.42**	0.10	0.59	0.08	0.83	**3.08**	0.05
Netherlands	0.30	0.94	0.04	0.03	0.10	0.82	0.12	0.19	0.01	0.24	–	0.67
Italy	0.040	0.02	–	0.00	**6.39**	0.06	0.01	0.05	0.03	0.15	….	0.11
Bahrain	**6.96**	**9.31**	0.14	**3.39**	–	**29.65**	–	–	–	**14.90**	–	–
Belgium	0.19	0.09	0.11	0.06	–	0.00	0.11	0.04	**126.45**	0.14	–	0.29
China	0.22	0.72	–	0.31	0.09	0.02	**4.15**	0.77	0.01	0.31	**4.79**	0.01
Iran	0.048	0.04	–	0.06	–	–	0.81	0.20	–	0.09	–	0.07
India	0.06	0.01	0.06	0.05	0.01	**1.45**	0.09	0.01	0.50	0.25	**1.09**	0.14
Afghanistan	–	–	–	–	–	–	–	–	–	–	–	–
Srilanka	0.52	0.41	0.41	0.34	–	–	–	–	–	**1.21**	–	0.98
Nepal	0.23	0.17	0.13	–	–	–	–	–	–	0.05	–	–
Bhutan	0.007	–	–	–	–	–	–	–	–	**1.04**	–	–
Maldevies	0.15	0.02	0.03	–	–	–	–	–	–	**1.04**	–	0.43
Bangladesh	0.44	0.23	**1.09**	0.24	–	**9.48**	**2.00**	**2.51**	–	**3.06**	–	0.20
Japan	0.10	0.11	0.01	0.12	0.09	0.09	0.05	0.36	0.53	0.36	0.46	0.00
Malaysia	0.26	0.20	0.03	0.52	0.11	**7.40**	0.05	0.09	–	0.64	0.78	0.99

Table 5.5

Bilateral Trade Intensity Index of Import of Pakistan with the Following Countries

	Total 1	Tran. 2	Trav. 3	Com. 4	Const. 5	Insur. 6	Finan. 7	Comp., Inform. 8	Roy., Lice. Fee 9	Other Busi. 10	Pers. Cult. 11	Govt. Serv. 12
USA	0.60	0.47	0.43	0.47	**1.80**	0.37	**1.53**	**1.35**	0.25	**1.62**	0.33	0.83
UK	0.61	0.57	0.83	0.89	**3.45**	**1.69**	0.29	**1.36**	**3.02**	0.83	**5.03**	0.54
UAE	**22.49**	**39.74**	**1.07**	–	–	–	–	–	–	–	–	0.38
Saudi Arabia	**11.97**	**28.44**	**2.09**	**1.31**	–	**1.33**	–	–	–	**36.85**	–	**7.78**
Switzerland	0.48	**1.54**	0.05	0.16	–	0.17	0.10	–	0.91	0.36	**73.05**	0.11
Denmark	0.11	0.06	0.01	0.22	0.00	0.00	**5.15**	0.02	0.01	0.22	–	0.08
Germany	0.26	0.31	0.14	0.07	**4.06**	0.43	**1.03**	0.14	0.71	0.20	0.17	0.16
Thailand	0.94	**1.69**	0.06	0.80	0.00	0.06	–	–	0.86	–	–	0.13
France	0.23	0.28	0.21	0.44	0.15	0.27	0.51	0.55	0.65	0.13	0.18	0.26
Hongkong	0.52	**1.13**	0.14	**2.06**	0.73	0.52	0.25	**2.52**	**4.52**	0.86	**2.66**	**1.40**
Singapore	**14.65**	0.70	0.11	**2.20**	0.06	**2.24**	0.40	**11.09**	**3.11**	0.37	**15.44**	0.08
Netherlands	0.24	0.29	0.09	0.10	0.00	**1.05**	0.73	0.35	0.23	0.25	–	0.04
Italy	0.21	0.34	0.02	0.22	**4.07**	0.00	0.20	0.38	0.07	0.41	–	0.25
Bahrain	**5.91**	**9.24**	**1.28**	**8.65**	–	**3.12**	–	–	–	**10.93**	–	–
Belgium	0.18	0.19	0.01	0.63	–	0.03	0.65	0.14	0.09	0.15	……	0.11
China	**1.53**	**1.16**	0.12	0.26	**3.19**	0.57	**76.77**	0.20	0.65	**2.44**	**3.44**	**3.07**
Iran	**2.24**	**1.84**	0.01	0.00	–	–	**3.00**	0.00	–	0.16	–	0.94
India	0.29	**1.10**	0.02	0.03	–	0.01	0.16	0.01	**2.11**	0.15	0.38	0.45
Afghanistan												
Srilanka	**2.22**	**1.34**	0.19	0.70	–	–	–	**1.15**	–	**3.16**	–	**4.70**
Nepal	0.45	0.38	0.03	–	–	–	–	–	–	**1.50**	–	–
Bhutan	0.26	0.17	–	–	–	–	–	–	–	–	–	–
Maldevies	0.21	0.04	0.00	–	–	–	–	–	–	–	–	**4.12**
Bangladesh	**1.37**	**6.48**	0.76	–	–	**1.70**	**16.34**	0.80	–	0.93	–	0.20
Japan	0.45	0.40	0.26	0.14	0.07	0.49	0.17	0.41	**2.46**	0.40	**2.38**	0.45
Malaysia	**1.25**	**2.20**	0.06	**3.38**	0.18	**6.24**	**3.02**	**5.60**	**5.40**	**1.02**	0.96	0.20

In total services, the value of trade intensity index of import is greater than 1 with UAE, Saudi Arabia, Singapore, Bahrain, China, Iran, Srilanka, Bangladesh and Malaysia. In transport services, these countries are UAE, Saudi Arabia, Switzerland, Thailand, Hongkong, Bahrain, China, Iran, Srilanka and Bangladesh. In travel services, the value of trade intensity index of export is greater than 1 with UAE, Saudi Arabia and Bahrain only. In Communication services, the countries are Saudi Arabia, Hongkong, Bahrain and Malaysia. In construction services, the countries are USA, UK, Germany, Italy and China. In insurance services, the countries are UK, Saudi Arabia, Netherland, Singapore, Bahrain, Bangladesh and Malaysia. In financial services, the countries are USA, Denmark, Germany, China, Iran, Bangladesh and Malaysia. In computer and information services, the countries are USA, UK, Hongkong, Singapore, Srilanka and Malaysia. In royalties and license fee, the countries are UK, Hongkong, Singapore, India, Japan and Malaysia. In other business services, the countries are USA, Saudi Arabia, Bahrain, China, Srilanka, Nepal and Malaysia. In personal and cultural services the countries are UK, Switzerland, Hongkong, Singapore, China and Japan. In government services, the countries are Saudi Arabia, Hongkong, China and Maldevies. An important fact comes out here that the value of TII of export and import is greater than 1 in about 75 percent the same countries.

Specifications 3.8 to 3.11 were estimated to calculate the Complementarity and Country bias indices of export and import to further decompose the TII and find out which factor is dominant and major contributor in TII. The results are shown in Tables 5.6, 5.7, 5.8 and 5.9. It is shown from the results that Country bias index in both export and import of services in almost each category dominates. It explains that fact that Pakistan' trade (both export and import) with its trading partners is based on favourable access between them.

Table 5.6

Complementarity Index by Category of Export of Service/Trading Partner, Neighbouring Country, SAARC Member Country

	Trans.	Trav.	Comm.	Const.	Insur.	Finan.	Comp. & Inform.	Royalt. & Lice. Fee	Other Busi.Serv	Pers. & Cult.	Govt. Serv.
	1	2	3	4	5	6	7	8	9	10	11
USA	0.251	0.062	0.036	0.009	0.009	0.016	0.030	0.008	0.107	0.000	0.326
UK	0.220	0.054	0.031	0.008	0.008	0.014	0.027	0.007	0.094	0.000	0.287
UAE	0.158	0.039	–	–	–	–	–	–	–	–	0.203
Saudi Arabia	0.174	0.043	0.025	0.006	0.007	0.011	–	–	0.074	–	0.230
Switzerland	0.115	0.028	0.016	–	0.004	0.007	–	0.004	0.049	0.000	0.149
Denmark	0.468	–	0.068	–	0.017	0.030	0.059	0.014	0.198	–	0.610
Germany	0.256	0.063	0.037	0.009	0.010	0.016	0.032	0.008	0.109	0.000	0.335
Thailand	0.535	0.129	0.149	–	0.019	–	–	0.013	–	–	0.675
France	0.366	0.090	0.056	0.012	0.013	0.024	0.046	0.011	0.155	0.001	0.474
Hong Kong	0.408	0.097	0.133	–	0.014	0.038	0.056	0.009	0.174	0.001	0.508
Singapore	0.387	0.093	0.106	0.011	0.013	0.032	0.051	0.009	0.165	0.001	0.489
Netherlands	0.211	0.051	0.053	0.006	0.007	0.017	0.027	0.005	0.090	–	0.268
Italy	0.244	–	0.070	0.007	0.008	0.021	0.032	0.006	0.104	–	0.306
Bahrain	0.476	0.114	0.134	–	0.017	–	–	–	0.202	–	–
Belgium	0.963	0.231	0.285	–	0.033	0.084	0.130	0.022	0.410	–	1.210
China	0.356	–	0.098	0.010	0.012	0.030	0.047	0.009	0.152	0.001	0.449
Iran	0.275	–	0.080	–	–	0.024	0.037	–	0.117	–	0.346
India	0.236	0.057	0.062	0.007	0.008	0.019	0.031	0.006	0.100	0.000	0.299
Afghanistan	–	–	–	–	–	–	–	–	–	–	–
Sri Lanka	0.658	0.159	0.163	–	0.023	–	–	–	0.280	–	0.838
Nepal	0.368	0.090	–	–	0.013	–	–	–	0.157	–	–
Bhutan	–	–	–	–	0.000	–	–	–	0.001	–	–
Maldives	0.575	0.138	–	–	0.020	–	–	–	0.245	–	0.726
Bangladesh	0.886	0.212	0.268	–	0.031	0.079	0.121	–	0.377	–	1.115
Japan	0.335	0.081	0.088	0.010	0.012	0.027	0.044	0.008	0.142	0.001	0.424
Malaysia	0.429	0.103	0.125	0.012	0.015	0.037	0.057	–	0.183	0.001	0.538

Table 5.7

Complementarity Index by Category of Import of Service

	Trans. 1	Trav. 2	Com. 3	Const. 4	Insur. 5	Finan. 6	Comp., Infor. 7	Royal., Lice. 8	Other Busi. 9	Pers., Cult. 10	Govt. Serv. 11
USA	0.273	0.087	0.014	0.005	0.012	0.010	0.011	0.008	0.163	0.007	0.053
UK	**1.209**	**1.359**	0.116	0.090	0.067	0.076	0.041	0.116	0.681	0.055	0.022
UAE	0.419	0.124	–	–	–	–	–	–	–	–	0.089
Saudi Arabia	0.377	0.114	0.019	–	0.017	–	–	–	0.213	–	0.074
Switzerland	0.167	0.053	0.008	–	0.008	0.006	–	0.005	0.099	0.004	0.033
Denmark	**1.256**	0.401	0.063	0.023	0.057	0.048	0.051	0.038	0.748	–	0.244
Germany	0.488	0.153	0.025	0.009	0.022	0.018	0.020	0.015	0.285	0.013	0.097
Thailand	0.449	0.138	0.024	0.009	0.021	–	–	0.013	–	–	0.093
France	0.667	0.182	0.039	0.014	0.033	0.023	0.031	0.020	0.339	0.026	0.156
Hongkong	0.178	0.047	0.010	0.003	0.008	0.006	0.008	0.005	0.087	0.006	0.040
Singapore	**13.285**	**4.295**	0.655	0.243	0.602	0.509	0.538	0.398	**8.012**	0.326	**2.542**
Netherlands	0.485	0.156	0.024	0.009	0.022	0.018	0.020	0.015	0.292	–	0.093
Italy	0.302	0.098	0.015	0.006	0.014	0.011	0.012	0.009	0.182	–	0.058
Bahrain	0.450	0.139	0.024	–	0.021	–	–	–	0.259	–	–
Belgium	0.572	0.184	0.028	–	0.026	0.022	0.023	0.017	0.343	–	0.109
China	0.499	0.155	0.026	0.009	0.023	0.019	0.021	0.015	0.289	0.015	0.103
Iran	**1.065**	0.325	0.056	–	–	0.039	0.045	–	0.606	–	0.220
India	0.251	0.073	0.014	–	0.012	0.009	0.011	0.007	0.136	0.008	0.054
Afghanistan	–	–	–	–	–	–	–	–	–	–	–
Srilanka	0.915	0.298	0.044	–	–	–	0.036	–	0.555	–	0.169
Nepal	0.152	0.046	–	–	–	–	–	–	0.085	–	–
Bhutan	0.533	–	–	–	–	–	–	–	–	–	–
Maldevies	0.111	0.033	–	–	–	–	–	–	–	–	0.023
Bangladesh	0.147	0.042	–	–	0.007	0.005	0.007	–	0.078	–	0.033
Japan	0.577	0.193	0.027	0.010	0.026	0.022	0.023	0.017	0.360	0.012	0.105
Malaysia	0.396	0.131	0.019	0.007	0.018	0.015	0.016	0.012	0.244	0.009	0.074

Table 5.8

Country Bias Index by Category of Export of Service/Trading Partner, Neighbouring Country, SAARC Member Country

	Transport	Travel	Comm.	Const.	Insur.	Finan.	Comp. & Inform.	Royalt. & Lice. Fee	Other Busi.Serv	Pers. & Cult.	Govt. Serv.
	1	2	3	4	5	6	7	8	9	10	11
USA	0.70	5.00	4.50	7.68	0.44	1.73	2.12	3.69	2.14	4.92	0.77
UK	1.93	0.10	0.61	1.13	8.83	0.44	1.24	0.28	0.68	1.79	1.28
UAE	14.92	0.27	–	–	–	–	–	–	–	–	0.34
Saudi Arabia	8.33	0.40	0.61	0.61	0.46	0.12	–	–	25.60	–	–0.21
Switzerland	0.67	0.07	0.32	–	5.30	0.36	–	0.06	10.17	7.01	1.28
Denmark	2.92	–	–0.07	–	0.36	0.16	0.21	0.05	–0.09	–	–0.56
Germany	0.13	–0.04	0.19	0.12	3.18	0.39	0.01	2.21	0.57	0.40	–0.15
Thailand	0.00	–0.05	0.11	–	0.03	–	–	–0.01	–	–	–0.62
France	0.48	–0.05	0.18	0.06	0.20	0.06	0.28	0.18	–0.01	0.02	–0.43
Hongkong	0.00	–0.08	–0.02	–	2.11	0.16	0.50	0.39	0.65	5.85	–0.18
Singapore	0.45	0.06	0.05	2.75	3.41	0.07	0.53	0.07	0.67	3.08	–0.44
Netherlands	0.73	–0.01	–0.02	0.09	0.81	0.10	0.16	0.00	0.15	–	0.41
Italy	–0.23	–	–0.07	6.38	0.05	–0.01	0.02	0.03	0.04	–	–0.19
Bahrain	8.83	0.03	3.25	–	29.64	–	–	–	14.70	–	–
Belgium	–0.87	–0.12	–0.23	–	–0.03	0.03	–0.09	126.43	–0.27	–	–0.92
China	0.37	–	0.21	0.08	0.01	4.12	0.72	0.00	0.16	4.79	–0.44
Iran	–0.23	–	–0.02	–	–	0.79	0.17	–	–0.03	–	–0.28
India	–0.22	0.00	–0.01	0.00	1.44	0.07	–0.02	0.49	0.15	1.09	–0.16
Afghanistan	–	–	–	–	–	–	–	–	–	–	–
Srilanka	–0.25	0.25	0.18	–	–	–	–	–	0.93	–	0.15
Nepal	–0.20	0.04	–	–	–	–	–	–	–0.11	–	–
Bhutan	–	–	–	–	–	–	–	–	1.04	–	–
Maldevies	–0.55	–0.11	–	–	–	–	–	–	0.80	–	–0.30
Bangladesh	–0.66	0.88	–0.03	–	9.45	1.93	2.39	–	2.68	–	–0.92
Japan	–0.22	–0.07	0.03	0.08	0.08	0.02	0.32	0.52	0.22	0.46	–0.42
Malysia	–0.23	–0.08	0.40	0.10	7.39	0.01	0.03	–	0.45	0.78	0.45

Table 5.9

Country Bias Index by Category of Import of Service

	Trans. 1	Trav. 2	Comm. 3	Const. 4	Insur. 5	Finan. 6	Comp. & Inform. 7	Royalt. & Lice. Fee 8	Other Busi.Serv 9	Pers. & Cult. 10	Govt. Serv. 11
USA	0.19	0.35	0.45	**1.79**	0.36	**1.52**	**1.34**	0.24	1.46	0.32	0.78
UK	–0.64	–0.53	0.77	**3.36**	**1.62**	0.21	**1.32**	**2.91**	0.15	4.98	0.51
UAE	**39.32**	0.94	–	–	–	–	–	–	–	–	0.29
Saudi Arabia	**28.06**	**1.98**	**1.29**	–	**1.31**	–	–	–	36.64	–	7.70
Switzerland	**1.38**	0.00	0.16	–	0.16	0.09	–	0.91	0.26	73.04	0.07
Denmark	–1.20	–0.39	0.16	–0.02	–0.06	**5.10**	–0.03	–0.03	–0.53	–	–0.16
Germany	–0.18	–0.01	0.05	**4.05**	0.41	**1.01**	0.12	0.69	–0.08	0.16	0.06
Thailand	**1.24**	–0.08	0.78	–0.01	0.04	–	–	0.85	–	–	0.04
France	–0.39	0.03	0.40	0.14	0.24	0.49	0.52	0.63	–0.21	0.16	0.10
Hongkong	0.95	0.09	**2.05**	0.73	0.51	0.24	**2.51**	**4.52**	0.77	2.65	1.36
Singapore	–2.58	–4.18	**1.54**	–0.19	**1.64**	–0.11	**10.56**	**2.71**	–7.65	15.11	–2.46
Netherlands	–0.20	–0.06	0.08	–0.01	**1.03**	0.71	0.33	0.22	–0.04	–	–0.06
Italy	0.04	–0.08	0.21	**4.06**	–0.01	0.19	0.37	0.06	0.23	–	0.19
Bahrain	**8.79**	**1.14**	**8.63**	–	**3.09**	–	–	–	10.67	–	–
Belgium	–0.39	–0.17	0.60	–	0.00	0.63	0.11	0.08	–0.19	–	0.00
China	0.66	–0.04	0.23	**3.18**	0.55	**76.75**	0.18	0.64	2.15	3.43	2.97
Iran	0.78	–0.32	–0.05	–	–	**2.96**	–0.05	–	–0.44	–	0.72
India	0.85	–0.05	0.01	–	–0.01	0.15	0.00	**2.11**	0.02	0.38	0.39
Afghanistan	–	–	–	–	–	–	–	–	–	–	–
Srilanka	0.43	–0.11	0.66	–	–	–	1.11	–	2.60	–	**4.53**
Nepal	0.23	–0.01	–	–	–	–	–	–	1.41	–	–
Bhutan	–0.36	–	–	–	–	–	–	–	–	–	–
Maldevies	–0.07	–0.03	–	–	–	–	–	–	–	–	**4.09**
Bangladesh	**6.33**	0.72	–	–	**1.69**	**16.33**	0.80	–	0.85	–	0.17
Japan	–0.17	0.07	0.11	0.05	0.46	0.15	0.39	**2.44**	0.04	**2.37**	0.35
Malysia	**1.81**	–0.07	**3.36**	0.17	**6.23**	**3.01**	5.58	**5.39**	0.78	0.96	0.12

In Specifications 3.12 and 3.13, the revealed comparative advantage indices (RCAIX and RCAIM) by category of service were estimated for Pakistan from 2006 to 2011. Pakistan has comparative advantage of export in transport, communication and government services, while it has comparative advantage of import in transport, communications, computer and Information, other business, personal, cultural and recreational and government services. An interesting note here is that in categories of services, Pakistan has RCAX; it also has RCAM in the same categories. This fact makes these categories more important to be focused first for policy making to get the maximum benefit in terms of increase in per capita income and employment generation. Since, mostly services are knowledge intensive, so the import of services in the second stage enhance knowledge capability and skills in the local labour and thus enhance their productivity which ultimately stimulates the growth of per capita income.

Specification 3.14 was estimated to find out the factors of revealed comparative advantage of exports. The results are reported in Table 5.11. It is shown from the results that all the explanatory variables significantly explain the variation in RCAIX and takes the expected sign as come out from the literature review. However, Capital / labour ratio, Logistic Index and Labour Participation Rate have positive sign in some categories and have negative sign other categories. The justification of negative sign is that with increase in capital / labour ratio, or /and logistic index or/and labour participation rate there would be an increase in the domestic demand for services as for more development there is more need of such factors to give the required services.

Table 5.10

Revealed Comparative Advantage Index (RCAI) by Category of Export of Service

	Trans.	Travel	Comm.	Const.	Insur.	Finan.	Comp. & Inform.	Royalt. & Lice. Fee	Other Busi.Serv	Pers. & Cult.	Govt. Serv.
Year	1	2	3	4	5	6	7	8	9	10	11
2006	1.52	0.32	1.93	0.34	0.28	0.21	0.56	0.19	0.50	0.02	14.16
2007	1.21	0.32	1.38	0.60	0.42	0.16	0.66	0.11	0.44	0.04	16.17
2008	1.20	0.32	0.86	0.32	0.69	0.13	0.79	0.10	0.41	0.06	18.36
2009	1.41	0.30	2.92	0.14	0.43	0.29	0.81	0.01	0.44	0.04	15.30
2010	1.56	0.28	9.54	0.06	0.26	0.61	0.81	0.00	0.45	0.03	12.53
2011	1.46	0.28	8.36	0.02	0.41	0.56	0.93	0.06	0.42	0.04	14.07
Avg.	**1.40**	**0.30**	**4.17**	**0.25**	**0.41**	**0.33**	**0.76**	**0.08**	**0.44**	**0.04**	**15.10**

Table 5.11

Revealed Comparative Advantage Index (RCAI) by Category of Import of Service

	Transp. **1**	Travel **2**	Comm. **3**	Const. **4**	Insur. **5**	Finan. **6**	Comp. & Inform. **7**	Royalt. & Lice. Fee **8**	Other Busi. Serv **9**	Pers. & Cult. **10**	Govt. Serv. **11**
2006	3.41	1.78	1.14	0.88	0.88	1.18	0.68	0.53	4.24	0.09	2.40
2007	3.24	1.57	1.11	0.50	0.85	0.96	1.09	0.47	3.53	0.03	2.86
2008	3.67	1.44	1.27	0.56	0.66	1.52	0.82	0.42	3.02	0.03	2.78
2009	3.42	0.70	1.79	0.62	0.77	0.96	1.09	0.31	1.45	0.44	4.02
2010	2.94	0.33	2.45	0.65	0.86	0.58	1.42	0.22	0.67	7.29	6.08
2011	3.11	0.03	2.54	0.54	0.77	0.69	1.46	0.16	0.19	6.02	6.19
Avg.	**3.30**	**0.97**	**1.72**	**0.63**	**0.80**	**0.98**	**1.09**	**0.35**	**2.18**	**2.32**	**4.06**

Table 5.11(a)

Regression Results
Dependent Varibale: RCIX by Category of Export of Service
Method: Pooled Least Squares Included Observations: 123
Cross-sections included: 26
Total Pool (Balanced) Observations: 3198

Var.	Trans. 1	Trav. 2	Com. 3	Const. 4	Insur. 5	Finan. 6	Comp.,Inf. 7	Roy., Lice. 8	Other Busi. 9	per.Cul. 10	Govt. 11
C	**–4.935**	**–2.130**	**–1.745**	**4.039**	**–4.117**	**–5.938**	**4.111**	**–1.630**	**–7.790**	**1.252**	**–0.680**
t value	*–3.78*	*–4.988*	*–3.283*	*9.716*	*–5.233*	*–5.671*	*11.798*	*–11.959*	*–6.608*	*7.862*	*–2.428*
BD	**–0.158**	**–0.026**	**–0.002**	**–0.031**	**–0.120**	**–0.133**	**–0.054**	**–0.019**	**–0.150**	**–0.008**	**–0.010**
t value	*–12.12*	*–6.07*	*–0.39*	*–7.39*	*–15.29*	*–12.750*	*–15.558*	*–14.144*	*–12.753*	*–5.226*	*–3.499*
ENR	**0.099**	**0.023**	**0.043**	**0.014**	**0.056**	**0.059**	**0.021**	**0.002**	**0.084**	**0.013**	**0.006**
t value	*15.80*	*11.29*	*16.943*	*6.804*	*15.016*	*11.768*	*12.905*	*3.100*	*14.853*	*16.853*	*–4.434*
GDP	**0.028**	**0.093**	**–0.069**	**0.004**	**0.002**	**0.024**	**0.085**	**0.039**	**0.002**	**0.006**	**0.007**
t value	*11.13*	*12.08*	*–0.625*	*5.544*	*13.605*	*12.241*	*12.770*	*15.141*	*9.670*	*22.033*	*1.463*
II	**–0.042**	**–0.016**	**–0.018**	**–0.058**	**–0.040**	**–0.002**	**–0.021**	**–0.006**	**–0.028**	**–0.046**	**–0.020**
t value	*–8.45*	*–14.70*	*–9.271*	*–3.694*	*–15.43*	*–5.313*	*–16.511*	*13.331*	*–6.239*	*–7.568*	*–18.39*
LI	**–1.401**	**–0.701**	**0.044**	**–0.163**	**0.003**	**–1.154**	**–0.031**	**–0.161**	**–0.760**	**–0.546**	**–2.013**
t value	*–3.92*	*–6.000*	*0.305*	*–1.437*	*0.012*	*–4.026*	*–0.321*	*–4.303*	*–2.354*	*–12.535*	*–26.259*
LPR	**–0.078**	**0.035**	**0.021**	**–0.082**	**–0.066**	**0.035**	**–0.122**	**0.015**	**–0.046**	**–0.021**	**0.154**
t value	*–4.01*	*5.499*	*2.675*	*–13.35*	*–5.681*	*–2.274*	*–23.547*	*7.350*	*–2.630*	*–9.049*	*37.169*
MG	**0.000**	**0.001**	**0.005**	**0.001**	**0.006**	**0.004**	**0.004**	**0.005**	**0.002**	**0.002**	**0.006**
t value	*0.03*	*0.787*	*4.601*	*0.809*	*3.500*	*1.741*	*4.972*	*17.257*	*0.845*	*5.792*	*11.226*
POP	**0.001**	**0.002**	**0.010**	**0.001**	**0.001**	**0.003**	**0.001**	**0.002**	**0.004**	**0.001**	**0.007**
t value	*9.84*	*5.184*	*0.915*	*10.014*	*6.779*	*9.672*	*41.761*	*5.955*	*10.526*	*21.996*	*17.019*
SG	**0.214**	**0.067**	**0.040**	**0.034**	**0.147**	**0.172**	**0.065**	**0.023**	**0.193**	**0.021**	**0.060**
t value	*21.03*	*20.115*	*9.669*	*10.537*	*23.959*	*21.109*	*23.819*	*21.826*	*21.079*	*17.015*	*–27.532*

In specification 3.15, the price elasticity of export in each category of service for Pakistan was estimated using data on quarterly frequency. The results are shown in Table 5.12. Since the absolute value of price elasticity of export is greater than 1 for each category, therefore without estimating the price elasticity of imports, we can say that the Marshall Lerner condition is satisfied and the trade in services has the characteristic of stability. After the Marshall Lerner condition is satisfied, the specifications 17 to 20 were estimated to analyse the demand and supply potential of trade in services and TOT situation with the partner countries. In this respect, the elasticities were estimated in Total services, transport services and financial services.

Table 5.12

Regression Results Measuring Price Elasticity of Export by Category of Service

	Trans.	Trav.	Comm.	Const.	Insur.	Finan.	Comp., inform.	Royalties and license fees	Other bus.	Pers. & cult. & recr.	Govt.	Total
	1	2	3	4	5	6	7	8	9	10	11	12
Constant	11.44	9.33	12.95	6.19	22.19	16.29	39		11		4.7	0.08
t-stat	3.83	1.7	0.55	2.5	1.28	0.88	2		1.5		2.5	0.02
Ep	**–1.27**	**–2.9**	**–1.85**	**–1.94**	**–5.35**	**–4.15**	**–9.5**		**–3.4**		**–2.2**	**–1.4**
t-stat	–2.33	–1.84	–4.7	–1.5	–1.4	1.2	–2.5		–2.8		–4.8	–3.5
R Squared	0.72	0.8	0.7	0.6	0.82	0.65	0.73		0.75		0.8	0.7

The results are shown in Tables 5.13 and 5.14 .The results show that with a unit change in domestic price of Total services causes a larger change in exports of Total services than its imports. It explains favourable TOT in Total services with all neighbouring countries of Pakistan. Among all, Pakistan should take measures to enhance Total services especially with China and India. Income elasticities also show that if there is one unit increase in the income than the increase in exports is 1.6 times while imports is 1.3 times one unit with the net inflow of income is 0.3 times one unit at world level. However with China, there is net outflow of income equal to 0.16 times one unit. The results show that with a unit change in domestic price of Transport services cause a larger change in imports of services than its exports. It explains an unfavourable TOT in Transport services with world and all neighbouring countries of Pakistan. Income elasticities also show unfavourable TOT that if there is one unit increase in the income then the increase in exports is only 0.4 times while imports is 1.3 times with the net outflow of income is 0.9 times at world level. However with China, there is net outflow of income equal to 1.25 times one unit. Similar situation is with other neighbouring countries. There is a need to look into the regulatory framework and its implementing procedures in the transport sector to enhance the accessibility, affordability and competitiveness in the least cost manner. The results show that with a unit change in domestic price of Financial services cause a larger change in exports of services than its imports. It explains favourable TOT in Financial services with world and all neighbouring countries of Pakistan. Income elasticities show unfavourable TOT only with China while it shows favourable TOT with the world and with all other neighbouring countries.

Table 5.13

Price Elasticities

Partner Country	Total		Transport		Financial	
	Exports	Imports	Exports	Imports	Exports	Imports
World	–2.64	–1.77	–0.89	–1.73	–3.43	–0.64
China	–2.96	–2.02	–0.81	–1.72	–3.98	–1.64
Iran	–2.5	–1.9	–0.89	–1.69	–3.6	–0.76
Afghanistan	–2.45	–1.88	–0.96	–1.57	–4.5	–0.98
India	–2.54	–1.77	–0.9	–1.72	–3.5	–0.62

Table 5.14

Income Elasticities

Partner Country	Total		Transport		Financial	
	Exports	Imports	Exports	Imports	Exports	Imports
World	1.6	1.3	0.4	1.3	1.8	1.3
China	1.29	1.45	0.3	1.28	1.13	1.45
Iran	1.04	1.1	0.3	1.25	1.43	1.1
Afghanistan	2	1.21	0.41	1.21	1.99	1.21
India	2.12	1.13	0.43	1.29	2.07	1.13

Based on the above analyses a strategic policy framework of liberalising trade in services for Pakistan was developed. It is as shown below in a tabular form.

Table A

Strategic Framework of Liberalising Trade in Services for Pakistan

Sr. No.	Type of Service	Direction of Trade	Policy Tools
	(descending order based on (RCIX, RCIM), TP)	(based) on TP, TBI, TII, TCI	Based on structural and institutional features and regulatory setup
	1	2	3
1	Govt.	Ho, Ne, It, Ba, Ir, Chi, Sin, UAE, Bel	Increase LPR, ENR; decrease Pop
2	Transport	USA, Ma, Ir, Chi, Sa, ho, Nep, Bhu,	decrease relative BD, pop ; increase relative ENR, LI, II, Mg
3	Communication	Ja, Sr, Ma, UAE,UK, Bang, Nep, Ir,	Inrease relative ENR, LI, LPR, II
4	Travel	In, Ma, Ba, Ho, Bhu, chi, Ir, Sa	decrease relative BD, pop ; increase relative ENR, LI, II, Mg
5	Insurance	Ma, Mal, Bhu, Chi, Nep, Tha, UAE	decrease relative BD, pop ; increase relative ENR, LI, II,
6	Financial	Ne, Tha, Sa, Nep, Bel, Bhu, Ma, Ho	decrease relative BD, pop ; increase relative ENR, LI, II, sg
7	Other Business Services	Bel, Tha, Ne, It, Sin, Fr, Ma,	decrease relative BD, pop ; increase relative ENR, LI, II, sg
8	Computer	Ma, Mal, Ja, Ne, Bhu, Ba, It, Uk	decrease relative BD, pop ; increase relative ENR, LI, II, sg
9	Personal, Cultural and Recreational	Tha, Ne, Bhu, Chi, Sa, Ma, Nep, De, Sin	decrease relative BD, pop ; increase relative ENR, LI, II, sg
10	Royalties and License Fee	Tha, Chi, Ma, Ge, Bhu, De, Mal, Nep	decrease relative BD, pop ; increase relative ENR, LI, II, sg
11	Construction	Bhu, Mal, Uk, Ma, Bang, In, USA	decrease relative BD, pop ; increase relative ENR, LI, II, sg

6. CONCLUSION

First, we analysed the relative contribution of trade in services to overall GDP across 60 countries combining into nine groups. In the period, 2006-10 the contribution remained very high and positive in all regional/trading blocks. It confirms the importance of trade in services sector in new growth models/strategies for growth and development. It is also shown that during period, 1981-2010, the developing countries in comparison with developed countries performed well in trade in services. An important result was found by analysing the contribution pattern in EU, NAFTA and SAARC at once. Since the NAFTA and EU are the major trading partners of SAARC countries and demand for service in trade is mostly the derived demand of merchandise trade. It is therefore, explicit that during the periods: 1986-90 and 1991-95, when the contribution was negative in both EU and NAFT, the contribution in SAARC countries was also negative and vice versa. Similarly, when the contribution was negative in one of the regional blocks (EU, NAFTA), the contribution sign in SAARC was determined by the relative impact of both the major trading partners (EU, NAFTA). It gives policy guidelines to the SAARC member countries to decrease the dependence on EU and NAFTA markets and look for other world markets to spread the base of major trading partners. In this regard, SAARC Free Trade Agreement on Trade in Services can increase the regional trade in services and decrease the huge dependence on EU, NAFTA markets. From Table 5.2, the growth of trade in services during the period 1980-2010 remained higher than the overall GDP growth and the growth of exports of services, on average, remained close to growth of imports during the period 1980-81 and remained very high during 2005-11. Keeping in view the consistent trend of almost positive contribution of trade in services in Pakistan during 1981-2010, and higher growth of exports of services than imports , the areas of trade in services should be focused in new growth strategy through institutional and structural development of Pakistan economy and society.

The result of specification 3.3 shows that the contribution of trade in services to the growth of per capita income is higher than that of trade in merchandise. Another important result is drawn from the table that 1 day decease in the "days to start a new business" will increase the per capita income by 0.04 percent. In specifications 3.4 and 3.5, the untapped potential of service by category and by partner was estimated. In specifications 3.6 and 3.7, the trade intensity index of export and import by category of service and by partner country was estimated.

Specifications 3.8 to 3.11 were estimated to calculate the Complementarity and Country bias indices of export and import to further decompose the TII and find out which factor is dominant and major contributor in TII. The results are shown in Tables 5.6, 5.7, 5.8 and 5.9. It is shown from the results that Country bias index in both export and import of services in almost each category dominate. It explains the fact that Pakistan' trade (both export and import) with its trading partners is based on favourable access between them.

In Specifications 3.12 and 3.13, the revealed comparative advantage indices (RCAIX and RCAIM) by category of service were estimated for Pakistan from 2006 to 2011. Pakistan has comparative advantage of export in transport, communication and government services, while it has comparative advantage of import in transport, communications, computer and Information, other business, personal, cultural and recreational and government services. An interesting note here is that in categories of services, Pakistan has RCAX greater than 1; it also has RCAM greater than 1 in the same categories. This fact makes these categories more important to be focused first for policy making to get the maximum benefit in terms of increase in trade volume in services and per capita income and employment generation. Since, mostly services are knowledge intensive, so the import of services in the second stage enhance knowledge capability and skills in the local labour and thus enhance their productivity which ultimately stimulates the growth of per capita income.

Specification 3.14 was estimated to find out the factors of revealed comparative advantage of exports. The results are reported in Table 5.11. It is shown from the results that all the explanatory variables significantly explain the variation in RCAIX and takes the expected sign as come out from the literature review. However, Capital / labour ratio, Logistic Index and Labour Participation Rate have positive sign in some categories and have negative sign other categories. The justification of negative sign is that with increase in capital / labour ratio, or /and logistic there would be an increase in the domestic demand for services as for more development there is more need of such factors to give the required services.

On the basis of results and analyses made, it is found that there is favourable TOT in Total services with all neighbouring countries of Pakistan especially with China and India. However, the income elasticity for Total Services explain neither favourable nor unfavorable scenario. Estimations in transport services sector explains an unfavorable TOT in Transport services (on the basis of both price and income elasticities) with world and all neighbouring countries of Pakistan, while estimations show favourable TOT in financial services with world and all neighbouring countries of Pakistan. There is a need to look into the regulatory framework and its implementing procedures in the transport sector to enhance the accessibility, affordability and competitiveness in the least cost manner. The strategic framework in terms of preference order of services, the direction of their trade and policy tools to fulfill the local requirements as chalked out in this study is a comprehensive guideline for the policy-makers to draft a trade policy with the guarantee of achieving win-win situation.

Annexure

Name	Abbreviation Used
U. S. A.	US
U. K.	Uk
U. A. E.	UAE
Saudi Arabia	SA
Switzerland	Sw
Denmark	Den
Germany	Ger
Thailand	Tha
France	Fr
Hongkong	Ho
Singapore	Sing
Netherlands	Neth
Italy	It
Bahrain	Ba
Belgium	Bel
China	Chi
Iran	Ir
India	In
Afghanistan	Af
Srilanka	Sr
Nepal	Nep
Bhutan	Bhu
Maldevies	Mal
Bangladesh	Ba
Japan	Ja
Malysia	Ma

Appendix Table 1

Exports of Services

Category	Details
1. Transportation	Charter of Pak ships with crew Charter of Pak aircrafts with crew Remitt. Rec. by recruit. Agents Earnings of Pak road transport Passage Earnings of Pak air Cos. Freight earnings Others Local disburs. of foreign Shipping/Air Cos.
2. Travel	Official travel Others official travel Commercial travel Non official-Delegation Medical Students Trainees Tourists Pak national Tourists foreign national Religious travel Receipts through Exchange Cos. Others
3. Communications Services	Postal services Courier services Telecommunication services Call centres
4. Construction Services	Construction Services
5. Insurance Services	Treaties and standing open cover - life Surplus funds rec.by Pak ins.Cos.-abroad Rev. surplus funds of f. ins. cos.-life Insurance P & I Club Treaties and standing open cover-marine Refund of Ins. payments-others Other miscellaneous insurance Facultative reinsurance-life Facultative reinsurance-marine Other non-life reinsurance services Services auxiliary to insurance
6. Financial Services	Bank commission and charges Remittances for guarantees involved Others financial services

Continued—

Table 1—(*Continued*)

7. Computer and Information Services	Hardware consultancy services Software consultancy services Maintenance & repairs of computer Export of Computer Software Other computer services Earnings of journalists / authors Subscription to news papers/periodicals News agents and correspondents
8. Royalties and Lisence Fees	Royalties, license fees & trade marks
9. Other Business Services	Merchanting. & trade related services Charter of ships without crew-op.leasing Charter of aircrafts without crew--op leasing Legal services A/c, auditing, & tax consulting Services Bus. & manag. Consult.& public relations Agency commission Printing charges of security documents Processing and repair fees Adv. market research & pub. opinion poll Research and development Arch., engineering, & technical services Agri., mining, & on-site proc. services Receipts of security dep. with tenders Services in medicine exports Misc. other business services, n.i.e. Refund
10. Personal, Cultural, Recreational Services	Audiovisual and related services Earnings of professional artists Other personal, cult. & recreation serv.
11. Government Services	Remitt. Rec. by foreign Missions in Pak. Military units and agencies Other government services Remittances Received by Int. Org. Receipt through Central govt. Receipts through International bodies Earnings of Pak Diplomatic Mission abroad

Appendix Table 2

Imports of Services

Category	Details
1. Transportation	Charter of Ships with crew Freight on commodity imports - sea Charter of Aircrafts with crew Freight on commodity imports- air Oper. Exp. of Pak rail/road transport Passage earnings of Foreign air lines 8 % freight on cash imports Freight on Foreign Economic Assistance Pak air /Shipping Cos expenses
2. Travel	Official travel -Business Commercial Travel-Business Non-official-Business Medical - Personal Travel Students and trainees Holiday (on recreational tours abroad) Religious travel - Hajj Religious travel - other - By air Religious travel - other - By land Salary of officials on leave abroad Payments through Exchange Cos & Others
3. Communications Services	Postal and courier services Telecommunication services
4. Construction Services	Construction services
5. Insurance Services	Treaties and standing open cover-life Surplus funds of foreign insurance cos. Rev. surplus funds of f. Ins. Cos. -life Insurance P & I Club Treaties and standing open cover-marine Accidental and health insurance services Motor vehicle insurance Surplus fund of foreign insurance Cos- Marine Marine, aviation and other transport ins. Facultative reinsurance-life Facultative reinsurance-marine Other non-life reinsurance services Auxiliary services Insurance under Foreign Economic Assistance

Continued—

Table 2—(*Continued*)

6. Financial Services	Bank comm. and charges-Fin. Services Remittances for guarantees involved Other financial services
7. Computer and Information Services	Hardware consultancy services-Com. Serv. Software consultancy services Maintenance and repairs of computers Import of Computer Software Other computer services Pay. to journalist/authors-Informal Ser. Subscription to newspapers / periodicals News agents and correspondents
8. Royalties and Lisence Fees	Royalties and trade marks & Exchange cos.
9. Other Business Services	Merchanting services Charter of ships without crew-op.leasing Charter of air crafts without crew-op. leasing Legal services A/c, audit, bookkeeping, tax cons. Ser. Buss. & Mang. consult., and public rel. Agency commission Printing charges of security documents Processing and repair fees Adv., market res., & public opin. Poll. Research and development Services Architect., eng., and technical services Agri., mining, & on-site proc. services Receipt of sec. Deposits with tenders Payments to journalists Technical fees to foreigners Miscellaneous services, n.s.e. Exchange Cos & Refund
10. Personal, Cultural, Recreational Services	Audiovisual & related serv.-P.C.R serv. Payment to professional artisits Other personal, cult., & rec. services
11. Government Services	Foreign Missions & Military units and agencies Govt. remitt. not specified elsewhere. Remittances to Int. Organisations. Payment through int. bodies(Rs. A/c) Expenditure of Pak Diplomatic Mission abroad Technical Assistance

LIST OF REGIONAL BLOCKS CONTAINING THE NAMES OF MEMBER COUNTRIES

The Asia Pacific Economic Cooperation (APEC)

Australia, Brunei Darussalam, Canada, Chile, China, Hong Kong SAR, Indonesia, Japan, Korea, Malaysia, Mexico, New Zealand, Papua New Guinea, Peru, the Philippines, Russia, Singapore, Taiwan Province of China, Thailand, the United States, and Vietnam.

Agreement on South Asian Association for Regional Cooperation (SAARC) Preferential Trading Arrangement (SAPTA)

Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan, and Sri Lanka, Afghanistan

Association of Southeast Asian Nations (ASEAN)

Brunei Darussalam, Cambodia, Indonesia, Lao P.D.R., Malaysia, Myanmar, Philippines, Singapore, Thailand, and Vietnam

ASEAN-6

ASEAN, China, Japan, Korea, Australia, New Zealand, India

Closer Economic Relation (CER)

Australia and New Zealand.

Eurasian Economic Community (EAEC)

Belarus, Kazakhstan, the Kyrgyz Republic, the Russian Federation, and Tajikistan.

European Union comprising 15 members (EU-15)

Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain, Sweden, and the United Kingdom.

North American Free Trade Agreement (NAFTA)

Canada, Mexico, and the United States.

Southern Common Market (Mercosur)

Argentina, Brazil, Paraguay, and Uruguay.

Trans-Pacific Strategic Economic Partnership (TPSEPA)

Brunei Darussalam, Chile, New Zealand, and Singapore.

Gulf Cooperation Council (GCC)

1981: Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, the United Arab Emirates.

Community of Sahel-Saharan States (CEN-SAD) 10

Libya, Niger, Sudan, Senegal, Egypt, Somalia, Ghana, Morocco, Liberia, Gambia

ECO

Afghanistan, Azerbaijan, Iran, Kazakhstan, Kyrgyz, Pakistan, Tajikistan, turkey, Turkmenistan, Uzbekistan,

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Consequences of Political Instability, Governance and Bureaucratic Corruption on Inflation and Growth: The Case of Pakistan

ADNAN HAIDER, MUSLEH UD DIN and EJAZ GHANI

"Countries that have pursued distortionary macroeconomic policies, including high inflation, large budget deficits and misaligned exchange rates, appear to have suffered more macroeconomic volatility and also grown more slowly during the postwar period. Does this reflect the causal effect of these macroeconomic policies on economic outcomes? One reason to suspect that the answer may be no is that countries pursuing poor macroeconomic policies also have weak ''institutions,'' including political institutions that do not constrain politicians and political elites, ineffective enforcement of property rights for investors, widespread corruption, and a high degree of political instability."

Acemoglu, *et al*. (2003)

1. INTRODUCTION

Political regimes in Pakistan have strongly influenced the economic outcomes. Whereas the autocratic regimes have tended to exhibit good economic performance with low and stable inflation, robust growth, and fiscal discipline helped by relatively high revenue generation and checks on public expenditure, the democratic regimes have been marked by macroeconomic instability and sluggish economic growth. In addition, autocratic regimes also witnessed relatively stable external sector along with low trade deficit and high capital inflows in the form of foreign direct investments and portfolio investments, which indicates high level of confidence of foreign investors in the domestic economy. On the other hand, key economic indicators have generally deteriorated during different episodes of democratic regimes.[1] Table 1 summarises the relative performance of selected macroeconomic variables across different political regimes.

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[1]For comprehensive comparison of both regimes, see Iqbal, *et al.* (2008) and Zaidi (2006).

Table 1

Performance of Selected Macroeconomic Indicators across Political Regimes

Regime*	RGDPgr	TFPgr	PINVgr	BBR	ER	INF	UR	M2gr	Corrp	Gov
1	3.18	2.10	22.14	–5.41	3.41	3.54	0.15	8.30	1.83	3.12
2	2.74	0.09	2.73	–9.11	4.55	4.38	0.10	10.41	3.13	3.75
3	5.69	1.19	7.45	–11.04	4.76	2.71	0.84	10.80	3.50	6.05
4	5.35	1.28	6.19	–9.24	4.76	3.80	1.85	9.42	3.00	6.50
5	3.67	–0.98	–2.46	–6.88	7.81	6.70	1.94	10.04	1.67	6.53
6	4.87	0.62	8.49	–9.44	9.90	16.69	2.32	18.87	1.50	3.73
7	6.45	1.67	4.94	–8.59	13.67	7.27	3.70	15.62	2.05	3.83
8	5.12	0.40	4.81	–9.57	22.87	9.30	4.37	16.48	2.00	6.11
9	2.44	–2.81	3.84	–9.09	28.11	9.83	4.70	17.77	2.00	5.25
10	4.69	–0.20	1.27	–7.01	34.85	11.72	5.43	15.35	2.23	2.06
11	2.17	–1.78	–0.33	–7.64	43.08	9.81	6.00	13.37	2.96	1.04
12	3.48	–0.02	0.84	–6.29	52.53	5.39	6.85	9.75	2.35	1.04
13	5.45	1.71	7.05	–4.52	60.02	6.57	7.06	16.35	2.67	4.40
14	3.68	1.90	7.28	–7.83	62.63	12.00	5.20	15.35	2.00	3.50
15	2.62	–0.77	–8.92	–5.47	82.68	15.43	5.78	12.63	1.00	1.40

Source: Author's calculations. For data sources and description of variables, please refer Section 3.

Variable List: RGDPgr = Average growth of real gross domestic product; TFPgr = Average growth of total factor productivity; PINVgr=Average growth of real private investment; BBR = Average of Budget Balance ratio to GDP (in percent); ER = Average Exchange rate; INF = Average inflation rate (in percent); UR = Average Unemployment rate; M2gr = Average growth in broad money (M2); Corrp = Aveage level of Corruption and Gov = Average Level of Governance.

* For political regime categorisation, please refer to Table A4 in Appendix. Further, shaded rows represent autocratic regimes.

The economy grew more than 5 percent per annum on average during autocratic regimes, which is 1.5 percentage points higher than the average growth rate observed during democratic regimes. Similarly, in all autocratic regimes, average economic growth remained above 5 percent with the exception of the second regime in which average economic growth was 2.74 percent. However, in the case of all democratic regimes average annual growth remained in the range from 2 percent to 5 percent. Therefore, more than 5 percent average annual growth across all autocratic regimes signifies the relatively strong macroeconomic fundamentals during these regimes. Similarly, growth in total factor productivity (TFP) during autocratic regimes outstripped the same in democratic eras: average annual growth of TFP during autocratic regimes was 1.19 percent as compared with TFP growth of –0.15 percent during the democratic regimes. A look at other macroeconomic indicators also shows that the economic performance during the autocratic regimes has been much better than that observed during the democratic regimes. For example, real private investment is a leading indicator of confidence the general public has in the government and its policies. Growth performance of real investment in autocratic eras has been far better than in the democratic regimes. Average growth in real investment in autocratic regimes was 5.67 percent per annum as compared with 3.70 percent during the democratic regimes.

Autocratic regimes have also outperformed the democratic regimes in terms of fiscal discipline and price stability. Consider, for example, the budget balance ratio which is the ratio of fiscal balance to GDP; the higher the ratio in absolute terms the worse is the fiscal position. Barring short periods where democratic regimes have a slight edge over autocratic regimes, the former have mostly outperformed the latter in terms of fiscal discipline: average budge balance ratio in autocratic regimes is –8.1 percent whereas in democratic regimes the same is –7.9 percent. In terms of price stability, the democratic regimes have often been marked by high levels of inflation: average inflation in autocratic regimes stood at 4.9 percent per annum as compared with 10 percent for democratic regimes.

What factors could explain the differences in economic performance during autocratic and democratic regimes? A growing and influential body of empirical research has sought to identify the causes of poor economic outcomes as reflected in high inflation and low economic growth. There is a near consensus in the literature that poor economic outcomes are often associated with lack of good governance and poor state institutions which promote rent seeking and corruption thus impeding the process of economic growth.[2]

In the case of Pakistan, few studies have examined the role of governance and institutions in macroeconomic outcomes. For example, Khawaja and Khan (2009), Hussain (2008) and Qayyum, *et al*. (2008) note that good governance and better institutional quality are necessary conditions for batter economic outcomes. Siddique and Ahmed (2010a, 2010b) investigate the long run positive relationship between institutional quality and economic growth. They find unidirectional causality running from institutional quality to economic growth. Another recent study by Zakria and Fida (2011) finds indirect effects of democracy on economic growth. Similarly, Qureshi, *et al.* (2010) and Khan and Saqib (2011) find positive and significant impact of political instability (where political instability is defined as frequent cabinet changes and government in crises) on inflation in Pakistan.

The above studies are mostly empirical in nature and lack theoretical foundations without which it is difficult to explain how governance, democracy, political instability, quality of institutions and other deeper determinants impact inflation and growth. This study fills the gap in the literature by developing a theoretical model with micro-foundations that captures some of the highlighted features of Pakistan's economy. Furthermore, using actual data, computational modeling is done by applying Markov-Regime switching technique with maximum-likelihood procedures. The estimation results based on empirical modeling setup are in line with the stylised-facts and also confirm the intuitive implications of the theoretical model.

The rest of the paper is organised as follows: Section 2 reviews the literature that explores the links between corruption, quality of governance, inflation and economic growth. Section 3 presents theoretical model. Section 4 describes data and empirical methodology. Main findings are discussed in Section 5 and the concluding remarks are stated in Section 6.

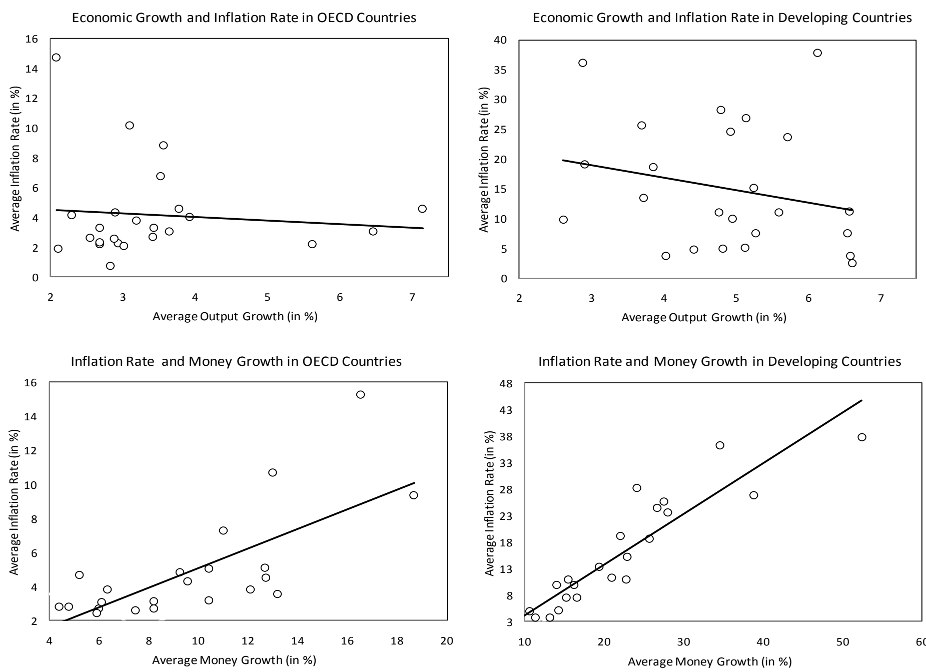
2. HOW CORRUPTION AND GOVERNANCE LEAD TO INFLATION AND ECONOMIC GROWTH?

Cross country studies provide many plausible explanations of persistence of high inflation with low economic growth. In general, high inflation might be associated with

[2] See for instance, Baumol (1990), Murphy, *et al.* (1991), Acemoglu (1995), Mauro (1995) and Baumol (2004).

market imperfections, exchange rates fluctuations, cost-push factors such as food supply shortages, energy inflation in the case of oil importing countries and conventional demand pull factors including private consumption and government expenditures. But research brings a common synthesis that in the long run inflation can persist only when there is excessive money supply growth [see for instance, McCandless and Weber (1995); David and Kanago (1998) and Fischer, *et al.* (2002)]. Several empirical studies on inflation-growth nexus have found that high and persistent inflation is harmful to economic growth whereas low and stable inflation is considered as conducive for the process of economic growth. For example, Khan and Senhadji (2001) estimate the threshold levels of inflation both for advance and emerging economies. They find that up to these threshold levels growth is positively related with inflation and beyond these levels, inflation exerts a negative effect on economic growth. In particular, the threshold estimates are 1-3 percent and 7-11 percent for industrial and developing countries, respectively. Figure 1 shows the relationship between CPI inflation and real GDP growth and between CPI inflation and M2 growth for OECD[3] (organisation for economic corporation and development) and developing countries[4] for the sample 1984 to 2010.

Fig. 1: Relationships of CPI Inflation with Economic Growth and Broad Money Growth



Source: Author's calculations based on International Financial Statistics of IMF Database.

[3]List of OECD countries: Australia, Austria , Belgium , Canada , Denmark, Finland, France, Greece , Hungary, Iceland, Ireland, Italy, Japan, Korea, Luxembourg, Netherland, New Zealand, Norway, Poland, Portugal, Spain, Sweden, Switzerland, Turkey, United Kingdom and United States.

[4]List of Developing Countries: Bangladesh, Chile, Colombia, Costa Rica, Egypt, Ghana, India, Indonesia, Israel, Jamaica, Jordan, Malawi, Malaysia, Morocco, Myanmar, Nigeria, Pakistan, Romania, South Africa, Sri Lanka, Thailand, Tunisia, Uganda, Venezuela and Zimbabwe.

This figure shows positive relationship between CPI inflation and M2 growth for both panels of countries. For developing countries this relationship is much stronger as compared with OECD case. Similarly, it shows negative relationship between CPI inflation and Real GDP growth for both the panels. In developing countries inflation normally persists at high levels so the negative relationship in this case is much stronger as compared with OECD countries where inflation remains below its threshold level. These observations confirm that high inflation is harmful for economic growth especially for emerging countries and it is mainly determined by high growth in money supply.

Apart from monetarist interpretations of high inflation coupled with low economic growth, recent research provides better explanations of the causes of high money growth and hence inflation. Rahmani and Yousefi (2009) classify these explanations into three broad categories: (a) political business cycle theories of inflation determination; (b) time inconsistency theory of optimal planning; and (c) seigniorage explanations of high rate of money growth and inflation.

The literature on political business cycle (PBC) theories provides two main explanations for sustained inflation: political instability with deficit bias hypothesis and war of iteration philosophy. The seminal attempts by Nordhaus (1975) and Alesina and Tabellini (1990) relate political instability to deficit bias as a possible determinant of inflation both in the long and short run spans. Nordhaus (1975) argues that with expectations augmented Phillips curve (EAPC) where expectations are assumed to be adaptive, there could be a likelihood of higher than social optimal inflation rate in the long-run. Alesina (1987), Alesina (1989), Rogoff and Sibert (1988) consider rational expectations approach as opposed to adaptive expectation schemes and come up with similar results. Alesina and Tabellini (1990) invoke deficit bias hypothesis and explain that alternating governments are either uncertain of each others' preferences or they disagree over the composition of public spending that gives rise to excessively high budget deficits. This deficit bias thus yields suboptimal outcomes which put pressure on inflation in both short and long run. Thus in this case inflation is a result of opportunistic behavior by alternative governments that are in office and try to influence myopic voters for reelection.

Alesina and Drazen (1991) expound the war of attrition philosophy which is the extension of Hibbs' (1977) findings. These studies focus on the cyclical behaviour of the economy and consider inflation as the result of ideological differences of political parties that come to power alternately within a setting of asymmetric information among key political parties. The higher the number of political parties in a legislative council, the higher the likelihood of conflict, the harder it is to reach agreements and the higher the increase in fiscal which ultimately leads to high inflation.

The second line of research attempts to explain the reasons of high inflation rates within an optimal planning framework with time inconsistency problems. These problems occur as a result of the game between policy making authorities and the private sector agents. The seminal attempts in this direction are Kydland and Prescott (1977), Barro and Gordon (1983a), Barro and Gordon (1983b), Backus and Driffill (1985) and Rogoff (1985). These studies explain the high money supply growth and inflation rates by using game theoretic approaches. The main argument is that the policy makers in certain cases take advantage of discretionary powers with the assumption of asymmetric information while preparing policies to reduce unemployment or to increase economic growth at the cost of higher inflation. Private agents on the other hand are rational and aware of these hidden incentives. They do not trust policy rules unless some kind of strict commitments exist. Therefore, credibility plays a major role in such cases. This body of research also proposes reputation and delegation as possible solutions to lower money growth and inflation rates.

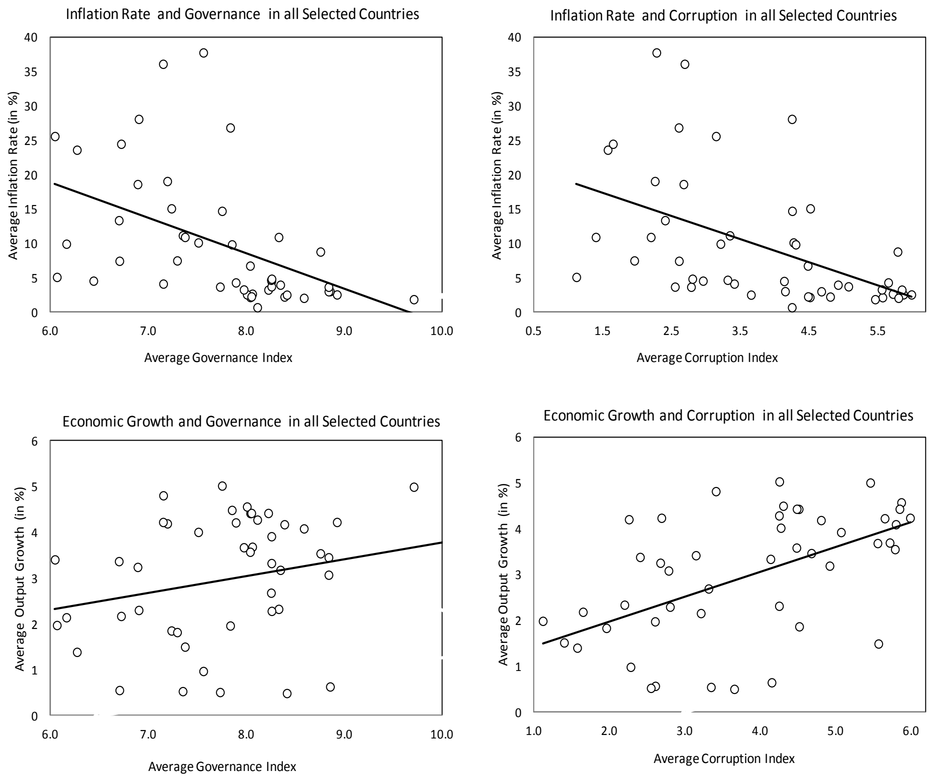
The third line of research for explaining high inflation rate is seigniorage. Khan and Saqib (2011) and Carlstom and Fuerst (2000) consider a weak form of fiscal theory of price level (weak-form FTPL) determination. According to the theory of optimal taxation,[5] the government tries to equate the marginal cost of inflation tax with the marginal cost of output taxes in order to minimise the distortions of taxation. Therefore, the government may choose to use seigniorage as a way to finance public expenditures and budget deficit. Recent studies including Telartar, *et al*. (2010), Aisen and Veiga (2008), Aisen and Veiga (2006), Cukeirman, *et al*. (1992) and Paldem (1987) also provide similar arguments that economies with political instability and weak institutions lack an efficient tax system, which results in reliance on seigniorage. To meet the demand for public expenditures governments print more money which eventually leads to higher inflation.

It is generally accepted that these three explanations for high money growth and high inflation can help in understanding the situation in developing countries. However, there could be some other plausible reasons due to the existence of bad governance, poor quality of institutions and high level of corruption activities in developing countries which can cause high inflation rates along with low economic growth. Figure 2 shows the relationship between governance and corruption with CPI inflation and real GDP growth for sixty OECD and developing countries.

This figure shows that less corruption and good governance is negatively related with average CPI inflation and positively related with real GDP growth. There are a number of reasons that can explain these stylised facts: (a) corruption may cause a misallocation of talent and skills away from productive (entrepreneurial) activities [Acemoglu (1995) and Murphy, *et al*., (1991)]; (b) corruption may undermine the protection of the property rights, create obstacles to doing business and impede innovation and technological transfer [Hall and Jones (1999) and North (1990)]; (d) corruption may cause firms to expand less rapidly, to adopt inefficient technologies and to shift their operations to the informal sector [Svensson (2005)]; (e) corruption may limit the extent of a country’s trade openness and reduce inflows of foreign investment [Pellegrini and Gerlagh (2004) and Wei (2000)]; (f) corruption may lead to costly concealment and detection of illegal income, resulting in a deadweight loss of resources [Blackburn, *et al.* (2006) and Blackburn and Forgues-Puccio (2007)]; (g) corruption may compromise human development through a deterioration in the scale and quality of public health and education programs [Blackburn and Sarmah (2008), Gupta, *et al*. (2000) and Reinikka and Svensson (2005)]; and (h) corruption may cause a general misallocation of public expenditures as certain areas of spending are targeted more for their capacity to generate bribes than their potential to improve living standards [Gupta, *et al*. (2001), Mauro (1995) and Tanzi and Davoodi (1997)].

[5] See, for instance, Phelps (1973), Vegh (1989) and Aizenman (1992).

Fig. 2. Relationships of CPI Inflation and Economic Growth with Corruption and Governance



Source: Author's calculations based on International Financial Statistics of IMF Database and International Country Risk Guide (ICRG) database.

In terms of public finances, corruption and poor governance may independently impact both the expenditure and revenue sides of the government's budget: for any given state of the latter, corruption can distort the composition of expenditures in ways described above; for any given state of the former, corruption can alter the manner by which revenues must be generated, as suggested by other empirical evidence. Thus Ghura (1998), Imam and Jacobs (2007) and Tanzi and Davoodi (1997, 2000) conclude that corruption reduces total tax revenues by reducing the revenues from almost all taxable sources. The implication is that, ceteris paribus, other means of raising income must be sought, and one of the most tempting of these is seigniorage. Significantly, it has been found that inflation is positively related to the incidence of corruption, see for instance, Al-Marhubi (2000) and Rahmani and Yousefi (2009). These studies also noted that corruption causes inflation to increase directly by increasing government expenditures and therefore budget deficit that is financed by seigniorage. However, there is an indirect channel through which corruption increase the inflation rate. Since the growth rate of GDP is lower when corruption is higher and since the inflationary effect of the growth in the money supply is higher when the growth rate of GDP is lower, the higher the inflation rate the higher is corruption.

3. DESCRIPTION OF THE THEORETICAL MODEL

This section provides a detailed description of the theoretical model explicitly outlining its micro-foundations.[6] The model economy consists of private households, public officials, firms and government as representative agents. Every agent tries to optimise its objective function subject to its constraints. The model links corruption motives of public officials and governance behaviour of government with different political regimes. These links have implications for the role of corruption and governance on inflation and growth which are discussed in the results section of the paper.

3.1. Agent's Preferences

The theoretical model considers an economy inhabited by a continuum of infinite-lived agents, who derive their lifetime utility based on consumption of private goods, C_t, consumption of public goods and services, S_t, and leisure, $(1–L_t)$. The agents-population is normalised to one and divided into a fraction, $\psi \in (0,1)$ of private agents (or assumed to be standard households), who provide labour to firms and the remaining fraction, $(1–\psi) \in (0,1)$ as bureaucrats, who work for the government as public officials. Labour supply decision of each agent follows standard Walrasian features.

At time t, the intertemporal utility function of the representative agent is specified as:

$$U = \mathrm{E}_t \sum_{t=0}^{\infty} \rho^t U_t \{C_t, S_t, (1-L_t)\} \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (3.1)$$

Where, $\rho \in (0,1)$ is a discount factor. It is assumed that utility function is separable in each of its argument and its specification is given as:

$$U_t\{C_t, S_t, (1-L_t)\} = \log(C_t) + \xi \log(S_t) + \frac{(1-L_t)^{1-\nu}}{1-\nu} \quad \ldots \quad \ldots \quad \ldots \quad (3.2)$$

Where, v is elasticity of labour supply and $\xi > 1$ is weight associated with consumption of public good in the agents welfare function. Utility function (3.2) also follows standard assumption about increasing with diminishing return in each of its argument, i.e., $\partial U_t / \partial(\bullet) > 0$ and $\partial^2 U_t / \partial(\bullet)^2 < 0$.

Each agent maximises his/her lifetime utility function (3.1) subject to the following intertemporal (flow) budget constraint:

$$C_t + S_t + \frac{M_t}{P_t} + A_{t+1} = W_t L_t + \frac{M_{t-1}}{P_t} + (1 + R_t) A_t \quad \ldots \quad \ldots \quad \ldots \quad (3.3)$$

and a sequence of cash-in-advance (CIA) constraint:

$$\frac{M_{t-1}}{P_t} \geq C_t + S_t + A_{t+1} - A_t \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (3.4)$$

[6]This model is an extension of Blackburn and Powell (2011) and Del Monte and Papagni (2001).

Where, M_t denotes nominal money holdings at time t, A_t denotes real asset holdings at time t, P_t denotes the general price level and R_t is the real returns on assets. The optimisation process solves the following problem as:

$$\Im = \sum_{t=0}^{\infty} \rho^t \left[\begin{array}{l} \left\{ \log(C_t) + \xi \log(S_t) + \dfrac{(1-L_t)^{1-\nu}}{1-\nu} \right\} + \lambda_{1t} \left\{ W_t L_t + \dfrac{M_{t-1}}{P_t} + (1+R_t)A_t - C_t - S_t - \dfrac{M_t}{P_t} - A_{t+1} \right\} \\ + \lambda_{2t} \left[\dfrac{M_{t-1}}{P_t} - C_t - S_t - A_{t+1} + A_t \right] \end{array} \right] \quad (3.5)$$

Where, λ_{1t} and λ_{1t} are Lagrange-multipliers associated with the flow budget constraint (3.3) and CIA constraint (3.4) respectively. The solution to the above optimisation problem (3.5) yields the following first order conditions (FOC's):

$$\frac{\partial \Im}{\partial C_t} = 0 \Rightarrow \quad \frac{1}{C_t} = \lambda_{1t} + \lambda_{2t} \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (3.6)$$

$$\frac{\partial \Im}{\partial S_t} = 0 \Rightarrow \quad \frac{\xi}{S_t} = \lambda_{1t} + \lambda_{2t} \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (3.7)$$

$$\frac{\partial \Im}{\partial L_t} = 0 \Rightarrow \quad (1-L_t)^{-\nu} = \lambda_{1t} W_t \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (3.8)$$

$$\frac{\partial \Im}{\partial A_{t+1}} = 0 \Rightarrow \quad \lambda_{1t} + \lambda_{2t} = \rho\left[(1+R_{t+1})\lambda_{1t+1} + \lambda_{2t+1}\right] \quad \ldots \quad \ldots \quad \ldots \quad (3.9)$$

$$\frac{\partial \Im}{\partial M_t} = 0 \Rightarrow \quad (1+\pi_{t+1})\lambda_{1t} = \rho\left[\lambda_{1t+1} + \lambda_{2t+1}\right] \quad \ldots \quad \ldots \quad \ldots \quad (3.10)$$

Where, $\pi_{t+1} = \dfrac{P_{t+1} - P_t}{P_t}$

3.2. Firm's Behaviour

Each firm hires labour from private households, ψL_t and produces output, Y_t with capital, K_t index of technological innovation,[7] Z_t and governance, G_t. The production function specification is Cobb-Douglas which is in line with the endogenous growth literature.[8]

$$Y_t = \vartheta Z_t^{\alpha} G_t^{\beta} (\psi L_t)^{\alpha} K_t^{1-\alpha-\beta} \qquad \alpha \in (0,1)\,, \quad \alpha + \beta < 1 \quad \ldots \quad \ldots \quad \ldots \quad (3.11)$$

Where, $\vartheta > 0$. Following, Barro (1990), Huang and Wie (2006) and Choudhary, *et al.* (2010), governance, G_t can be defined as:

$$G_t = \chi \tau_t \qquad 0 < \chi \leq 1 \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (3.12)$$

[7]It captures positive externality effect associated with learning-by-doing process as similar with endogenous growth literature. See for example: Jones (1995) and Romer (1986).

[8] For seminal work, please refer: Barro (1990) and Barro and Sala-i-Martin (1992).

Where, τ_t is a lump-sum tax paid to government on behalf of the governance and χ denotes the parameter of governance efficiency scale. If it is less then unity then it implies that government is unable to translate tax revenue into effective governance. [9]

Due to long-run considerations, prices are assumed to be completely flexible and there is no fixed cost. The total variable cost of each firm consists of wages, $\psi W_t L_t$, lump-sum tax cost , τ_t and rate of return on capital, $R_t K_t$. Firm's profit maximisation problem implies:

$$\Pi = \vartheta Z_t^{\alpha} G_t^{\beta} (\psi L_t)^{\alpha} K_t^{1-\alpha-\beta} - \psi W_t L_t - R_t K_t - \tau_t \qquad \dots \qquad \dots \qquad \dots (3.13)$$

From (3.12), we have,

$$\max_{L_t, K_t, G_t} \Pi = \vartheta Z_t^{\alpha} G_t^{\beta} (\psi L_t)^{\alpha} K_t^{1-\alpha-\beta} - \psi W_t L_t - R_t K_t - \frac{1}{\chi} G_t$$

FOC's are:

$$\frac{\partial \Pi}{\partial L_t} = 0 \Rightarrow \qquad \alpha \frac{Y_t}{L_t} = \psi W_t \qquad \dots \qquad \dots \qquad \dots \qquad \dots \qquad \dots (3.14)$$

$$\frac{\partial \Pi}{\partial K_t} = 0 \Rightarrow \qquad (1-\alpha-\beta) \frac{Y_t}{K_t} = R_t \qquad \dots \qquad \dots \qquad \dots \qquad \dots \qquad \dots (3.15)$$

$$\frac{\partial \Pi}{\partial G_t} = 0 \Rightarrow \qquad \beta \frac{Y_t}{G_t} = \frac{1}{\chi} \qquad \dots \qquad \dots \qquad \dots \qquad \dots \qquad \dots (3.16)$$

These FOC's simply state that on optimum marginal products are equal to their respective prices. Further due to the consideration of Walrasian features, there is no markup associated with any price.

3.3. Behaviour of Bureaucratic Corruption across Political Regimes

In order to model bureaucratic corruption, it is assumed that a fraction, $\Phi \in (0,1)$, of public officials is involved in corruption by embezzling public funds. This creates a leakage in the government revenues which puts pressures on government to make less expenditure on public infrastructure. This can be observed by simply linking corruption with governance efficiency scale. Following, Svensson (1995) we assume that Φ is inversely linked with χ. Therefore, (3.16) can be written as:

$$\beta \frac{Y_t}{G_t} = \frac{1}{\chi} = \Phi \qquad \dots \qquad \dots \qquad \dots \qquad \dots \qquad \dots \qquad \dots \qquad \dots (3.17)$$

This implies that an increase in the level of bureaucratic corruption leads toward less-effective governance. So in this way government can directly affect a firm's net-worth, an assumption consistent with Choudhary, *et al.* (2010). However, outcome of this

[9]Following, Choudhary, *et al.* (2010), Hall and Jones (1999) and North (1990), good governance is defined in terms of institutional credibility, effective laws/regulations and infrastructure stability which favours production process.

type of bureaucratic corruption is uncertain because of the changing nature of political regimes. An autocratic regime, where government aims at good governance, bears a monitoring cost in order to reduce the level of corruption. Following, Del Monte and Papagni (2001), it is assumed that on optimal government imposes a penalty of getting caught, which is exactly equal to the monetary value of monitoring cost. While maintaining the assumption of risk neutrality, the bureaucrat maximises expected profits as:

$$E(\Theta_B) = \omega\Phi\tau_t + (1-\omega)\Phi\tau_t - \omega\Omega\tau_t \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots (3.18)$$

Where, ω is the probability of getting caught which is defined as: $\omega = (1/2)\Phi^2$. This implies that as corruption rises, probability of getting caught also rises with the penalty rate Ω. The Optimisation problem yields the following solution:

$$\frac{E(\Theta_B)}{\partial\Phi} = \frac{\partial}{\partial\Phi}\left(\Phi\tau_t - (1/2)\Phi^2\Omega\tau_t\right) = 0$$

$$\tau_t\left(1 - \Phi\Omega\right) = 0$$

$$\Phi = \frac{1}{\Omega} \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots (3.19)$$

Hence, as penalty rate rises bureaucratic corruption reduces. Using (3.19) it is easy to define political regimes as politically stable and politically instable as:

$$\begin{cases} \text{(a)} \quad \lim\limits_{\Omega\to\infty} \Phi \to 0 \quad \Rightarrow \quad \chi \to 1 \quad : \quad \text{Politically Sable Regime} \\[2ex] \text{(b)} \quad \lim\limits_{\Omega\to 0} \Phi \to \infty \quad \Rightarrow \quad \chi \to 0 \quad : \quad \text{Politically Instable Regime} \end{cases}$$

In politically stable regime, as penalty rate rises, bureaucratic corruption reduces. This reduction causes increase in governance efficiency scale. It promotes favorable conditions for firms to produce more and on aggregate, the economy wide output increases.

3.4. Government

In our model economy, the government performs the following tasks. It receives tax revenues from firms in exchange of the governance it provides. Among these tax revenues, it makes expenditures on public infrastructure at the rate, $\varphi \in (0,1)$ and also pays salaries to public officials, $(1-\psi)W_tL_t$. Since a fraction of public officials is involved in corruption there is a possible leakage of the available tax revenue which otherwise can be available for expenditures. Hence, corruption causes deficit in the government fiscal balance. This deficit is finance by monetary seigniorage, $(H_t - H_{t-1})$ which ultimately causes inflation in the economy. Thus, the government budget constraint is the following:

$$\frac{\overline{m}}{1+\overline{m}}\left[\frac{H_t}{P_t}\right] = (1-\psi)W_tL_t + \varphi\tau_t - (1-\Phi)\tau_t \quad \ldots \quad \ldots \quad \ldots \quad \ldots (3.20)$$

Where, $((1–\Phi)\tau_t$ is the remaining amount of public funds after corruption and $\overline{m}$ is the rate of growth in monetary base defined as: $\overline{m} = \frac{H_t - H_{t-1}}{H_{t-1}}$. Therefore, in this way on aggregate both weak governance and corruption are positively associated with high inflationary due to high dependency on monetary seigniorage and, reduce output by effecting firm's net-worth via (3.17) and (3.19) channels.

Hence, as (3.17), (3.19) and (3.20) confirm that as stable political regime comes into power, governance increases and bureaucratic corruption reduces thus increasing output and slowing down the inflationary process. Unstable political regime reverses the whole scenario. Therefore, both governance and corruption have different implications on inflation and growth in different political regimes.

3.5. Solution of the Theoretical Model

Due to long run considerations, we will restrict our model solution to the balance growth equilibrium of the model. For simplicity, it is assumed that the steady state growth rate of all real variables is γ. For solution, we need to collect all equilibrium conditions of the model with the assumptions that capital and money markets are clear in the long run, i.e. $A_t = K_t$ and $M_t = H_t$. The equilibrium conditions, therefore, are:

(a) $\frac{1}{C_t} = \lambda_{1t} + \lambda_{2t}$

(b) $\frac{\xi}{S_t} = \lambda_{1t} + \lambda_{2t}$

(c) $(1 - L_t)^{-\nu} = \lambda_{1t} W_t$

(d) $\lambda_{1t} + \lambda_{2t} = \rho\left[(1 + R_{t+1})\lambda_{1t+1} + \lambda_{2t+1}\right]$

(e) $(1 + \pi_{t+1})\lambda_{1t} = \rho\left[\lambda_{1t+1} + \lambda_{2t+1}\right]$ $\qquad 1 + \pi_{t+1} = \frac{P_{t+1}}{P_t}$

(f) $\frac{M_{t-1}}{P_t} = C_t - S_t - A_{t+1} + A_t$

(g) $C_t + S_t + \frac{M_t}{P_t} + A_{t+1} = W_t L_t + \frac{M_{t-1}}{P_t} + (1 + R_t) A_t$

(h) $G_t = \frac{1}{\Phi}\tau_t$

(i) $\alpha \frac{Y_t}{L_t} = \psi W_t$

(j) $(1 - \alpha - \beta)\frac{Y_t}{K_t} = R_t$

(k) $\beta \frac{Y_t}{G_t} = \Phi$

(l) $\frac{\overline{m}}{1 + \overline{m}}\left[\frac{H_t}{P_t}\right] = (1 - \psi) W_t L_t + \varphi\tau_t - (1 - \Phi)\tau_t$

In the balanced-growth path C_t grows at a constant rate $(1+\gamma)$. So $(\lambda_{1t}+\lambda_{2t})$ grows at $(1+\gamma)^{-1}$. Thus condition (e) implies: $(1+\gamma-\rho)(\lambda_{1t+1}+\lambda_{2t+1})=\rho r\lambda_{1t+1}$. Substituting it in (f) implies:

$$(1+\gamma)(1+\pi_{t+1})\lambda_{1t+1}=\rho(\lambda_{1t+1}+\lambda_{12+1})$$

By virtue of the binding CIA constraint (g), inflation is constant and inversely related to growth according to:

$$\frac{1+\overline{m}}{1+\pi}=1+\gamma \qquad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots (3.21)$$

(f) and (g) also yield the following result:

$$(1+\gamma-\rho)(1+\gamma)=\frac{R\rho^2}{1+\pi} \qquad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots (3.22)$$

In aggregate x_t comprises the income of all agents as:

$$x_t=\psi L_tW_t+(1-\Phi)(1-\psi)L_tW_t+\Phi(1-\psi)L_t\left[W_t+\frac{\tau_t}{(1-\psi)L_t}\right]$$

After simplification and substituting equilibrium conditions we have:

$$x_t=\alpha\frac{Y_t}{\psi}+\Phi\beta Y_t=\left[\frac{\alpha}{\psi}+\Phi\beta\right]Y_t \qquad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots (3.23)$$

CIA and agents budget constraint simultaneously simplifies with equilibrium conditions as:

$$\frac{H_t}{P_t}=x_t+RK_t$$

Therefore,

$$\frac{H_t}{P_t}=\left[\frac{\alpha}{\psi}+\Phi\beta\right]Y_t+(1-\alpha-\beta)Y_t=\left[\frac{\alpha}{\psi}+\Phi\beta+1-\alpha-\beta\right]Y_t$$

Substituting it in (m) we get:

$$\frac{\overline{m}}{1+\overline{m}}\left[\frac{\alpha}{\psi}+\Phi\beta+1-\alpha-\beta\right]Y_t=(1-\psi)W_tL_t+\varphi\tau_t-(1-\Phi)\tau_t$$

After simplification we get:

$$\frac{\overline{m}}{1+\overline{m}}=\frac{\left[(1-\psi)\alpha+\beta\psi\eta-(1-\varphi)\psi\beta\right]}{\left[\alpha+\Phi\psi\beta-\psi-\alpha\psi-\beta\psi\right]}=\frac{\left[(1-\psi)\alpha+\beta\psi\Phi-(1-\varphi)\psi\beta\right]}{\left[(1-\psi)\alpha+\beta\psi\Phi+(1-\psi)\beta\right]}$$

$$\frac{\overline{m}}{1+\overline{m}} = \frac{[(1-\psi)\alpha + \beta\psi\Phi - (1-\varphi)\psi\beta]}{[(1-\psi)\alpha + \beta\psi\Phi + (1-\psi)\beta]}$$

$$\overline{m} = \frac{[(1-\psi)\alpha + \beta\psi\Phi - (1-\varphi)\psi\beta]}{(1-\psi\varphi)\beta}$$

Hence,

$$\pi \cong \overline{m} = \frac{[(1-\psi)\alpha + \beta\psi\Phi - (1-\varphi)\psi\beta]}{(1-\psi\varphi)\beta} \qquad \dots \qquad \dots \qquad \dots \qquad \dots (3.24)$$

Hence, (3.19), (3.21) and (3.24) show that in the presence of corruption, an increase in governance inefficiency leads to inflationary pressure along with low economic growth.

4. DESCRIPTION OF EMPIRICAL MODELS

This section briefly outlines the empirical setup by illustrating data, specification of econometric models and regime switching estimation methodology used in this paper.

4.1. Data

To estimate the model parameters, data over the annual frequencies from 1950 to 2011 on fourteen macroeconomic/political variables are used: the inflation rate based on consumer price index (CPI); real gross domestic product (Real GDP); per capita output; trade shares in terms of GDP as a proxy of openness; agriculture output shares in terms of GDP; nominal exchange rate of Pak-Rupees in terms of US dollars; government borrowing; fiscal balance ratio as percent of GDP; private sector credit; international oil prices; avg. year of schooling as proxy of human capital; central bank governor turnover; index of corruption and index of governance. Details on the construction and the sources of the data set are provided in table A1 of Appendix-A. Descriptive statistics and pair-wise correlation matrix of above mentioned variables are also reported in Table A2 and table A3 of Appendix-A. These correlations are consistent with the standard theory. The results based on descriptive statistics show that average levels of corruption and governance for the complete sample are 2.24 and 6.21 respectively. The low values of corruption and governance indices indicate high levels of corruption along with poor governance. The average inflation and economic growth for the complete sample are 7.5 and 5.0 respectively. The correlation coefficients of corruption with inflation and growth are –0.48 and 0.11. These negative values show positive relationship of corruption with inflation and positive correlation values of corruption with growth shows negative relationship. Similarly, pair-wise correlation values show negative relationship of governance with inflation and positive relationship of governance with growth.

4.2. Specification of the Econometric Models

Following standard practices, we specify two econometric models, one for the explanation of inflation and second for economic growth. The approach followed here is to add corruption and governance in both the models as explanatory variables along with the standard determinants of inflation and economic growth. In order to examine the interactions of governance and corruption with inflation and growth across different political regimes, we find it useful to estimate econometric models with Markov-Regime switching approach. This approach enables us to examine the varying nature of deeper determinants across different regimes. The specification of growth model is consistent with Barro (1991), Hall and Jones (1999), Ahmed and Danish (2010a, 2010b) and Zakaria and Fida (2011); whereas the specification of the econometric model for inflation is consistent with Al-Marhubi (2000), Rahmani and Yousefi (2009), Khan and Saqib (2011). These specifications are given as:

$$\inf_t = \alpha_0 + \alpha_1 pcy_t + \alpha_2 openn_t + \alpha_3 AgriOutput_t + \alpha_4 ExRate_t + \alpha_5 GovtBorrowing_t + \alpha_6 FBR_t + \alpha_7 PvtCredit_t + \alpha_8 Oilp_t + \alpha_9 CBGovernerTurnover_t + \eta_{1,st} corrup_t + \eta_{2,st} gov_t + \varepsilon_{\inf,t}$$

and

$$y_t = \beta_0 + \beta_1 \inf_t + \beta_2 openn_t + \beta_3 AgriOutput_t + \beta_4 GovtBorrowing_t + \beta_5 FBR_t + \beta_6 PvtCredit_t + \beta_7 Oilp_t + \beta_8 HC_t + \mu_{1,st} corrup_t + \mu_{2,st} gov_t + \varepsilon_{y,t}$$

Where; *inf*:= CPI inflation rate; *y*:=real GDP growth; *pcy*:=per capita output growth; *openn*:= trade shares as percent of GDP; *ExRate*:=nominal exchange rate; *GovtBorrowing*:= net budgetary borrowing as percent of GDP; *FBR*:= fiscal balance ratio as percent of GDP; *PvtCredit*:= growth in private sector credit; *Oilp*:= international oil prices; *CBGovernerTurnover*:= Central Bank Governer Turnover; *HC*:=Human capital; *corrupt*:= index of corruption; *gov*:= index of governance and ε's:= residual terms.

Here, $\alpha's$ and $\beta's$ are fixed coefficients and $\eta's$ and $\mu's$ are regime switching coefficients. S_t represents the state at time t with switching to take place between autocratic and democratic regimes. We also allow the variance of the error terms to switch simultaneously between the states.

4.3. Markov Regime Switching Approach

The Markov Regime Switching (hence after, MRS) modeling approach was originally introduced by Goldfeld and Quandt (1973) in the field of econometrics. Cosslett and Lee (1985) have extended this approach by providing iterative algorithms to compute likelihood functions. This seminal attempt was similar in spirit of the state-space modeling using Kalman filter approach. Later, this approach has been used extensively in various economic applications, including Hamilton (1989), in the case of business cycle modeling and Engel and Hamilton (1990) for exchange rate analysis. To validate the outcomes of this approach various statistical tests have been developed. Some of the tests based on moment conditions and stationarity diagnostics can be found in Tjøstheim (1986), Yang (2000) and Francq and Zakoïan (2001). A comprehensive textbook treatment of this approach can be found in Hamilton (1994).

In our case, this approach allows us to estimate how much bureaucratic corruption and governance quantitatively impacts inflation and economic growth across different political regimes. Some of the technical details are given below.

Let us assume a time series, π_t, (let it denotes inflation rate) with its conditional density function: $f(\pi_t \mid \Omega_{t-1};\beta)$ where; Ω_{t-1} is the information set which contains past values and other explanatory variables and β is the vector of parameters to be estimated. The simplest two-state case in which the structural changes occur at the particular time, $t = t_1$, its density function changes to $f(\pi_t \mid 1,\Omega_{t-1};\beta)$ for t_1 observations and $f(\pi_t \mid 2,\Omega_{t-1};\beta)$ for other $t_n - t_1$ observations. The corresponding likelihood functions are: $\prod_{t=0}^{t_1} f(\pi_t \mid 1,\Omega_{t-1};\beta)$ and $\prod_{t=0}^{t_n - t_1} f(\pi_t \mid 2,\Omega_{t-1};\beta)$. For example, the time series $\pi_t = u_i + u_t$, where $u_t \sim i.i.d.\mathrm{N}(0,\sigma_i^2)$. For i = 1, 2, the density function is: $f(\pi_t \mid i,\Omega_{t-1};\beta) = \frac{1}{\sqrt{2(3.1416)\sigma_i^2}} \exp\left[-\frac{1}{2}\frac{(\pi_t - u_i)^2}{\sigma_i^2}\right]$. In order to model multiple regime shifts, we can replace the index i in the density function $f(\pi_t \mid i,\Omega_{t-1};\beta)$ by a discrete variable S_t, whose possible values are 1, 2, . . . , k and the density function generalises to $f(\pi_t \mid S_t,\Omega_{t-1};\beta)$. Thus S_t, can be considered as a regime indicator which is serially dependent upon S_{t-1}, S_{t-2}, …, S_{t-k}, in which case the regime switching process is referred to as a k^{th} order Markov switching process. It is important to note that S_t, has its own distribution which cannot be observed, which means that we cannot construct the likelihood function by using $f(\pi_t \mid S_t,\Omega_{t-1};\beta)$. Consequently, we must have the density function $f(\pi_t \mid \Omega_{t-1};\beta)$ by eliminating the unobserved term S_t. If the past information Ω_{t-1} does not help in evaluating the distribution of S_t, we can use an approach here: we consider a conditional likelihood, $P(S_t \mid \Omega_{t-1})$, and multiply it to the conditional density $f(\pi_t \mid S_t,\Omega_{t-1};\beta)$:

$$f(\pi_t \mid \Omega_{t-1};\beta) = \sum_{s_t=1}^{J} f(\pi_t \mid S_t,\Omega_{t-1};\beta)\cdot P(S_t \mid \Omega_{t-1}) \quad \ldots \quad \ldots \quad \ldots \quad (4.1)$$

The unobserved term S_t can be eliminated by summing up all the possible values of it. The corresponding likelihood is:

$$\prod_{t=1}^{T} f(\pi_t \mid \Omega_{t-1};\beta) = \prod_{t=1}^{T}\sum_{s_t=1}^{k} f(\pi_t \mid S_t,\Omega_{t-1};\beta)\cdot P(S_t \mid \Omega_{t-1}) \quad \ldots \quad \ldots \quad (4.2)$$

This log-likelihood function from (4.2) can be written as:

$$\ln L = \prod_{t=1}^{T} \ln f(\pi_t \mid \Omega_{t-1};\beta) = \prod_{t=1}^{T} \ln \sum_{s_t=1}^{k} f(\pi_t \mid S_t,\Omega_{t-1};\beta)\cdot P(S_t \mid \Omega_{t-1}) \quad \ldots \quad (4.3)$$

This function is a weighted average of the density functions for multiple regimes, with weights being the probability of each regime. Finally this MRS representation is used to estimate the model with explanatory variables with endogenous regime switching.

For solution algorithms, Hamilton (1994) simplifies the analysis to the cases where the density function of π_t depends only on finitely many past values of S_t:

$$f(\pi_t \mid S_t, S_{t-1}, \Omega_{t-1}; \beta) = f(\pi_t \mid S_t, S_{t-1}, \ldots, S_{t-m}, \Omega_{t-1}; \beta) \qquad \ldots \qquad \ldots \quad (4.4)$$

for some finite integer m, and the corresponding conditional likelihood is $P(S_t, S_{t-1}, \ldots, S_{t-m} \mid \Omega_{t-1})$, with the assumption that S_t follows a first-order Markov chain: $P(S_t \mid S_{t-1}, \Omega_{t-1}) = P(S_t \mid S_{t-1}) \equiv p_{st-1st}$, where the transition probability, p_{St-1St}, is specified as a constant coefficient that is independent of time t (time-invariant). The conditional likelihood $P(S_t, S_{t-1}, \ldots, S_{t-m} \mid \Omega_{t-1})$ can then be calculated iteratively through two equations as follows:

$$P(S_t, \ldots, S_{t-m} \mid \Omega_{t-1}) = \sum_{S_{t-m-1}=1}^{k} P(S_t \mid S_{t-1}, \ldots, S_{t-m-1}, \Omega_{t-1}) \cdot P(S_{t-1}, \ldots, S_{t-m-1} \mid \Omega_{t-1})$$

$$= \sum_{S_{t-m-1}=1}^{k} p_{S_{t-1}S_t} \cdot P(S_{t-1}, \ldots, S_{t-m-1} \mid \Omega_{t-1})$$

$$= \begin{cases} p_{S_{t-1}S_t} \cdot P(S_{t-1}, \ldots, S_{t-m} \mid \Omega_{t-1}), m > 0, \\ \sum_{S_{t-1}}^{k} p_{S_{t-1}S_t} \cdot P(S_{t-1} \mid \Omega_{t-1}), m = 0 \end{cases} \qquad \ldots \qquad \ldots \qquad \ldots \qquad \ldots \quad (4.5)$$

for t = 2, 3. . . . , T. Note that the left-hand side term $P(S_t, S_{t-1}, \ldots, S_{t-m} \mid \Omega_{t-1})$ differs from the second term on the right-hand side $P(S_t, S_{t-1}, \ldots, S_{t-m} \mid \Omega_{t-1})$ in that all of the S_t terms are one period ahead. The term, $P(S_t, S_{t-1}, \ldots, S_{t-m} \mid \Omega_{t-1})$, in which the first S_{t-1} term and Ω_{t-1} are both subscripted by the same period of time, is then computed as follows:

$$P(S_t, \ldots, S_{t-m} \mid \Omega_t) = \frac{f(\pi_t \mid S_t, \ldots, S_{t-m}, \Omega_{t-1}) \cdot P(S_t, \ldots, S_{t-m} \mid \Omega_{t-1})}{\sum_{S_t=1}^{K} \cdots \sum_{S_{t-m}=1}^{k} f(\pi_t \mid S_t, \ldots, S_{t-m}, \Omega_{t-1}) \cdot P(S_t, \ldots, S_{t-m} \mid \Omega_{t-1})}$$

$$= \frac{f(\pi_t \mid S_t, \ldots, S_{t-m}, \Omega_{t-1}) \cdot P(S_t, \ldots, S_{t-m} \mid \Omega_{t-1})}{f(\pi_t \mid \Omega_{t-1})} \qquad \ldots \quad (4.6)$$

for t = 1, 2, . . . , T . Given initial values, $P(S_t, S_{t-1}, \ldots, S_{t-m} \mid \pi_0)$, we can calculate $P(S_t, S_{t-1}, \ldots, S_{t-m} \mid \Omega_{t-1})$ by using (4.5) and (4.6) iteratively, as discussed in Kim and Nelson (1999). Now to determine the initial values, $P(S_t, S_{t-1}, \ldots, S_{t-m} \mid \pi_0)$, we first note that if we further assume that $P(S_{-j} \mid S_{-j-1}, S_{-j-2}, \ldots, \pi_0) = P(S_{-j} \mid S_{-j-1}) \equiv P_{S_{-j-1}S_{-j}}$, for j = 0, 1, 2, . . ., then we have: $P(S_1, S_0, S_{-1}, \ldots, S_{-(m-1)} \mid \pi_0) = p_{S_0S_1} \cdot p_{S_{-1}S_0} \cdots p_{S_{-(m-1)}S_{-(m-2)}} \cdot P(S_{-(m-1)} \mid \pi_0)$.

Given the m terms of transition probabilities $p_{S_0S_1} \cdot p_{S_{-1}S_0} \cdots p_{S_{-(m-1)}S_{-(m-2)}}$, we have to determine k values for the $P(s_{-(m-1)} \mid Y_0)$ term for the k possible states of $s_{-(m-1)}$. The easiest approach is to assume they are some given constants such as the same number $k-1$ for each of them. Hamilton (1994) also provides an alternative way to find these initial values, i.e. to consider these as fixed parameters just like the way the transition probabilities p_{St-1st} are assumed to be fixed parameters. Therefore, this approach starts the filter at time t =1, and the initial values are obtained from ordinary least square regression. Once the coefficients of the model are estimated using an iterative maximum likelihood procedure and the transition probabilities are generated, it can provide an easy way to use the algorithm in Kim and Nelson (1999) to derive the filtered probabilities for S_t using all the information up to time *t*.

5. THE RESULTS

This section provides a discussion of the main results based on calibration of the theoretical model and estimation of regime switching models of inflation and economic growth. Calibration results are presented in Appendix B, whereas estimation results are reported in Appendix C.

5.1. Calibration Results of the Theoretical Model

The deep parameter values for model calibrations are given in Table B1 of section B. Most of these parameter values are based on authors' calculations except that the share of governance in the production function is taken from Choudhary, *et al*. (2010). The parameter value of discount factor (ρ) is set in order to obtain historical mean of the nominal interest rate in the steady state which turns out to be 0.987 for Pakistan's case. The value of steady state growth (γ) is 6.0, which is calculated by taking long-run average of real GDP of the whole sample. Share of governance (β) in production function is set to be 0.25. The share of expenditure on public infrastructure (φ) is calculated by taking the ratio of total expenditure on public infrastructure to GDP which turns out to be 0.45. The share of public officials (bureaucrats) in the economy ($1-\Psi$) is calculated by taking the ratio of employed labor in public sector to total labor force and the obtained value is 0.25. The parameter of corruption (Φ) and governance (χ) are calculated from indices of bureaucratic corruption and governance. Using these parameter values, the theoretical model is calibrated recursively. The process of iteration is performed up to forty years, where the initial period is taken as 1970. It covers the full post-partition episode of Pakistan's economy.[10] Model simulation results for CPI inflation and real GDP growth are given in Table B2 and Figures B1, B2 and B3 of Appendix B. These results show that simulated series of the theoretical model closely mimic the actual series. The subsample results across different political regimes are also robust. It confirms the implications of the theoretical model that when any autocratic regime comes into power macroeconomic fundamentals tend to improve with slowdown in inflation, robust growth, and lower bureaucratic corruption due to good governance. But in the case of democratic regimes, these results are reversed: governance becomes weak with increase in the level of corruption. Also, the elected governments tend to rely more on seigniorage to finance their expenditures with adverse consequences for inflation and growth. The model calibration results also indicate that the model is quite suitable for analysing the inflation dynamics in Pakistan: within sample inflation predictions outperform growth predictions which implies that inflation in Pakistan is more sensitive to political instability, corruption and poor governance.

[10] East, West Pakistan separation.

5.2. Estimation Results of Regime Switching Models

The estimation results[11] of regime switching models (RSM) are reported in Table C1. Both econometric models of inflation and economic growth are subdivided into two forms: one with corruption and second with governance. This is due to computational simplicity as parameters associated with these variables are varying (not fixed) subject to regime change. It reduces computational complexity in terms of state selection and also provides independent smoothed probabilities at high and low frequencies across sub political regimes. The parameters associated with all other explanatory variables are treated as fixed and their estimated values can be interpreted in the usual way.

The first term in all RSMs is intercept which is insignificant in all the cases. It indicates the fitness of these RSMs showing that there are minimum risks of omitted variable bias. The per capita output growth is negatively related with CPI. The estimates of agriculture output shares in inflation regressions also provide similar results. In case of growth models, these results are robust. The estimation results of growth model show that Inflation contributes negatively to output growth. It implies that to have sustained output growth, inflation should be curtailed at non-harmful levels.

Trade openness estimates in the case of inflation models appear are positive and significant. One possible interpretation may be the higher propensity of imports which may put pressure on balance of payment position through the trade account. Worsening of balance of payment position means depreciation of local currency and hence ends up with high inflation. Similarly, estimation results of growth models show trade openness as a positive and significant determinant of output growth, because it is associated with productivity improvements resulting from enhanced competitiveness.

The results of RSM1 and RSM2 show that Inflation is positively related to nominal exchange rate and negatively to output growth. Again being a net importer, any depreciation of local currency will have an adverse impact on inflation and economic growth. The government borrowing ratio is positively associated with inflation and negatively with output growth. The higher is the government borrowing from the domestic financial sector the higher will be the crowding out of the private sector resulting in low economic activity and low level of output growth.

The fiscal balance ratio is negatively related to inflation which basically shows that higher deficit is accompanied with higher inflation. As with the majority of developing countries, due to lower credit rating in international market, the main source of financing the fiscal deficit is borrowing from internal sources. Higher fiscal deficit affects the rate of inflation in two ways; first by directly increasing inflation and, second by increasing the government borrowing which in turn impacts the rate of inflation. But surprisingly, it has a negative association with output growth which means that higher fiscal deficit will bring a higher level of output growth. The fiscal balance ratio is statistically significant in the model but its contribution in explaining output growth is marginal.

[11]MATLAB package MS-Regress [developed by Marcelo Perlin (2009)] is used to estimate Multivariate Markov-Regime Switching models with Maximum likelihood procedures. This toolkit is freely available on internet on the following link: www.mathworks.com [Reference: Parlin (2009). *MS-Regress: A package for Markov-Regime Switching Models in MATLAB*. Matlab central: File Exchange].

The private sector credit is negatively associated with inflation, which shows that private sector credit stimulates output which helps in curtailing inflation. This result is in contrast with earlier findings. Although private sector credit is statistically significant but its contribution in the explanation of inflation in the model is marginal. The private sector credit is positively related to output growth showing that access to the financial resources stimulates economic activity and hence output growth.

As Pakistan is a net oil importer, inflation is positively related to international oil prices. The estimation results of inflation models confirm this scenario. Due to scarce financial resources, any hike in international oil prices is passed on to domestic consumers leading to higher cost of transportation and increase in prices of consumer items. Similar to the estimates of the inflation model, the growth model estimates show that international oil prices are negatively associated with economic growth.

Inflation is positively associated with central bank governor turnover, which means that frequent changes in the top leadership of the central bank could be inflationary. One possible interpretation of this positive relationship may be the validity of fiscal dominance hypothesis that potentially undermines central bank policy decisions on price stability. Output growth is positively related to human capital which is in line with the predictions of the endogenous growth models. A well-educated and skilled human capital can be instrumental in research and development, adoption of new technology and productivity improvements resulting in higher output growth.

The regime switching estimates of corruption in the case of inflation model show positive linkages with inflation both in autocratic and democratic regimes. However, in autocratic regime, its magnitude is negligible, whereas in democratic regimes corruption significantly contributes towards high inflation. Similar results are found in the case of governance, which is negatively related to inflation in both the regimes. In autocratic regimes, high magnitude of governance implies a significant slowdown of inflation in such regimes. These dynamics can also be observed from Figure C1 and Figure C2 of Appendix-C, where Markov-regime switching probabilities of corruption and governance are plotted along with inflation. These figures show that democratic regimes are more vulnerable with high level of corruption and bad governance.

The results of growth model show a negative association of corruption with economic growth both in autocratic and democratic regimes. Corruption significantly declines economic growth in democratic regimes but autocratic regimes show insignificant results. Governance appears is positively related to economic growth in both the regimes. In autocratic regimes, high magnitude of governance implies a significant surge in growth process. These results are robust in the case of Markov-Regime switching plots which are shown in Figure C3 and Figure C4 of Appendix-C, where smoothing probabilities of corruption and governance are plotted with real GDP growth. These figures show that autocratic regimes tend to show better economic performance with robust economic growth, low level of corruption, and good governance.

Along with regime switching estimates, autoregressive coefficients (of order 1) of the inflation models show high persistence. Such high persistence means inflation takes a fair amount of time in changing its curvature. Once the economy enters in high inflationary period, sustained efforts are required to get the economy back to a low level of inflation. The level of corruption and poor quality of governance are the main determinants of high persistence rate in inflation indicating that both corruption and poor governance cause continuous distortions in market mechanisms and price structures making inflation stubborn. However, in the case of economic growth, low level of persistence in output is observed indicating that output is more vulnerable to different types of political regimes. Sustained output growth requires corruption free implementation of development activities which could only be achieved with good governance. These findings are consistent with the implications of the theoretical models.

6. CONCLUDING REMARKS

This study mainly focuses on analysing the consequences of political instability, governance and bureaucratic corruption on inflation and growth in the case of Pakistan. A representative agent model with micro-foundations and two Markov-Regime switching models of inflation and growth have been used. The analyses based on both these approaches show that high corruption along with weak governance cause high inflation and low growth. In an environment with weak governance, agents enhance their level of corruption resulting in leakages in public revenues and forcing the government to rely on seigniorage to finance public expenditures with adverse consequences for inflation and economic growth. Based on stylised facts, the paper shows that both corruption and poor governance typically coincide with political instability during the democratic regimes signifying the critical need to achieve political stability and to enhance the quality of governance for better economic outcomes.

APPENDIX-A

Table A1

Description and Sources of Selected Variables

S. No.	Variable	Description / Source
VAR1	CPI Inflation Rate	Overall domestic inflation. This series is the annual growth rates of consumer price index (CPI: base 2000=100) for Pakistan. Data source of this variable is FBS, Islamabad, Pakistan.
VAR2	Real GDP Growth	Real Gross Domestic Product (Real GDP). This series is the annual growth rates of Real GDP with base 2000-01. Data source of this variable is Pakistan Economic Survey, MOF, Islamabad, Pakistan.
VAR3	Per Capital Output Growth	Per capita output is calculated by taking ratio of Real GDP to total population. Then series is constructed by taking annual growth rates of per capita output. Data on total population is taken from Pakistan Economic Survey, Various issues, MOF, Islamabad, Pakistan.
VAR4	Trade Share	Trade Shares are computed by taking ratio of total trade (total exports + total imports) to nominal GDP. This series is taken as proxy of trade openness. Data on total exports and total imports are taken from FBS, Islamabad, Pakistan.
VAR5	Agriculture Output Share	Agriculture output shares are calculated by taking ratio of total agriculture output to real GDP. Data on agriculture output is taken from Pakistan Economic Survey, MOF, Islamabad, Pakistan.
VAR6	Exchange Rate	Bilateral nominal Exchange rate of Pakistan Rupees in terms of US Dollars. The data of this series is taken from the Statistics Department of the State Bank of Pakistan, Karachi, Pakistan.
VAR7	Government Borrowing Ratio	Government Borrowing ratio is computed by taking ratio of net budgetary borrowing to GDP. The data on net budgetary borrowing is taken from Statistics Department of the State Bank of Pakistan, Karachi, Pakistan.
VAR8	Fiscal Balance Ratio	Fiscal Balance Ratio is computed by taking ratio of total budget balance (total revenue - total expenditure) to nominal GDP. The data on fiscal balance is taken from Pakistan Economic Survey, various issues, MOF, Islamabad, Pakistan.
VAR9	Growth in Private Credit	The series is the annual growth rates of total private sector credit. Data of this series is taken from Statistics Department of the State Bank of Pakistan, Karachi, Pakistan.
VAR10	International Oil Prices	Data on international oil prices is taken from International Financial Statistics (IFS) of International Monetary Fund database.
VAR11	Human Capital	Data on Human capital formation is proxy by average year of schooling. Data source of this variable is Barro and Lee (2010).
VAR12	Central Bank Governor Turnover	This variable is proxy by a dummy variable. In this series, value 1 being assigned to all those years where governor turnover (State Bank of Pakistan) is taking place.
VAR13	Index of Corruption	Index of Corruption is taken from Barro (1991) and International Country Risk Guide (ICRG) database. This index is ranked from 0 to 10. Low index value of corruption shows high level of corruption.
VAR14	Index of Governance	Index of Governance is also taken from Barro (1991) and International Country Risk Guide (ICRG) database. This index is ranked from 0 to 10. Low index value of governance shows poor level of governance.

Note: MOF: Ministry of Finance; FBS: Federal Bureau of Statistics.

Table A2

Descriptive Statistics of Selected Variables Included in Regime Switching Regressions

S. No.	Variables	Mean	Median	Maximum	Minimum	Variance	Std. Dev.	Kurtosis	No. of Obs.
1.	CPI Inflation Rate	7.45	6.04	27.98	–3.23	31.96	5.65	5.08	61
2.	Real GDP Growth	4.94	5.03	9.83	–1.33	5.53	2.35	–0.44	61
3.	Per Capital Output Growth	2.25	2.18	7.78	–3.70	5.30	2.30	–0.12	61
4.	Trade Share	29.45	30.14	39.30	16.56	32.25	5.68	–0.58	62
5.	Agriculture Output	0.33	0.30	0.53	0.21	0.01	0.10	–1.04	62
6.	Exchange Rate	23.50	9.99	85.55	3.31	565.19	23.77	0.11	62
7.	Government Borrowing Ratio	7.97	3.10	25.32	–2.75	75.01	8.66	–1.12	62
8.	Fiscal Balance Ratio	–8.04	–8.25	–2.48	–15.80	7.41	2.72	0.02	62
9.	Growth in Private Credit	15.48	15.01	46.23	–13.82	109.33	10.46	1.01	61
10.	International Oil Prices	20.28	14.77	97.04	1.62	533.12	23.09	3.16	62
11.	Human Capital	2.18	1.83	4.90	0.85	1.59	1.26	–0.34	62
12.	Central Bank Governor Turnover	0.25	0.00	1.00	0.00	0.19	0.43	–0.55	62
13.	Index of Corruption	2.24	2.00	3.50	1.00	0.63	0.79	–1.02	62
14.	Index of Governance	3.89	3.88	6.53	1.04	4.96	2.23	–0.95	62

Table A3

Pairwise Correlation Matrix

	Var1	Var2	Var3	Var4	Var5	Var6	Var7	Var8	Var9	Var10	Var11	Var12	Var13	Var14
Var1	1.00	–	–	–	–	–	–	–	–	–	–	–	–	–
Var2	–0.05	1.00	–	–	–	–	–	–	–	–	–	–	–	–
Var3	–0.05	–0.21	1.00	–	–	–	–	–	–	–	–	–	–	–
Var4	0.43	0.02	0.09	1.00	–	–	–	–	–	–	–	–	–	–
Var5	–0.42	–0.13	–0.19	–0.72	1.00	–	–	–	–	–	–	–	–	–
Var6	0.27	–0.12	0.01	0.54	–0.76	1.00	–	–	–	–	–	–	–	–
Var7	–0.47	–0.04	–0.07	–0.66	0.72	–0.57	1.00	–	–	–	–	–	–	–
Var8	0.09	–0.11	–0.04	0.26	–0.32	0.57	–0.53	1.00	–	–	–	–	–	–
Var9	–0.16	0.42	0.37	0.00	–0.01	–0.13	0.09	–0.13	1.00	–	–	–	–	–
Var10	0.36	0.01	0.10	0.56	–0.71	0.82	–0.53	0.45	–0.04	1.00	–	–	–	–
Var11	0.32	–0.01	0.10	0.62	–0.85	0.97	–0.63	0.55	–0.05	0.87	1.00	–	–	–
Var12	0.23	–0.21	–0.19	0.05	–0.18	0.20	–0.11	–0.06	–0.16	0.18	0.19	1.00	–	–
Var13	–0.48	0.11	0.08	–0.38	0.53	–0.50	–0.76	–0.62	0.17	–0.53	–0.55	–0.25	1.00	–
Var14	–0.04	0.13	0.03	–0.29	0.42	–0.67	0.58	–0.58	0.07	–0.44	–0.61	–0.03	0.44	1.00

Table A4

List of Pakistan's Political Regimes

Regime*	Duration	Type**	President / Governor	Prime Minister(s)
1	Oct 19, 1951 to Aug 07, 1955	Democratic	Malik Ghulam Mohammed	Khawaja Nazimuddin / Mohammad Ali Bogra
2	Aug 07, 1955 to Oct 27, 1958	Autocratic	Major General Iskandar Mirza	Chaudhry Mohammad Ali / Hussain Shaheed Suharwardy / I.I. Chundrigar / Malik Feroze khan Noon
3	Oct 27, 1958 to Mar 25, 1969	Autocratic	Field Marshal Mohammad Ayub Khan	Post Abolished
4	Mar 25, 1969 to Dec 20, 1971	Autocratic	General Agha Mohammad Yahya khan	Nurul Amin
5	Dec 20, 1971 to Aug 14, 1973	Democratic	Zulfikar Ali Bhutto	Post Abolished
6	Aug 14, 1973 to Sep 16, 1978	Democratic	Chaudhry Fazal Illahi	Zulfikar Ali Bhutto
7	Sep 16, 1978 to Aug 17, 1988	Autocratic	General Mohammad Zia-ul-Haq	Muhammad Khan Junejo
8	Aug 17, 1988 to Jul 18, 1993	Democratic	Ghulam Ishaq Khan	Benazir Bhutto /Ghulam Mustafa Khan Jatoi /Mian Mohammad Nawaz Sharif/Balakh Sher Mazari/Mian Mohammad Nawaz Sharif
9	Jul 18, 1993 to Nov 14, 1993	Democratic	Wasim Sajjad	Moin Qureshi
10	Nov 14, 1993 to Dec 2, 1997	Democratic	Sardar Farooq Ahmad Khan Leghari	Benazir Bhutto / Malik Miraj Khalid/Mian Mohammad Nawaz Sharif
11	Dec 2, 1997 to Jan 1, 1998	Democratic	Wasim Sajjad	Mian Mohammad Nawaz Sharif
12	Jan 1, 1998 to Jun 20, 2001	Democratic	Justice (Ret.) Rafique Tarrar	Mian Mohammad Nawaz Sharif
13	Jun 20, 2001 to Aug 18, 2008	Autocratic	General Parvez Musharraf	Mir Zafarullah Khan Jamali / Chuadhary Shujaat Hussain / Shaukat Aziz
14	Aug 18, 2008 to Sep 9, 2008	Democratic	Muhammad Mian Soomro	Muhammad Mian Soomro / Syed Yousaf Raza Gillani
15	Sep 9, 2008 to Dated	Democratic	Asif Ali Zardari	Syed Yousaf Raza Gillani

Notes: Khan and Saqib (2011). Shaded rows represent autocratic regimes.

*Our data sample starts from 1950. Therefore, we have excluded initial two regimes, [Aug 14, 1947 to Sep 11, 1948, Governor: Quaid-e-Azam Mohammed Ali Jinnah] and [Sep 14, 1948 to Oct 19, 1951, Governor: Khawaja Nazimuddin].

**Type of political regimes is specified on the basis of the selection of presidents where autocratic type indicates military regime.

Table A4

APPENDIX – B

CALIBRATION RESULTS OF THEORETICAL MODEL

Table B1

Parameter Values for Calibration

Parameter	Description	Value	Source
ρ	Discount Factor	0.987	Author's Calculations
γ	Steady State Growth Rate	6.000	Author's Calculations
β	Share of '*G*' in production function	0.250	Choudhary *et al.*, (2010)
φ	Share of expenditure on public infrastructure	0.450	Author's Calculations
$(1-\psi)$	Share of Public Officials in the economy	0.250	Author's Calculations based on Labor Survey Data
Φ	Parameter of Corruption	[0,10]	Recursive calculation based on Index of Corruption
χ	Parameter of Governance	[0,10]	Recursive calculation based on Index of Governance

Table B2

Model Calibration Results

Regime*	RGDP Growth (Actual)	RGDP Growth (Simulated)	CPI Inflation (Actual)	CPI Inflation (Simulated)
4	5.35	8.61	3.80	3.76
5	3.67	8.66	6.70	5.97
6	4.87	5.80	16.69	9.25
7	6.45	7.48	7.27	7.08
8	5.12	5.63	9.30	9.36
9	2.44	5.38	9.83	9.61
10	4.69	4.54	11.72	11.56
11	2.17	5.94	9.81	9.27
12	3.48	5.37	5.39	4.88
13	5.45	6.11	6.57	6.19
14	3.68	6.20	12.00	8.23
15	2.62	4.48	15.43	12.03

Note: For list of regimes, please refer Table A4.

Fig. B1.

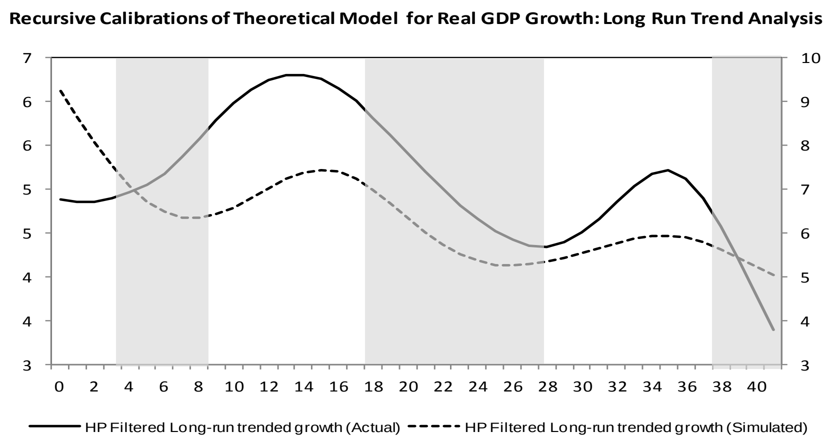
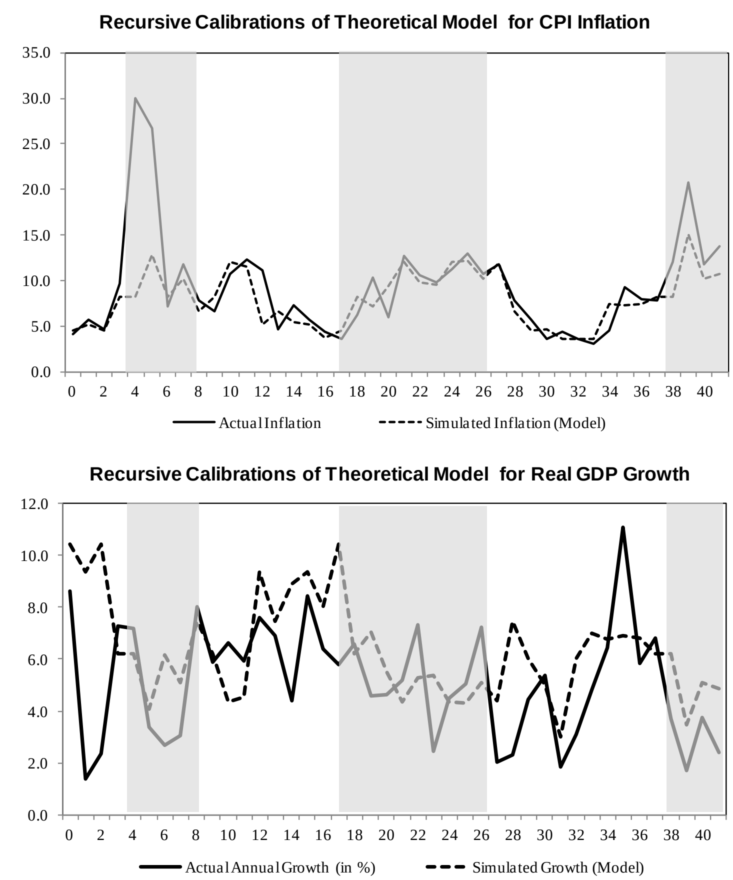


Fig. B2.



Notes: Shaded area in these figures represent democratic regimes.
Horizontal axis shows annual periods (starts from 1970).

APPENDIX – C

REGIME SWITCHING MODELING RESULTS

Table C1

Estimation Results Based on Regime Switching Modeling Approach

	RSM1	RSM2	RSM3	RSM4
	Dependent Variables			
Regressors with Fixed Coefficients	CPI Inflation Rate	CPI Inflation Rate	Real GDP Growth	Real GDP Growth
Intercept	0.061	0.064	0.051	0.053
	(0.184)	(0.196)	(0.152)	(0.183)
CPI Inflation Rate	–	–	–0.049	–0.057
	–	–	(0.047)	(0.034)
Real GDP Growth	–	–	–	–
	–	–	–	–
Per Capital Output Growth	–0.124	–0.119	–	–
	(0.031)	(0.027)	–	–
Trade Share	0.314	0.268	0.081	0.072
	(0.117)	(0.023)	(0.053)	(0.061)
Agriculture Output Share	–0.247	–0.133	–	–
	(0.098)	(0.071)	–	–
Exchange Rate	0.063	0.052	–0.012	–0.014
	(0.030)	(0.028)	(0.009)	(0.011)
Government Borrowing Ratio	0.307	0.249	–0.032	–0.028
	(0.075)	(0.064)	(0.015)	(0.014)
Fiscal Balance Ratio	–0.192	–0.271	–0.097	–0.084
	(0.026)	(0.037)	(0.051)	(0.044)
Growth in Private Credit	–0.087	–0.081	0.094	0.089
	(0.069)	(0.064)	(0.030)	(0.026)
International Oil Prices	0.081	0.076	–0.014	–0.017
	(0.029)	(0.021)	(0.008)	(0.010)
Human Capital	–	–	0.0314	0.028
	–	–	(0.012)	(0.011)
Central Bank Governor Turnover	0.027	0.025	–	–
	(0.016)	(0.014)	–	–
AR(1)	0.586	0.421	0.042	0.038
	(0.049)	(0.043)	(0.014)	(0.013)
Regressors with Regime Switching coefficients				
Avg. regime switching estimates of Corruption on autocratic regimes	–0.012	–	0.034	–
	(0.097)	–	(0.019)	–
Avg. regime switching estimates of Corruption on democratic regimes	–0.109	–	0.019	–
	(0.039)	–	(0.011)	–
Avg. regime switching estimates of governance on autocratic regimes	–	–0.063	–	0.064
	–	(0.016)	–	(0.021)
Avg. regime switching estimates of governance on democratic regimes	–	–0.021	–	0.020
	–	(0.041)	–	(0.008)
Avg. Probability of autocratic Regime Switching States	0.92	0.91	0.93	0.92
Avg. Probability of democratic Regime Switching States	0.95	0.94	0.94	0.92
Avg. Duration of Autocratic Regimes	35	35	35	35
Avg. Duration of Democratic Regimes	29	29	29	29
Final Log Likelihood Ratios	–169.24	–168.48	–126.76	–127.23

Note: Standard Errors are given in parentheses.

Fig. C1. Markov Regime Smoothed Probabilities (Inflation Rate and Corruption Case)

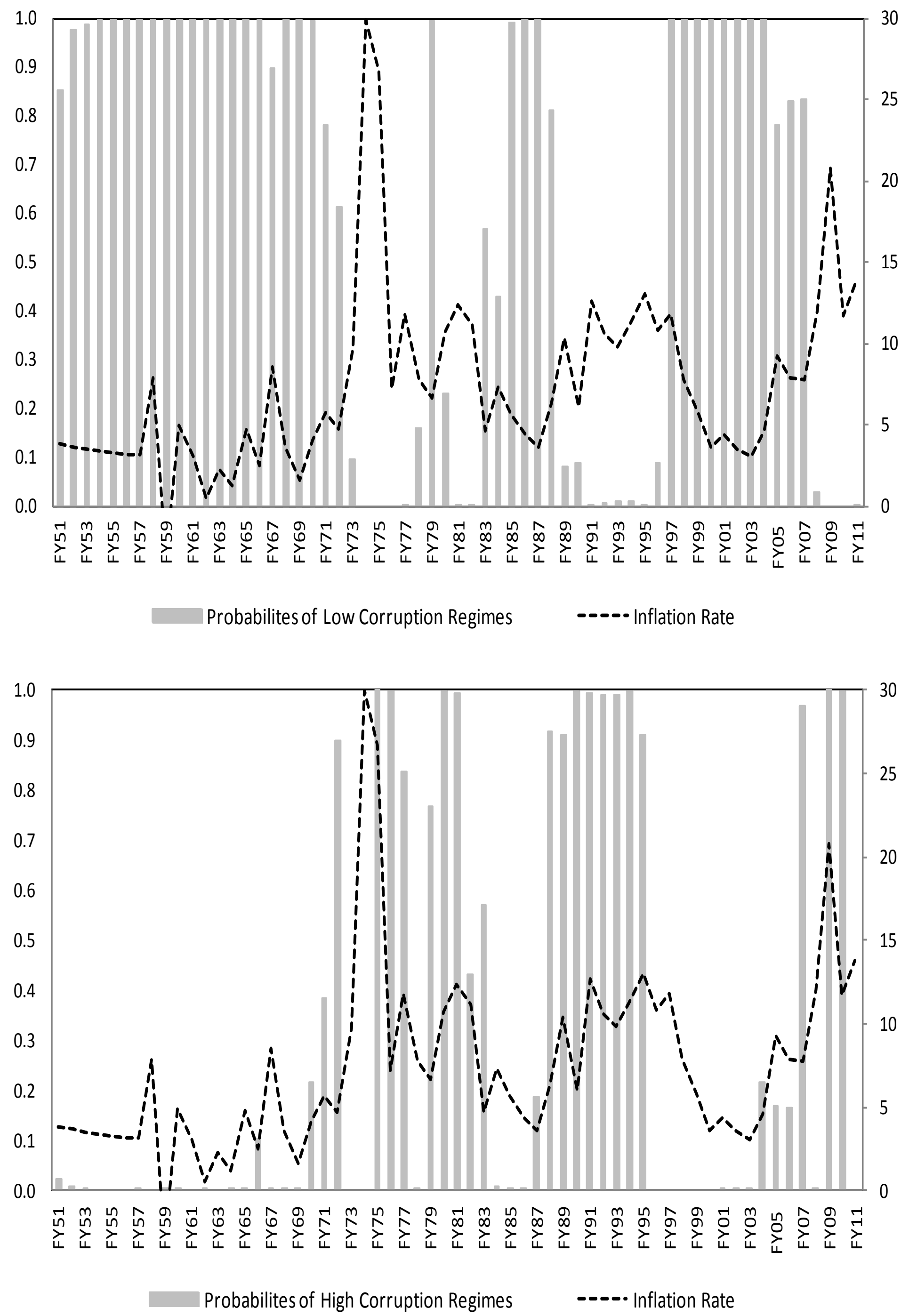


Fig. C2. Markov Regime Smoothed Probabilities (Inflation Rate and Governance Case)

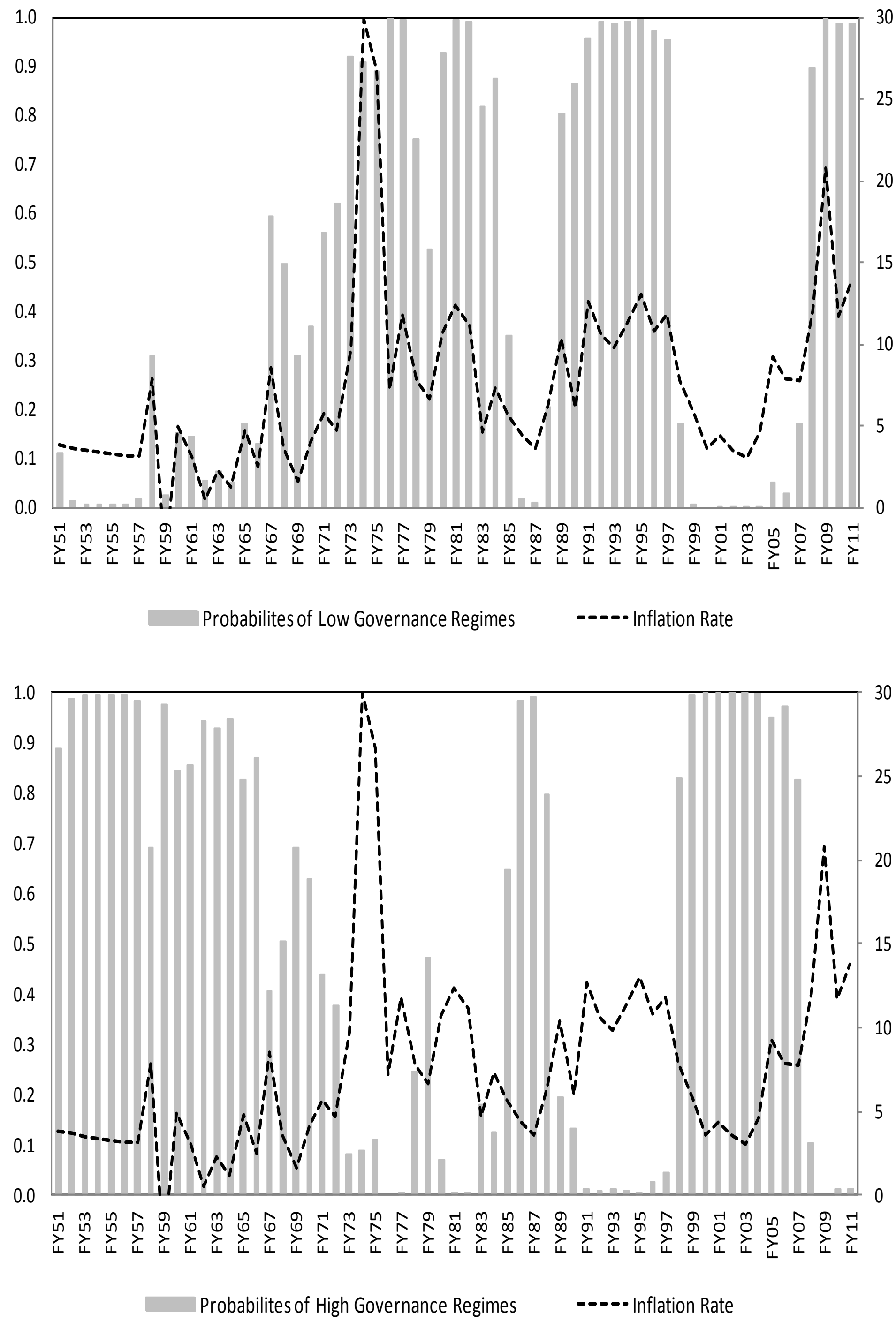


Fig. C3. Markov Regime Smoothed Probabilities (Output Growth and Corruption Case)

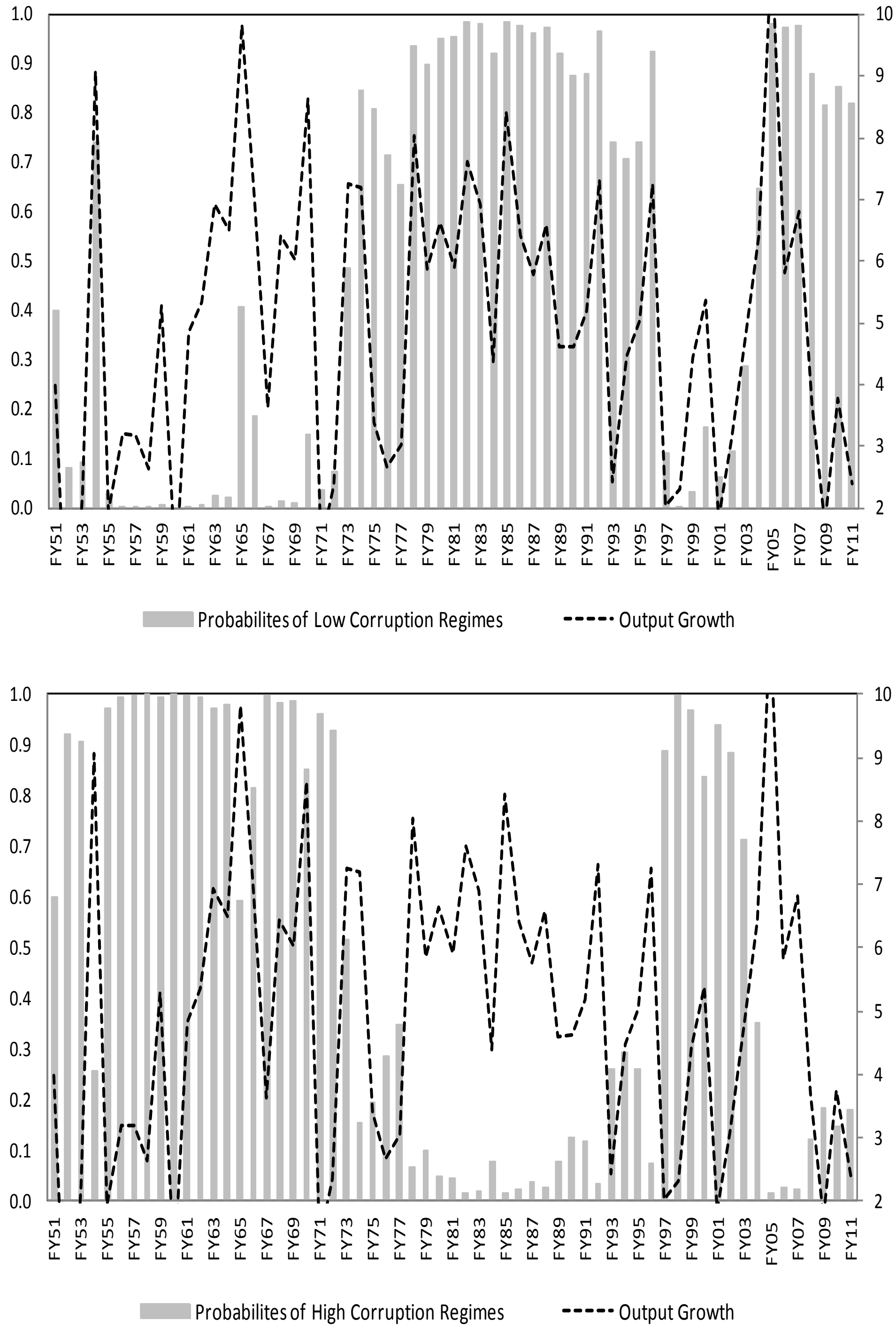
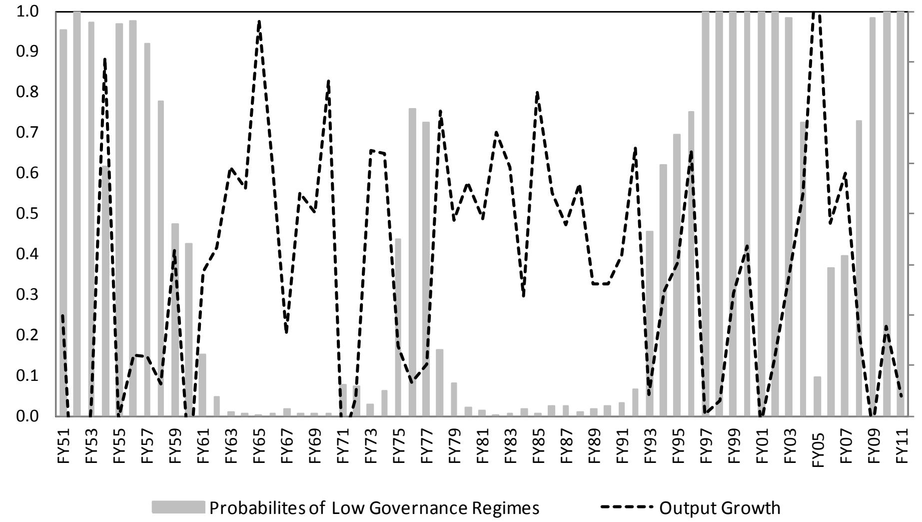
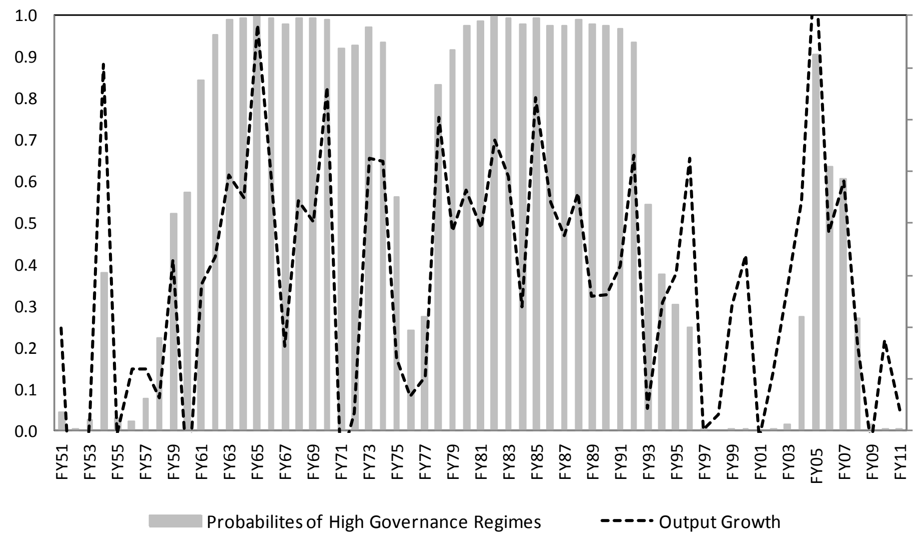


Fig.C4. Markov Regime Smoothed Probabilities (Inflation Rate and Governance Case)





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Predation, Institutional Quality and Economic Growth

SAJAWAL KHAN and IDREES KHAWAJA

1. INTRODUCTION

Large disparity exists among the per capita income of the countries'. World's average per capita income was USD 9,238 in 2010. The average per capita income of the 20 poorest and the 20 richest countries, in 2010, respectively were: USD 913 and USD 46,734—the disparity is hard to miss.[1] Thus an average person, living in high income countries of the world is earning about 50 times more than what the average individual earns in low income countries. Pakistan, with per capita income at USD 1,030 stood close to the 20 poorest countries in 2010. Though some of the economies like South Korea and China have shown good economic performance in recent history, many remain stagnant or have even deteriorated over time.

Negative correlation between inflation and per capita income growth, which is contrary to conventional wisdom, is a characteristic feature of the poor countries. Moreover while inflation is significantly higher in poor countries the per capita GDP growth in these countries is much lower than that of the high income countries. The questions then are: Why some economies grow slower than others and exhibit low steady state equilibrium? Why convergence does not take place as the conventional wisdom anticipates? Do conventional economic policies which have proved a success in developed economies work in poor countries as well?

These questions remain unsettled despite different theories having been put forth to explain the divergence in economic growth among the economies. Recently the role of institutions and governance, once an ignored topic, has gained currency as an explanation of differences in economic growth among countries and regions [Chang (2010)]. Better institutions and good governance are the driving force behind high and sustained economic growth. This view dominates all other explanations despite the unsettled debate over the direction of causality between institutions and growth [see for example, Acemoglu, *et al.* (2005) and North (2005)].[2] Traditional policies that have worked well in developed countries have failed to show their

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[1]The data is from http://data.worldbank.org/indicator/NY.GDP.PCAP.PP.CD.

[2]The institutions have been defined along a broad spectrum. Most widely cited definition in literature is from North (1981) "a set of rules, compliance procedures, and moral and ethical behavioural norms designed to constrain the behaviour of individuals in the interests of maximising the wealth or utility of principals". We define Institution more broadly to include the attitude of society or social system governing the overall behaviour of society. For (economic) governance we use the definition given by Dixit (2009) "the structure and functioning of the legal and social institutions that support economic activity and economic transactions by protecting property rights, enforcing contracts, and taking collective action to provide physical and organisational infrastructure".

magic in the developing and poorer countries. The failure, it is argued, is owed to weak institutions and poor quality of governance, a norm in these countries.

The institutional vacuum that exists in the developing world has provided room for parasitic behaviour. The parasites, though enjoying entrepreneurial potential do not contribute to production. They feed themselves on the profits of other entrepreneurs through illegal activities. Though the parasites can be found in industrialised countries too, they are more rampant and dangerous in developing countries. These parasites include regular thieves, transformed rebel groups, middlemen, politicians, job shirkers in public sector, rent seekers, free riders and even those who earn more than what they rightfully deserve. In countries like Pakistan activities such as theft, robbery, bribery, *bhatha* (extortion), *chanda* (forced charity) and hoarding etc. are widespread. Such activities typically take place under the umbrella of those who wield *dejure* as well *defecto* power (e.g. powerful political, ethnic and religious groups). The absence or weaknesses of the institutions help flourish all kinds of parasitic activities. Good institutions curb parasitic activities by effectively protecting property rights, enforcing rule of law and by affording social and economic justice. In Pakistan 15,135 kidnapping, 19,943 robberies, 14,943 burglaries, and 36,023 theft cases were reported only in 2008.[3] Pakistan's ranking on institutional quality indicators like government effectiveness, rule of law and corruption is below the South Asian average. The country's rankings for government effectiveness and rule of law or close to the rankings of the least developed countries while the ranking for control corruption is even worse than that of the LDC.[4] A look at per capita growth, inflation and institutional quality across countries suggest that the countries with good institutional quality have higher per capita GDP and lower inflation.

A limited literature attempts to model parasitic behaviour that seeks to explain the divergence in growth pattern among different countries and the vicious circle of poverty observed in many countries. These models are mainly derived from Murphy, *et al*. (1989) where the degree of industrialisation is function of the size of the market and vice versa. Melham, *et al*. (2003) embeds predatory activities within a dynamic general equilibrium model of industrialisation. Predation in their model lowers profitability of the producers

Table 1

Per Capita Income, Inflation, and Governance Indicators

Indicators	20 Richest Countries (Average)	20 Poorest Countries (Average)	South Asian Countries (Average)	Pakistan
Per Capita GDP*	USD 46,734	USD 913	USD 3,586	USD 2,674
Per Capita GDP* Growth	4.4%	3.6%	5.9%	3.5%
Inflation Rates	1.4%	6.3%	8.8%	13.9%
Correlation between Inflation Per Capita GDP Growth	0.46	–0.46	0.0007	–0.16
Government Effectiveness	1.55	–0.95	–0.32	–0.16
Rule of Law	1.42	–0.95	–0.42	–0.77
Control of Corruption	1.67	–0.73	–0.50	–1.10

Source: World Bank (these statistics are for 2010 only).

Note: Values of institutional quality indicators lie between –2.5 and +2.5. * GDP per capita based on purchasing power parity.

[3]*Source*: Federal Bureau of Statistics.

[4]Data is available at http://info.worldbank.org/governance/wgi/sc_country.asp

and hence reduces the investment and national income. They show how economies may fall into vicious circle of poverty and predation. Their model also predicts that probability of a society making an exit from the vicious circle depends on the flow of new entrepreneurs into the production club.

North (1990) argues that the problem of switching institutional path is analogous to technological changes. In this spirit, the increasing returns to institutions due to specialisation and accumulation of knowledge make the switching behaviour costly and unattractive. Murphy, *et al*. (1991, 1993) and Acemoglu (1995) discuss how and when parasitic behaviour may yield rewards greater than entrepreneurship. If the institutions are weak it is more likely that more talented individuals will choose to be predators rather than producers. This situation allows for the existence of multiple equilibria within general equilibrium framework. The outcomes would hence be different in different social systems (or institutional set up?) Using this approach number of studies show how a society falls into poverty trap [for example Acemoglu (1995), Grossman and Kim (1995, 1998 and 2002)]. Grossman (2002) shows that the existence of some central authority, that enforces property rights, is beneficial for predators as well as for producers. Norris and Freeman (2004) developed a model with endogenous enforcement and showed that identical initial conditions may yield different equilibria depending upon the presence or absence of predation. Nuun (2005) formulates a sequential game, on similar lines, to explain the existence of underdevelopment in Africa. Wilhite (2006) has studied different types of protection against predation by applying agent-based computational economics. Amegashie (2008) shows how unequal income distribution induces predatory behaviour in poor segments of society.

The main objective of this study is to develop a model showing how parasitic behaviour reduces national income level and its growth through inefficient utilisation of existing resources. We have made an attempt to show that how weak institutions cause parasitic behaviour which throws the economy into low growth trap. We also show how inferior technology and low productivity aggravates this situation by increasing the returns of the parasites. More specifically, this paper is an attempt to answer questions like; what are the conditions under which appropriative activities become more lucrative than productive ones and how these activities can be minimised to increase aggregate output and hence social welfare.

Rest of the paper is organised as follows: The theoretical model and its implications under different scenarios are presented in Section 2. The Section 3 is devoted to discussion of results and Section 4 concludes the study.

2. THE MODEL

The limitation of the general equilibrium models is that these models allocate resources only among different productive activities and assume efficient distribution of output in a perfectly secured environment [Grossman (1998)]. In practice resources are also allocated to appropriative activities that damage the cause of production. Allocation of resources to appropriative activities is all together ignored in the general equilibrium models. Unfair appropriation of output reduces the rate of return on innovation and therefore discourages investment and technological progress. Given the failure to account for appropriative activities, the general equilibrium models fail to explain non-convergence and the divergence of growth path among the economies of globe.

We consider different scenarios to analyse the impacts of appropriative activities on individuals' consumption and overall welfare of the society. Our model is closer in spirit to Grossman (1998a, 1998b) but is different in the sense that we assume perfectly rational agents fully aware of all outcomes who are more concerned about absolute rather than relative consumption. This assumption rules out the possibility of Pareto sub-optimal equilibrium. Thus our model does not allow for sub-optimal equilibrium.[5]

To examine the influence of parasitic behaviour on national income and its growth, we assume that the parasites emerge from the common pool of entrepreneurs and that the parasites feed themselves on producers' profits. To establish the initial settings common to all cases described below suppose there are n potential producers each endowed with Λ_i units which can be used for production as well as predation. Each individual chooses to be either a producer or predator after comparing the level of consumption possible under either of the two activities. Each producer (*say i*th) can produce y_i units of differentiated consumable good. The producer consumes a part of the produce himself and the remaining is exchanged for consumable goods produced by others. The producer maximises the utility function given by Equation (1) subject to the budget constraint given by Equation (2).

$$U(c_1, c_{2,}, \ldots\ldots c_n) \qquad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \qquad (1)$$

$$C_i = \sum c_j = y_i \qquad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \qquad (2)$$

2.1. Case I: Identical Resource Endowments and Productivity of Agents

Given the initial setting described above, if all potential producers take part in the production process then aggregate output and consumption will be:

$$Y_1 = C_1 = ny_i \qquad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \qquad (3)$$

Now assume that m percent of n persons choose to become predators. The aggregate output and consumption, under some predatory activity will be:

$$Y_2 = C_2 = (n-m)y_i \langle Y_1 \qquad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \qquad (4)$$

and per capita consumption, will be:

$$c_i = (1-\phi)y_i \langle y_i \qquad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \qquad (5)$$

Where $\phi = m/n$

Suppose all the m predators appropriate a portion θ of aggregate output, then the consumption per predator would be:

$$c_j = \frac{\theta}{m}(n-m)y_i \qquad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \qquad (6)$$

and consumption per producer is:

$$c_i = (1-\theta)y_i \qquad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \qquad (7)$$

[5]Sub-optimality may occur in short run due to for example irreversibility of resources or agents make choice randomly.

The Pay-off matrix for the consumption of producers and predators is given in Table 2.

Table 2

		Player i	
		Producer	Predator
Player j	Producer	$c_i = y_i$, $c_j = y_i$	$c_i = (1-\phi)y_i$, $c_j =$ $c_i = (n-m)y_i$
	Predator	$c_i = (1-\phi)y_i$, $c_j = (1-\phi)y_i$	$c_i = 0$, $c_j = 0$

The pay-off matrix, given in Table 2, shows that in predation the pay-off from predation and production is equal but less than the case when predation is absent. There being no incentive to predate, predation is not likely to occur irrespective of the value of ϕ i.e., the ratio m/n. Equating consumptions from production and predation i.e., Equation (6) and Equation (7) we obtain:

$$\frac{\theta}{m}(n-m) = 1-\theta$$

$$\text{or} \quad \frac{\theta}{1-\theta} = \frac{m}{(n-m)} \qquad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (8)$$

Equation (8) states that given identical endowments of the producers and predators, the ratio of share of predators' to producers' in total output is equal to the ratio of number of predators to producers. Though predation is not likely to occur however if it does occur than the aggregate output under predation ($Y2$) would be less than the output under ideal conditions ($Y1$) [see Equation 4]. Similarly per capita consumption under predation would also be lesser (Equation 5). The reason is that a part of the output is appropriated by the predator without participating in the production process.

2.2. Case II: Identical Resource Endowments and Same Productive but Some Individuals have Comparative Advantage in Predation

Now assume that some agents enjoy comparative advantage in predation, for example they might have association with a criminal, ethnic group or a politician who may facilitate predation. In this case predator's consumption is not only greater than that of a producer's consumption ($c_i = (1 - \theta)\, y_i$) but his consumption is also higher than y_i— the consumption of an agent under ideal conditions i.e., under no predation at all. His consumption c_j would be:

$$c_j = \frac{\theta}{m}(n-m)y_i \geq y_i \rangle (1-\theta)y_i \qquad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (9)$$

$$\text{or} \quad \frac{\theta}{m}(n-m) \geq 1$$

Since $\theta \langle 1$ this implies that $(n–m) \rangle m$. This means that the number producers must be sufficiently large relative to the number of predators.

or $\theta(n-m) \geq m$

or $\theta \geq \dfrac{m}{(n-m)}$ … … … … … … … (10)

and $1-\theta \leq 1-\dfrac{m}{(n-m)}$ … … … … … … (11)

Using Equation (10) and (11) we obtain:

$$\frac{\theta}{1-\theta} \geq \frac{m}{(n-2m)} \rangle \frac{m}{n-m}$$

In this case the ratio of the 'shares' of the predators' to producers' in the total output is larger than ratio of the 'number' of predators to producers. In simple terms a small numbers of predators enjoy a larger share of the aggregate output. The pay-off matrix for consumption of producers and predators is given in Table 3.

Table 3

		Player i	
		Producer	Predator
Player j	Producer	$c_i = y_t$, $c_j = y_t$	$c_i = (1-\phi)\, y_i$, $c_j = (1-\phi)\, y_i$
	Predator	$ci = (1-\theta)\, yi$, $cj = \dfrac{\theta}{m}\ (n-m)\, y_i \geq y_i$	$c_j = 0$, $c_j = 0$

Thus when only some agents (but not all) enjoy comparative advantage in predation, it is profitable for individual i to be a producer and for individual j to be a predator. The agent j is the one who enjoys comparative advantage in predation. The Nash equilibrium in this case is the intersection of second last column and last row of Table 3. To conclude, if some agents enjoy a comparative advantage in predation than a small number of predators enjoy a major share of the aggregate output. Moreover aggregate output and per capita consumption would be less than what the output and consumption are under ideal conditions would be i.e., in the absence of predation.

2.3. Case III: Unequal Resource Endowments

We assume that r of n individuals are well endowed while $n–r$ are poorly endowed with productive resources. This could be due to factors like differences in accumulation of access to physical or human capital. We also assume that the well-endowed agent produce y_i while the poorly endowed produce αy_i where $\alpha \in (0,1)$.

If all the potential producers take part in production process then the aggregate output and consumption will be:

$$Y_1 = C_1 = ry_i + \alpha(n-r)y_i$$

or $$Y_1 = C_1 = [r + \alpha(n-r)]y_i$$

Here $$c_i = \begin{bmatrix} y_i \ \ if\ well\, endwoed \\ \alpha y_i \ \ if\ poorly\ endowed \end{bmatrix}$$

Now suppose *l* and *s* are respectively well endowed and poorly endowed agents and both choose to become predators. The aggregate output then is:

$$Y_2 = C_2 = [r - l + \alpha(n - r - s)]y_i \langle Y_1 \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (12)$$

Also assume that all *m* predators appropriate a portion θ of aggregate output. The consumption per predator would then be:

$$c_j = \frac{\theta}{m}[r - l + \alpha(n - r - s)]y_i \begin{bmatrix} \langle y_i \\ \rangle \alpha y_i \end{bmatrix} \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (13)$$

Here $m = l + s$. It is apparent from Equation 13 that predation is not profitable for well a endowed agent because consumption for him is the equal from predation and non-predation. This result is analogous to the case 1 discussed earlier. However, the poorly endowed individual can appropriate more from predation as compared to what he obtains from production. Therefore all well-endowed agents prefer to be producers while all poorly endowed agents prefer to be predators.[6]

Under unequal endowments, $l = 0$, $(n - r = s)$, therefore Equation (12) can be written as:

$$Y_2 = C_2 = ry_i \langle Y_1$$

$$c_i = (1-\theta)ry_i \qquad c_j = \frac{\theta}{s} ry_i$$

For predation to be profitable:

$$c_j = \frac{\theta}{s} ry_i \begin{bmatrix} \le (1-\theta)y_i \\ \rangle \alpha y_i \end{bmatrix}$$

This implies:

$$\frac{\theta}{s} r \rangle \alpha \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (14)$$

Equation (14) implies that smaller the value of α i.e., larger the differential between well-endowed and poorly endowed and smaller the ratio of poorly endowed to well endowed, the more profitable will it be for the poorly endowed to predate. The payoff matrix, under unequal endowments, is given in Table 4.

[6]To keep the analysis simple we have fixed the differential between endowments of well-endowed agents and poorly endowed agents.

Table 4

		Player i	
		Producer	Predator
Player j	Producer	$c_i = c_j = \begin{bmatrix} y_i \text{ if well endwoed} \\ \alpha y_i \text{ if poorly endowed} \end{bmatrix}$	$c_i = \frac{\theta}{m}[r - l + \alpha(n - r - s)]y_i$ $c_j = \begin{bmatrix} (1-\theta)y_i \text{ if well endwoed} \\ \alpha(1-\theta)y_i \text{ if poorly endowed} \end{bmatrix}$
	Predator	$c_i = \begin{bmatrix} (1-\theta)y_i \text{ if well endwoed} \\ \alpha(1-\theta)y_i \text{ if poorly endowed} \end{bmatrix}$ $c_j = \frac{\theta}{m}[r - l + \alpha(n - r - s)]y_i$	$c_i = c_j = 0$

It follows from this that poor outcomes commonly attributed to the predatory activities of the rich and to inequality are not attributable to inequality *per se* because, *citrus Paribas*, well-endowed individuals do not have an incentive to engage in predation. How, then, we explain the observed fact that well-endowed individuals do engage in predation. It is noteworthy, in this context, that the outcome just described considers only unequal endowments. If unequal endowments are considered together with comparative advantage in predation then the outcome would be different. Intuitively it is not difficult to visualise that, if unequal endowments are coupled with comparative advantage in predation, then the well-endowed would also enjoy an incentive to predate. This case has not been included here with rigour to avoid the complexity of analysis.

2.4. Collective Safeguard against the Appropriative Activities

(a) *Identical Resource Endowments, Some Individuals have Comparative Advantage in Predation*

Suppose a central authority exists which provides protection to producers from appropriative activities and each producer pays a portion say $\mu \in (0, 1)$ to buy protection. The cost of protection is increasing in ratio of the number of predators to producers i.e., $\frac{m}{n-m}$, output. Let us further assume that:[7]

$$\mu = \kappa\left(\frac{m}{n-m}\right) \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (15)$$

Here $\kappa \in (0, 1)$ is the speed/scale parameter. Let p be the probability that predator will be successful i.e. will predate but will escape penal action of any sort. Then the expected consumption of the predator and producer are given by:

$$c_j = p\frac{\Theta}{m}(n-m)y_i$$

$$c_i = p(1-\Theta)(1-\mu)y_i + (1-p)(1-\mu)y_i$$

[7]To simplify we ignore here the possibility of free riding.

Now equating consumption from predation and consumption from production and making use of Equation (15) we obtain:

$$(p\theta - 1)\mu^2 - (p\theta - 1)\mu - p\theta\kappa = 0$$

or

$$\mu = \frac{1}{2}\left\{1 - \sqrt{1 - \frac{4p\theta\kappa}{1 - \theta p}}\right\} \qquad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (16)$$

We can discard the root with positive sign because μ cannot be greater than 1. Equation (16) then implies that larger is the probability of successful predation (i.e., predating without facing penal action from any quarter) the higher will be the cost borne by the producer and lower will be aggregate consumption and social welfare.

(b) ***Unequal Resource Endowments***

The protection cost of poorly endowed agent is given by:

$$\mu_l = \kappa_l\left(\frac{s}{r}\right) \qquad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (17)$$

The expected consumptions of the poorly endowed individual from production and predation, under this scenario, respectively are:

$$c_i = p(1-\mu_l)(1-\theta)\alpha y_i + (1-p)(1-\mu_l)\alpha y_i \quad \text{and} \quad c_j = p\frac{\theta}{s} r y_i$$

Equating the consumption from production and predation and making use of Equation (17) we obtain:

$$\alpha(p\theta - 1)\mu_l^{\,2} - \alpha(p\theta - 1)\mu_l - p\theta\kappa_l = 0$$

or

$$\mu_l = \frac{1}{2}\{1 - \sqrt{1 - \frac{4p\theta\kappa_l}{\alpha(1 - \theta p)}} \qquad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (18)$$

Equation (18) is same as Equation 16 except that the endowment differential parameter appears under the square root sign. This means that larger the value of α i.e., smaller the endowments differential, lower will be the protection cost borne by the poorly endowed. The cost is even less than what the agents bear when the endowments are identical (Case 1). This is because the well-endowed have a greater share in production and therefore bear greater protection cost.

2.5. Redistribution of Resources

Let us assume that central authority to redistributes resources rather than spending on protection against predation. This could be through public spending on education of the poor or providing training to them to enhance their productivity.

Suppose a portion $\mu\langle\theta$ of each of the well-endowed agent's wealth is redistributed equally among the poorly endowed individuals so that consumption of both type of agents is equalised.[8] We then have:

$$(1-\mu)y_i = \left(\alpha + \mu\frac{r}{s}\right)y_i$$

Or

$$\mu = 1-\alpha\left(\frac{s}{r+s}\right) = 1-\alpha\left(\frac{s}{n}\right) \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (19)$$

In Equation (19) the proportion redistributed depends on the endowment differential (between the well-endowed and poorly endowed) and the share of poorly endowed in the total population. The redistribution not only results into high per capita consumption but is 'Pareto improvement' as well.

3. DISCUSSION

We examined the impact of predation on aggregate consumption and output under three different scenarios: (i) all agents have identical endowments and productivity, (ii) the agents have identical endowments and productivity but some agents enjoy comparative advantage in predation, (iii) endowments of the agents are unequal. Next we examined the cost of protection against predation under different scenarios and finally we demonstrated how aggregate consumption and output behaves in the face of redistribution from the well-endowed to the poorly endowed.

The theoretical model suggests that given identical endowments and productivity of the agents, in the absence of protection against predation, the level of consumption from production and predation will be equal but the output and consumption of the agents would be less than the case when there is no predation at all. So when the agents are equally endowed and have similar productivity then given equal payoffs from production and predation, there is no incentive to predate and therefore predation is less likely. This case is analogous to a competitive environment. The main feature of the next case that we examined is that some agents enjoy comparative advantage in predation. Agents are still assumed to possess identical endowments and productive capacity. We demonstrated, under this setting, that in the absence of collective safeguards against predation, it pays those with comparative advantage in predation, to predate. However predation is not beneficial for others who do not enjoy such a comparative advantage. We also showed that a greater part of the output under this scenario accrues to the predators. It is noteworthy here that richness is only one source of yielding comparative advantage in predation. There are number of other sources as well. In fact all sources of rent seeking yield the requisite comparative advantage. Examples include; closeness to *dejure* power who may influence outcomes in favour of some agents, *defecto* power enjoyed by criminals, and all those who somehow enjoy the ability to solve some collective action problem. Politicians, spiritual leaders and number of other individuals enjoy this ability. Next we demonstrated that given unequal endowments

[8]Redistribution is possible only in the case of unequal endowment.

it is beneficial for poorly endowed agents to engage in predation but not for the well-endowed. This raises the question how we may explain the common observation that well-endowed agents (rich in this case) do, in fact, engage in predation. The answer is that predation is not due to endowments differential (richness) *per se*, rather it is owed to the comparative advantage enjoyed by the agents in predation. It is another matter that more commonly the rich enjoys the requisite comparative advantage however they are not the only ones enjoying such advantage. We also showed that a central authority can provide protection against predation. We demonstrated that if some agents enjoy comparative advantage in predation, the cost of protection for producers will increase with increase in probability of predation. Moreover aggregate consumption and social welfare will decrease, with increase in probability of predation. Finally we demonstrated that redistribution from the rich to the poor increase per capita consumption and is a 'Pareto improvement'.

The most important result of this study is that it is not the inequality *per se* that encourages predation rather it is the comparative advantage in predation, which has many sources, that allows predation. Good quality institutions, like rule of law, effective government, security of property right and effective control over corruption can tame the comparative advantage that any agent may enjoy in predation. The lesser degree of predation observed in countries with high inequality but with good institutions supports this statement. The United States perhaps serves as an example to support this statement. Thus it is the institutional quality that determines the level of predation.

These results can be extended to the global level. The extremism, terrorism and other criminal activities that have effects across the globe, may be alleviated through redistribution from rich to the poor nations in term of technological transfer, investment in education and skill development. A check on powerful nations to restrain them from exercising their comparative advantage, which could be used to exploit the weaker nations, will also help in increasing aggregate output. One possible source of such restraint could be the strengthening international institutions like United Nation Organisation (UNO) and International Court of Justice etc.

4. CONCLUSIONS

Predation reduces aggregate output and per capita consumption. Those who predate enjoy comparative advantage in predation. Given inequality the poorly endowed will predate, on the other hand, the payoffs from production and predation being equal for the well-endowed, the well-endowed will not predate. However if the well-endowed (implying rich here) engage in predation, it would be due to their comparative advantage in predation and rather than the inequality *per se*. Good institutional quality, like rule of law, effective government, protection of property rights and control over corruption, curbs this comparative advantage and hence predation. Thus institutional quality determines predation. Therefore to increase aggregate output improvement in institutional quality is called for. Moreover redistribution from the well-endowed to the poorly endowed also increases per capita consumption and is a 'Pareto improvement' as well.

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Monetary Policy Announcements and Market Interest Rates in Pakistan: An Event Study Approach

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1. INTRODUCTION

The short term interest rates in the market are directly affected by the decision of Monetary Policy Committee. But, it also depends upon the expectations of market participants. If they have forward-thinking then their expectations towards policy rate will affect money market rates. It is an important aspect of MP transmission. The Participants of the market may predict the upcoming policy decisions if they have good understanding of MP. So, we can say that money market interest rates have some information about upcoming policy rate changes.

This fact has laid down the groundwork for a rich literature investigating the role of information in financial markets and macroeconomic announcement is an integral part of this information. Monetary policy announcement is one of the important macroeconomic announcements. FOMC (Federal Open Market Committee) has conducted eight regular meetings since 1981 in USA according to the pre-defined schedule. Similar is the case of UK and other developed economies. Many studies have analysed the effect of these meetings on market interest rates. In Pakistan, these meetings were conducted on irregular intervals but from 2005 onwards, monetary policy committee of the central board is conducting regular meetings. No one has analysed the impact of monetary policy announcements on market interest rates using event study methodology in Pakistan.

Andersen and Bollerslev (1998), Jones, Lamont, and Lumsdaine (1998), Berry and Howe (1994), Mitchell and Mulherin (1994), Ederington and Lee (1993), Cutler, Poterba, and Summers (1989), Roll (1988), Bomfim and Reinhart (2000), Kuttner (1999), Roley and Sellon (1998), Thornton (1998), Jensen and Johnson (1995) and Reinhart and Simin (1997) measured the financial market's reaction to monetary policy actions by following event study approach.

This study is an effort to add to the literature enlightening the impact of monetary policy announcements on interest rates by analysing the Pakistani markets. Pakistan is an

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emerging market and not been much studied. This study will be a value addition in this regard.

The objective of this study is to analyse the impact of monetary policy announcements on market interest rates at nine different maturities (1/Week, 2/Week, 1/Month, 3/Months, 6/Months, 9/Months, 1/Year, 2/Years and 3/Years) in Pakistan. As a first step of my analysis, We examined the impact of MP announcements on market interest rates at different nine maturities by using daily data from Jan. 2005 to Mar 2011 on discount rate and Karachi Inter Bank Offered Rate (KIBOR) by using event study methodology. The source of this daily data is State Bank of Pakistan. We constructed the economic impact of event by using market interest observed over relatively short time period. An 11-days event window (–5, 0, +5) with an estimation window of 250 days is applied for each event/announcement [MacKinlay (1997)]. Abnormal Rates were calculated by taking the difference of normal/forecasted rates and actual interest rates at different maturities prevailing in the market. So, the normal/forecasted rates were estimated by using GARCH and ARIMA (p,d,q) on the estimation window. Breusch Pagen ARCH Test was applied at the market interest rates of all maturities and GARCH model was applied for forecasting of six maturities (1/Week, 2/Week, 1/Month, 3/Months, 6/Months, 9/Months) having ARCH effect at 0.05. No ARCH effect was observed by applying Breusch Pagen ARCH Test at last three maturities (1-Year, 2-Years and 3-Years). ARIMA (p,d,q) was applied to measure the normal/forecasted rates at last three maturities. After finding the abnormal rates and their day-wise and event-wise aggregation, t-test was applied to check the null hypothesis that event has no impact on the market interest rates at nine different maturities.

2. LITERATURE REVIEW

Cook and Hahn (1989) is the prior study on the linkage between policy rate and the market interest rates using event study methodology. They used the following ordinary least squared to analyse the effect of policy rate in USA on market interest rates at different maturities on and around the day of change.

$$\Delta R_t = \beta_1 + \beta_2\, \Delta REF_1 + \mu_t$$

He concluded with the reverse proportion of rates and maturity.

Pederson (1997) concluded with a significant effect of Danish discount rate on the market rates. He further analysed a decline in this effect with maturity. Hardy (1998) reported the similar results and further decomposed the policy rates in expected and un-expected interest rates and then analysed their impact. This impact became stronger with this decomposition of policy rates into anticipated and un-anticipated rates. Hardy (1998) also reported sequentially smaller effects with the increase in asset's maturity.

Andersen and Bollerslev (1998), Jones, Lamont, and Lumsdaine (1998), Berry and Howe (1994), Mitchell and Mulherin (1994), Ederington and Lee (1993), Cutler, Poterba, and Summers (1989), Roll (1988), Bomfim and Reinhart (2000), Kuttner (1999), Roley and Sellon (1998), Thornton (1998), Jensen and Johnson (1995) and Reinhart and Simin (1997) measured the financial market's reaction to monetary policy actions by following event study approach.

Patelis (1997) conducted an event study by using Vector Autoregressive (VAR) model and arrived at the results, those were alike. He also reported a low illuminating power of MP. Conver, Jensen and Johnson (1999) analysed sixteen industrial economies and founded that markets also reacted to US monetary environment as well as local.

Jochen, Geoffery and Natalia (2005) studied the behaviour of emerging bond markets as a respond of macroeconomic announcements and concluded that all announcements had an impact on market interest rates volatility. Kashyap and Wilcox (1993) and Bernank and Blinder (1992) analysed a strong impact of a tightening the monetary policy on highly bank-dependant borrowing firms as the overall supply of credit is affected.

Agha, Ahmed, Mubarik and Shah (2005) analysed the transmission Mechanism of monetary policy in Pakistan by using Vector Autoregressive (VAR) and concluded that the linkage of monetary policy with the real sector is direct; that is, through the bank lending channel.

Thorton (1998) used event study methodology to study the impact of Federal Fund Rate (FFR) on the market interest rates by analysing only the event day. He concluded that market participant's expectations have more weightage in case of longer maturities and the direct liquidity is the major factor in case of short rates. Garfinkel and Thorton (1995) concluded that short term market interest rate is a good indicator of MP than the FFR. Dale (1993) analysed the reaction of market interest rates at seven different maturities against change in policy rate by using event study approach. He reported a significant impact on these interest rates having maturities from one month to five years and for both expected and un-expected rates.

Thorton (1986 and 1994), Cook and Hahn (1988), Rudebuch (1995), Dueker (1992), Paquet and Perez (1995) and Kuttner (2000) conducted the same studies with the findings of linkage between changes in policy rates and market interest rates in united states.

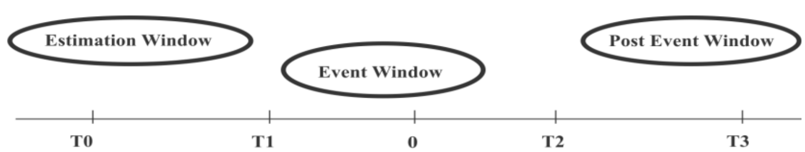
We will discuss Study Design and Methodology in Section 3. Section 4 will comprise of Data Analysis and Results and we will conclude it in Section 5.

3. METHODOLOGY

We used the event study approach with the following three steps;[1]

3.1. Event Window for the Study

The study constructed the economic impact of event by using market interest rates observed over relatively short time period. The time line for our event study is illustrated below;



Time Line for an Event Study

[1]Kaketsis and Sarantis (2006).

The Estimation and event windows should not overlap. If the event window is included in estimation of normal rates, then normal and abnormal rates both would capture the event impact. This would be problematic because the assumption of this methodology is that the event impact is captured by the abnormal returns only.

An 11-days event window (–5, 0, +5) with an estimation window of 250[2] days is used for each event/announcement [MacKinlay (1997)].

3.2. Determining the Impact of Intervention Rate

One method to determine the effect of policy rate on market interest rate is to run the following regression;

$$\Delta R_t = \propto_1 + \propto_2 \Delta(Intv) + \mu_t$$

Where:

ΔR_t → is the change in interest rates prevailing in the market at specific time t;
$\Delta(Intv)$ → is the respective change in policy rate at specific time t;

Here only the change in rates within event window will be used for this regression analysis. Estimation and Post event windows will not be included in this regression analysis. Dale (1993) and Kaketsis and Sarantis (2006) pointed out that for obtaining unbiased results of co-efficient β, other external factors should be included in this regression. As these missing explanatory variables can be qualitative, so it will be very difficult, if not impossible, to measure their impact in this regression analysis. They further pointed out that this analysis is limited with the number of observations only in event window so the results will not be significant. Cook and Hahn (1989) have used same regression analysis by using following equation;

$$\Delta R_t = \beta_1 + \beta_2 \Delta REF_1 + \mu_t$$

But, Dale (1993) suggested the mean responses of abnormal change and their aggregation within and across the event window which we applied here in our study.

3.3. Significance of Results

Kaketsis and Sarantis (2006) proposed not to compare policy rate changes directly with the rates observed over the sample. In case of event studies MacKinlay (1997) proposed the following three steps for measuring the significance of results.

3.3.1. *Calculating the Abnormal Rate*

The abnormal rates were calculated by taking the difference of actual interest rates and normal/forecasted rates at different maturities prevailing in the market within the event window. So, the normal/forecasted rates were estimated by using GARCH and ARIMA (p,d,q) on the estimation window after finding out the ARCH effect in market

[2]1st estimation window was for 94 days and 2nd for 195 days due to data structure while remaining estimation windows were for exact 250 days.

interest rate at each maturity. Breusch Pagen ARCH Test was applied at the market interest rates of all maturities. GARCH model was applied on the market interest rate having ARCH effect. In case of having no ARCH effect, unit root test was applied to check the stationary and then ARIMA (p,d,q) was applied for the forecasting of normal rates.

3.3.2. *Abnormal Rate-Aggregation*

Abnormal Rates must be aggregated across the days within event window (–5, –4, –3, –2, –1, 0, +1, +2, +3,+4, +5) and across the events.

3.3.2.1. Day-wise Aggregation

Let (–5, –4, –3, –2, –1, 0, +1, +2, +3,+4, +5) days are surrounding within event day. Aggregated Abnormal Rate (AAR) is here defined as the cumulative abnormal rate on the *nth* event for the *ith* market:

$$\mathrm{AAR}_{\mathrm{in}} = \sum_{\tau-5}^{\tau+5} \mathrm{AAR}_{\mathrm{in}}$$

Average of AAR_{in} is calculated as follows:

$$\overline{\mathrm{AAR}_{\mathrm{in}}} = \frac{1}{11}\sum_{\tau-5}^{\tau+5} \mathrm{AAR}_{\mathrm{in}}$$

3.3.2.2. Aggregation Across Event Window

As we were interested in the overall significance of results so we aggregated the abnormal returns across event windows.

We calculated CAC (Cumulative Abnormal Rate) for the interest rate *i* across all the events;

$$\mathrm{CAR}_{\mathrm{in}} = \sum_{n=1}^{N} \mathrm{AR}_{\mathrm{in}}$$

Then its average is calculated as follows:

$$\overline{\mathrm{CAR}_{\mathrm{in}}} = \frac{1}{N}\sum_{n=1}^{N} \mathrm{CAR}_{\mathrm{in}}$$

3.3.3. *Hypothesis Testing*

The study applies t-test to check the null hypothesis that event has no impact on the market interest rates by assuming that rates are distributed normally with zero mean. Jarque-Bera state and their respective p-values shows the normality of data (Table 1).

Table 1

Descriptive Statistics Sample: 1/02/2005 3/31/2011

	OW	TWW	OM	THM	SM	NM	OY	TWY	THY
Mean	10.52	10.44	10.69	10.99	11.23	11.50	11.68	11.92	12.12
Median	10.15	9.88	9.97	10.30	10.55	10.75	10.92	11.16	11.39
Maximum	15.68	14.91	14.90	15.52	15.76	16.02	16.11	16.19	16.30
Minimum	2.40	3.09	4.22	5.07	5.80	6.12	6.41	6.79	7.18
Kurtosis	4.18	3.17	2.62	2.56	2.58	2.52	2.57	2.51	2.52
Jarque-Bera	351.04	121.59	76.53	26.70	17.61	21.54	17.56	24.49	24.63
P-Value	**0.00***	**0.00***	**0.00***	**0.00***	**0.00***	**0.00***	**0.00***	**0.00***	**0.00***
Sum	23,986	23,814	24,382	25,056	25,608	26,213	26,630	27,177	27,641
Sum Sq. Dev.	10,750	11,453	11,586	11,239	10,394	10,693	10,233	9,627	9,126
Observations	2280	2280	2280	2280	2280	2280	2280	2280	2280

Following are the hypotheses of our study;

H_0: Abnormal Rates = Zeero
H_1: Abnormal Rates $\neq$ Zeero

4. ESTIMATION AND DISCUSSION OF RESULTS

Figures 1 and 2 shows that reaction of market rates is event specific and using regression analysis is unwise. So, here measuring the average change in abnormal rates within and across the event window will clarify the results.

Fig. 1. Event-wise Abnormal Rates

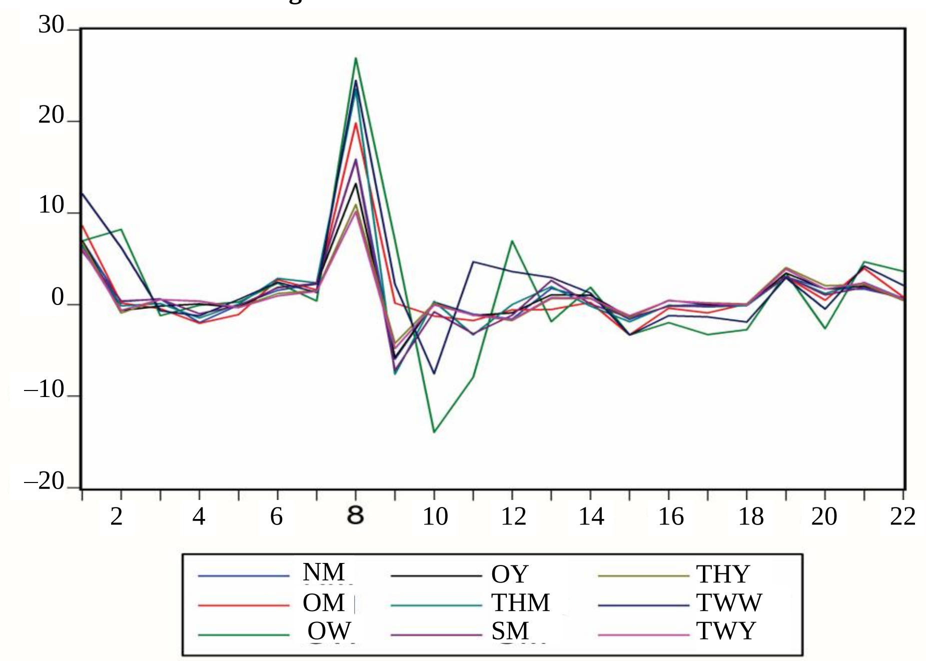
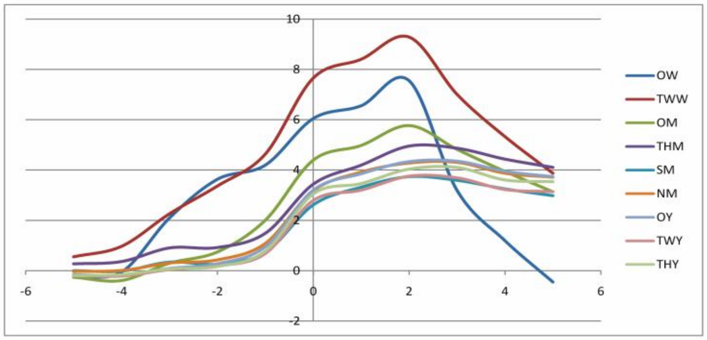


Fig. 2. Day-wise Abnormal Rates



The abnormal rates were analysed from two dimensions; within event window (where abnormal returns were analysed at (–5, –4, –3, –2, –1, 0, +1, +2, +3,+4, +5) and across the event window. Abnormal Rates were calculated by taking the difference of actual interest rates and normal/forecasted rates at different maturities prevailing in the market within the event window. So, the normal/forecasted rates were estimated by using GARCH and ARIMA (p,d,q) on the estimation window. Breusch Pagen ARCH Test was applied at the market interest rates of all maturities and GARCH model was applied for forecasting of six maturities (1/Week, 2/Week, 1/Month, 3/Months, 6/Months, 9/Months) having ARCH effect at 0.05 (Table 2).

Table 2

Breusch-Pagan ARCH Test

Adjusted Sample :	Jan 04, 2005 to Mar 31, 2011		
Included observations: 2278 after adjustments			
1-Week ARCH (1) Effect:			
F - Stat	51.90508	P - Value	0.00000
		P - Value (Chi-Squ)	**0.00000**
2-Week ARCH (1) Effect:			
F - Stat	31.07646	P - Value	0.00000
		P - Value (Chi-Squ)	**0.00000**
1-Month ARCH (1) Effect:			
F - Stat	16.17531	P - Value	0.00006
		P - Value (Chi-Squ)	**0.00006**
3-Month ARCH (1) Effect:			
F - Stat	8.80197	P - Value	0.00304
		P - Value (Chi-Squ)	**0.00305**
6-Month ARCH (1) Effect:			
F - Stat	8.33394	P - Value	0.00393
		P - Value (Chi-Squ)	**0.00394**
9-Month ARCH (1) Effect:			
F - Stat	4.13689	P - Value	0.04207
		P - Value (Chi-Squ)	**0.04205**
1-Year ARCH (1) Effect:			
F - Stat	1.91624	P - Value	0.16641
		P - Value (Chi-Squ)	0.16626
2-Year ARCH (1) Effect:			
F - Stat	0.05537	P - Value	0.81399
		P - Value (Chi-Squ)	0.81389
3-Year ARCH (1) Effect:			
F - Stat	0.08780	P - Value	0.76702
		P - Value (Chi-Squ)	0.76690

No ARCH effect was observed by applying BreuschPagen ARCH Test at last three maturities (1-Year, 2-Years and 3-Years). So, ARIMA (p,d,q) was applied to measure the normal/forecasted rates at last three maturities. Before moving towards the ARIMA (p,d,q) process, unit root tests were applied to clear the order of (d).

All of the market interest rates having no ARCH effect (1-Year, 2-Years and 3-Years) were integrated of orders one (Table 3).

Table 3

Test for Stationarity

	AD test Statistics		*Phillips-Perron Test Statistics*		*Kwiatkowski-Phillips-Schmidt-Shin test statistic*	
	Null Hypothesis: Variable is Nonstationary		Null Hypothesis: Variable is Nonstationary		Null Hypothesis: Variable is Stationary	
Maturities	*At Level*	*At 1st Diff.*	*At Level*	*At 1st Diff.*	*At Level*	*At 1st Diff.*
1-Year	–2.1238	*–22.15845	–2.2449	*–41.81464	4.1012	***0.211026**
2-Year	–2.1001	*–22.20074	–2.2820	*–45.64057	4.0319	***0.232992**
3-Year	–2.1595	*–28.31471	–2.2587	*–46.20714	3.9336	***0.230053**
			Test critical values			
1% Level	–3.4330		–3.4330		0.74	
5% Level	–2.8626		–2.8626		0.46	
10% Level	–2.5674		–2.5674		0.35	

*Implies that the co-efficient is significant at 0.05 probability level.

- AR(p) denotes auto-regressive model of order (p) as is mentioned below;

$$Y_t = \beta_0 + \sum_{\tau i=1}^{p} \varphi_i Y_{t-i} + \mu_t$$

- MA(q) denotes moving-average equation/model of order (q) as is mentioned below:

$$Y_t = \mu_t + \varepsilon_t + \sum_{i=1}^{q} \theta_i \varepsilon_{t-i}$$

- Autoregressive Moving Average (p, q) at univariate time series:

$$Y_t = \beta_0 + \varepsilon_t + \sum_{\tau i=1}^{p} \varphi_i Y_{t-i} + \sum_{i=1}^{q} \theta_i \varepsilon_{t-i}$$

ARIMA model is fitted on basis of following criteria:

(1) Where BIC value will be lower (Schwarz criterion),
(2) Where Adjusted R-Squared will be higher,
(3) Where Standard Error of Equation (SEE) will be lower,
(4) Correlogram and Q-Stat: Both show the pattern left in the ACF and PACF of the residuals. For model selection criteria, residual should be white noise.

We used 1st three criteria to find out the order of ARIMA (p,d,q).

The Detailed calculation is provided in Tables 4, 5 and 6 for ARIMA ordering on the basis of this criterion.

Table 4

ARIMA Model Fitting (One Year Maturity)

MP Announcements	ARIMA (p,d,q)	Adjusted R2	SEE	SIC	MP Announcements	ARIMA (p,d,q)	Adjusted R2	SEE	SIC
1st Meeting dt: 4/11/2005	(1, 1 , 0)	–0.00311	0.03739	–3.65875	2nd Meeting dt:7/21/2005	(1, 1 , 0)	–0.00475	0.07885	–2.19832
	(1, 1, 1)	*0.11011*	*0.03521*	*–3.74053*		(1, 1, 1)	0.04263	0.07697	–2.22461
	(2, 1, 0)	–0.01317	0.03771	–3.60286		(2, 1, 0)	0.12254	0.07388	–2.30646
	(0, 1, 1)	–0.00270	0.03733	–3.66252		(0, 1, 1)	–0.00493	0.07868	–2.20301
	(0, 1, 2)	–0.01375	0.03753	–3.61387		*(0, 1, 2)*	*0.12964*	*0.07322*	*–2.32484*
3rd Meeting dt: 1/26/2006	(1, 1 , 0)	0.05257	0.03629	–3.75834	4th Meeting dt: 7/31/2006	*(1, 1 , 0)*	*0.00012*	*0.04356*	*–3.39314*
	(1, 1, 1)	0.05431	0.03626	–3.74213		(1, 1, 1)	–0.00393	0.04365	–3.37106
	(2, 1, 0)	0.05437	0.03626	–3.74220		(2, 1, 0)	–0.00390	0.04365	–3.37109
	(0, 1, 1)	*0.05812*	*0.03619*	*–3.76421*		(0, 1, 1)	0.00000	0.04356	–3.39303
	(0, 1, 2)	0.05432	0.03626	–3.74214		(0, 1, 2)	–0.00343	0.04364	–3.37156
5th Meeting dt: 1/18/2007	(1, 1 , 0)	–0.00335	0.04081	–3.52376	6th Meeting dt: 8/1/2007	(1, 1 , 0)	0.00130	0.01743	–5.22561
	(1, 1, 1)	*0.03625*	*0.03999*	*–3.54598*		*(1, 1, 1)*	*0.00614*	*0.01738*	*–5.21242*
	(2, 1, 0)	–0.00741	0.04089	–3.50168		(2, 1, 0)	0.00158	0.01742	–5.20785
	(0, 1, 1)	–0.00334	0.04081	–3.52377		(0, 1, 1)	0.00209	0.01742	–5.22641
	(0, 1, 2)	–0.00718	0.04089	–3.50191		(0, 1, 2)	0.00247	0.01742	–5.20874
7th Meeting dt: 2/1/2008	*(1, 1 , 0)*	*0.01631*	*0.02196*	*–4.76326*	8th Meeting dt: 5/23/2008	(1, 1 , 0)	0.05143	0.02713	–4.34041
	(1, 1, 1)	0.01237	0.02200	–4.74122		(1, 1, 1)	0.11675	0.02618	–4.39371
	(2, 1, 0)	0.01392	0.02198	–4.74279		*(2, 1, 0)*	*0.17637*	*0.02528*	*–4.46360*
	(0, 1, 1)	0.01569	0.02197	–4.76263		(0, 1, 1)	0.02945	0.02744	–4.31750
	(0, 1, 2)	0.01189	0.02201	–4.74072		(0, 1, 2)	0.15008	0.02568	–4.43218
9th Meeting dt: 7/30/2008	*(1, 1 , 0)*	*0.03994*	*0.13434*	*–1.14078*	10th Meeting dt: 11/13/2008	*(1, 1 , 0)*	*0.05168*	*0.13715*	*–1.09929*
	(1, 1, 1)	0.03861	0.13443	–1.12135		(1, 1, 1)	0.04967	0.13730	–1.07913
	(2, 1, 0)	0.03783	0.13449	–1.12053		(2, 1, 0)	0.04901	0.13735	–1.07843
	(0, 1, 1)	0.03640	0.13459	–1.13710		(0, 1, 1)	0.04775	0.13744	–1.09515
	(0, 1, 2)	0.03432	0.13473	–1.11689		(0, 1, 2)	0.04537	0.13761	–1.07460
11th Meeting dt: 1/31/2009	(1, 1 , 0)	0.04996	0.13629	–1.11197	12th Meeting dt: 4/21/2009	*(1, 1 , 0)*	*0.11599*	*0.05944*	*–2.77146*
	(1, 1, 1)	*0.14079*	*0.12961*	*–1.19441*		(1, 1, 1)	0.11288	0.05955	–2.74990
	(2, 1, 0)	0.04709	0.13649	–1.09091		(2, 1, 0)	0.11268	0.05955	–2.74967
	(0, 1, 1)	0.04546	0.13661	–1.10725		(0, 1, 1)	0.10427	0.05984	–2.75829
	(0, 1, 2)	0.04507	0.13664	–1.08879		(0, 1, 2)	0.10849	0.05970	–2.74496

Continued—

Table 4—(*Continued*)

13th Meeting dt: 8/17/2009	*(1, 1 , 0)*	*0.06695*	*0.05589*	*–2.89482*	14th Meeting dt: 9/29/2009	*(1, 1 , 0)*	*0.06842*	*0.05623*	*–2.88274*
	(1, 1, 1)	0.06320	0.05600	–2.87277		(1, 1, 1)	0.06501	0.05633	–2.86104
	(2, 1, 0)	0.06322	0.05600	–2.87279		(2, 1, 0)	0.06488	0.05633	–2.86089
	(0, 1, 1)	0.06268	0.05602	–2.89026		(0, 1, 1)	0.06282	0.05640	–2.87675
	(0, 1, 2)	0.06258	0.05602	–2.87211		(0, 1, 2)	0.06354	0.05637	–2.85946
15th Meeting dt: 11/25/2009	(1, 1 , 0)	0.04566	0.03085	–4.08306	16th Meeting dt: 1/30/2010	(1, 1 , 0)	0.06085	0.02734	–4.32512
	(1, 1, 1)	*0.08420*	*0.03022*	*–4.10624*		*(1, 1, 1)*	*0.12196*	*0.02643*	*–4.37435*
	(2, 1, 0)	0.04320	0.03089	–4.06244		(2, 1, 0)	0.07131	0.02718	–4.31826
	(0, 1, 1)	0.04139	0.03092	–4.07859		(0, 1, 1)	0.04549	0.02756	–4.30889
	(0, 1, 2)	0.04036	0.03094	–4.05948		(0, 1, 2)	0.05817	0.02738	–4.30422
17th Meeting dt: 3/27/2010	*(1, 1 , 0)*	*0.00415*	*0.02010*	*–4.93963*	18th Meeting dt: 5/24/2010	*(1, 1 , 0)*	*0.00811*	*0.01955*	*–4.99544*
	(1, 1, 1)	0.00051	0.02014	–4.91794		(1, 1, 1)	0.00438	0.01959	–4.97364
	(2, 1, 0)	0.00055	0.02014	–4.91797		(2, 1, 0)	0.00419	0.01959	–4.97345
	(0, 1, 1)	0.00384	0.02011	–4.93931		(0, 1, 1)	0.00723	0.01956	–4.99455
	(0, 1, 2)	0.00069	0.02014	–4.91811		(0, 1, 2)	0.00334	0.01960	–4.97260
19th Meeting dt: 8/2/2010	(1, 1 , 0)	0.00060	0.02484	–4.51686	20th Meeting dt: 9/29/2010	(1, 1 , 0)	0.04327	0.02037	–4.91382
	(1, 1, 1)	–0.00330	0.02489	–4.49491		*(1, 1, 1)*	*0.06328*	*0.02015*	*–4.91691*
	(2, 1, 0)	–0.00332	0.02489	–4.49490		(2, 1, 0)	0.06235	0.02016	–4.91592
	(0, 1, 1)	*0.00068*	*0.02484*	*–4.51694*		(0, 1, 1)	0.03176	0.02049	–4.90187
	(0, 1, 2)	–0.00330	0.02489	–4.49491		(0, 1, 2)	0.05140	0.02028	–4.90430
21st Meeting dt: 30-Nov-2010	*(1, 1 , 0)*	*0.00457*	*0.03144*	*–4.04528*	22nd Meeting dt: 29-Jan-2011	(1, 1 , 0)	0.01679	0.03243	–3.98347
	(1, 1, 1)	0.00448	0.03144	–4.02714		*(1, 1, 1)*	*0.01777*	*0.03241*	*–3.96642*
	(2, 1, 0)	0.00286	0.03147	–4.02551		(2, 1, 0)	0.01652	0.03243	–3.96514
	(0, 1, 1)	0.00380	0.03145	–4.04451		(0, 1, 1)	0.01462	0.03246	–3.98126
	(0, 1, 2)	0.00208	0.03148	–4.02474		(0, 1, 2)	0.01503	0.03246	–3.96363

Italic values shows ARIMA model fitting.

Table 5

ARIMA Model Fitting (Two Years Maturity)

MP Announcements	ARIMA (p,d,q)	Adjusted R2	SEE	SIC	MP Announcements	ARIMA (p,d,q)	Adjusted R2	SEE	SIC
1st Meeting dt: 4/11/2005	(1, 1 , 0)	–0.00567	0.03312	–3.90086	2nd Meeting dt:7/21/2005	(1, 1 , 0)	0.00048	0.07660	–2.25630
	(1, 1, 1)	*0.20247*	*0.02950*	*–4.09478*		(1, 1, 1)	0.01565	0.07602	–2.24958
	(2, 1, 0)	–0.01844	0.03263	–3.89216		*(2, 1, 0)*	*0.09572*	*0.07291*	*–2.33267*
	(0, 1, 1)	–0.00571	0.03460	–3.81418		(0, 1, 1)	–0.00171	0.07679	–2.25159
	(0, 1, 2)	–0.01270	0.03472	–3.76957		(0, 1, 2)	0.09465	0.07300	–2.33081
3rd Meeting dt: 1/26/2006	(1, 1 , 0)	0.07223	0.03842	–3.64436	4th Meeting dt: 7/31/2006	*(1, 1 , 0)*	*0.01682*	*0.04245*	*–3.44470*
	(1, 1, 1)	*0.10590*	*0.03772*	*–3.66328*		(1, 1, 1)	0.01308	0.04253	–3.42286
	(2, 1, 0)	0.08980	0.03805	–3.64544		(2, 1, 0)	0.01394	0.04252	–3.42374
	(0, 1, 1)	0.10218	0.03779	–3.67718		(0, 1, 1)	0.01663	0.04246	–3.44451
	(0, 1, 2)	0.10560	0.03772	–3.66295		(0, 1, 2)	0.01358	0.04252	–3.42336
5th Meeting dt: 1/18/2007	*(1, 1 , 0)*	*–0.00350*	*0.03788*	*–3.67270*	6th Meeting dt: 8/1/2007	(1, 1 , 0)	0.01554	0.01789	–5.17285
	(1, 1, 1)	–0.00757	0.03796	–3.65062		*(1, 1, 1)*	*0.02471*	*0.01781*	*–5.16416*
	(2, 1, 0)	–0.00755	0.03796	–3.65063		(2, 1, 0)	0.01809	0.01787	–5.15739
	(0, 1, 1)	–0.00351	0.03788	–3.67270		(0, 1, 1)	0.01929	0.01786	–5.17666
	(0, 1, 2)	–0.00750	0.03795	–3.65068		(0, 1, 2)	0.02181	0.01783	–5.16119
7th Meeting dt: 2/1/2008	(1, 1 , 0)	0.03402	0.01620	–5.37205	8th Meeting dt: 5/23/2008	(1, 1 , 0)	0.13902	0.02374	–4.60711
	(1, 1, 1)	*0.05761*	*0.01600*	*–5.37873*		(1, 1, 1)	0.22064	0.02259	–4.68865
	(2, 1, 0)	0.04536	0.01610	–5.36581		*(2, 1, 0)*	*0.26479*	*0.02194*	*–4.74698*
	(0, 1, 1)	0.04452	0.01611	–5.38298		(0, 1, 1)	0.08294	0.02450	–4.54401
	(0, 1, 2)	0.04985	0.01606	–5.37053		(0, 1, 2)	0.21231	0.02271	–4.67803
9th Meeting dt: 7/30/2008	(1, 1 , 0)	0.01011	0.13363	–1.15142	10th Meeting dt: 11/13/2008	(1, 1 , 0)	0.01575	0.13699	–1.10169
	(1, 1, 1)	*0.01445*	*0.13333*	*–1.13776*		*(1, 1, 1)*	*0.01975*	*0.13671*	*–1.08772*
	(2, 1, 0)	0.01368	0.13338	–1.13699		(2, 1, 0)	0.01848	0.13680	–1.08642
	(0, 1, 1)	0.00811	0.13376	–1.14940		(0, 1, 1)	0.01309	0.13717	–1.09900
	(0, 1, 2)	0.01086	0.13357	–1.13413		(0, 1, 2)	0.01502	0.13704	–1.08291
11th Meeting dt: 1/31/2009	(1, 1 , 0)	0.01386	0.13605	–1.11548	12th Meeting dt: 4/21/2009	(1, 1 , 0)	0.09291	0.05662	–2.86873
	(1, 1, 1)	*0.14058*	*0.12701*	*–1.23497*		*(1, 1, 1)*	*0.09520*	*0.05655*	*–2.85321*
	(2, 1, 0)	0.01589	0.13591	–1.09950		(2, 1, 0)	0.09177	0.05666	–2.84943
	(0, 1, 1)	0.01133	0.13622	–1.11292		(0, 1, 1)	0.07952	0.05704	–2.85408
	(0, 1, 2)	0.01435	0.13601	–1.09793		(0, 1, 2)	0.08703	0.05680	–2.84423

Continued—

Table 5—(*Continued*)

13th Meeting dt: 8/17/2009	*(1, 1 , 0)*	*0.04025*	*0.05211*	*–3.03464*	14th Meeting dt: 9/29/2009	*(1, 1 , 0)*	*0.04072*	*0.05209*	*–3.03566*
	(1, 1, 1)	0.03752	0.05219	–3.01375		(1, 1, 1)	0.03833	0.05215	–3.01512
	(2, 1, 0)	0.03767	0.05218	–3.01391		(2, 1, 0)	0.03820	0.05216	–3.01500
	(0, 1, 1)	0.03586	0.05223	–3.03008		(0, 1, 1)	0.03621	0.05221	–3.03097
	(0, 1, 2)	0.03745	0.05219	–3.01367		(0, 1, 2)	0.03783	0.05217	–3.01460
15th Meeting dt: 11/25/2009	*(1, 1 , 0)*	*0.04031*	*0.02328*	*–4.64678*	16th Meeting dt: 1/30/2010	(1, 1 , 0)	0.01000	0.02402	–4.58375
	(1, 1, 1)	0.03646	0.02332	–4.62473		*(1, 1, 1)*	*0.02194*	*0.02387*	*–4.57784*
	(2, 1, 0)	0.03703	0.02331	–4.62532		(2, 1, 0)	0.01055	0.02401	–4.56626
	(0, 1, 1)	0.03770	0.02331	–4.64406		(0, 1, 1)	0.00856	0.02404	–4.58229
	(0, 1, 2)	0.03872	0.02329	–4.62708		(0, 1, 2)	0.01124	0.02401	–4.56696
17th Meeting dt: 3/27/2010	*(1, 1 , 0)*	*0.00857*	*0.01945*	*–5.00564*	18th Meeting dt: 5/24/2010	(1, 1 , 0)	0.01325	0.01915	–5.03653
	(1, 1, 1)	0.00662	0.01947	–4.98563		(1, 1, 1)	0.01016	0.01918	–5.01536
	(2, 1, 0)	0.00489	0.01949	–4.98389		(2, 1, 0)	0.00982	0.01919	–5.01501
	(0, 1, 1)	0.00820	0.01946	–5.00527		*(0, 1, 1)*	*0.01397*	*0.01915*	*–5.03726*
	(0, 1, 2)	0.00426	0.01949	–4.98326		(0, 1, 2)	0.01009	0.01918	–5.01528
19th Meeting dt: 8/2/2010	*(1, 1 , 0)*	*–0.00069*	*0.02497*	*–4.50637*	20th Meeting dt: 9/29/2010	(1, 1 , 0)	0.05227	0.02116	–4.83690
	(1, 1, 1)	–0.00456	0.02502	–4.48446		(1, 1, 1)	0.09249	0.02071	–4.86222
	(2, 1, 0)	–0.00455	0.02502	–4.48447		*(2, 1, 0)*	*0.10392*	*0.02058*	*–4.87489*
	(0, 1, 1)	–0.00078	0.02497	–4.50628		(0, 1, 1)	0.03389	0.02137	–4.81770
	(0, 1, 2)	–0.00456	0.02502	–4.48447		(0, 1, 2)	0.08128	0.02084	–4.84995
21st Meeting dt: 30-Nov-2010	(1, 1 , 0)	0.00472	0.03169	–4.02970	22nd Meeting dt: 29-Jan-2011	(1, 1 , 0)	0.01780	0.03324	–3.93395
	(1, 1, 1)	0.01266	0.03156	–4.01966		(1, 1, 1)	0.02898	0.03305	–3.92735
	(2, 1, 0)	*0.01270*	*0.03156*	*–4.01971*		*(2, 1, 0)*	*0.03059*	*0.03302*	*–3.92901*
	(0, 1, 1)	0.00317	0.03171	–4.02814		(0, 1, 1)	0.01316	0.03332	–3.92924
	(0, 1, 2)	0.01029	0.03160	–4.01727		(0, 1, 2)	0.02706	0.03308	–3.92537

Italic values shows ARIMA model fitting.

Table 6

ARIMA Model Fitting (Three Years Maturity)

MP Announcements	ARIMA (p,d,q)	Adjusted R2	SEE	SIC	MP Announcements	ARIMA (p,d,q)	Adjusted R2	SEE	SIC
1st Meeting dt: 4/11/2005	(1, 1 , 0)	–0.01098	0.03874	–3.58745	2nd Meeting dt:7/21/2005	(1, 1 , 0)	0.00901	0.08281	–2.10046
	(1, 1, 1)	*0.23889*	*0.03362*	*–3.83337*		(1, 1, 1)	0.04069	0.08147	–2.11093
	(2, 1, 0)	–0.01779	0.03752	–3.61289		(2, 1, 0)	0.12130	0.07792	–2.19999
	(0, 1, 1)	–0.01085	0.03927	–3.56122		(0, 1, 1)	0.00321	0.08296	–2.09688
	(0, 1, 2)	–0.02208	0.03948	–3.51248		*(0, 1, 2)*	*0.12088*	*0.07791*	*–2.20057*
3rd Meeting dt: 1/26/2006	(1, 1 , 0)	0.07005	0.04135	–3.49739	4th Meeting dt: 7/31/2006	(1, 1 , 0)	0.02754	0.01966	–4.98393
	(1, 1, 1)	*0.13492*	*0.03988*	*–3.55165*		*(1, 1, 1)*	*0.06383*	*0.01929*	*–5.00392*
	(2, 1, 0)	0.09261	0.04084	–3.50391		(2, 1, 0)	0.04755	0.01946	–4.98668
	(0, 1, 1)	0.10955	0.04046	–3.54080		(0, 1, 1)	0.03972	0.01954	–4.99654
	(0, 1, 2)	0.13033	0.03999	–3.54636		(0, 1, 2)	0.05311	0.01940	–4.99254
5th Meeting dt: 1/18/2007	(1, 1 , 0)	–0.00083	0.03691	–3.72472	6th Meeting dt: 8/1/2007	(1, 1 , 0)	0.01605	0.01925	–5.02695
	(1, 1, 1)	–0.00482	0.03698	–3.70271		*(1, 1, 1)*	*0.03887*	*0.01902*	*–5.03238*
	(2, 1, 0)	–0.00411	0.03697	–3.70341		(2, 1, 0)	0.02136	0.01919	–5.01432
	(0, 1, 1)	*–0.00076*	*0.03691*	*–3.72479*		(0, 1, 1)	0.02128	0.01919	–5.03229
	(0, 1, 2)	–0.00481	0.03698	–3.70271		(0, 1, 2)	0.03201	0.01909	–5.02527
7th Meeting dt: 2/1/2008	(1, 1 , 0)	0.02754	0.01966	–4.98393	8th Meeting dt: 5/23/2008	(1, 1 , 0)	0.02991	0.02789	–4.28476
	(1, 1, 1)	*0.06383*	*0.01929*	*–5.00392*		(1, 1, 1)	0.10223	0.02683	–4.34419
	(2, 1, 0)	0.04755	0.01946	–4.98668		*(2, 1, 0)*	*0.15540*	*0.02603*	*–4.40523*
	(0, 1, 1)	0.03972	0.01954	–4.99654		(0, 1, 1)	0.01767	0.02807	–4.27222
	(0, 1, 2)	0.05311	0.01940	–4.99254		(0, 1, 2)	0.13268	0.02637	–4.37869
9th Meeting dt: 7/30/2008	(1, 1 , 0)	0.00985	0.13503	–1.13044	10th Meeting dt: 11/13/2008	(1, 1 , 0)	0.01479	0.13757	–1.09318
	(1, 1, 1)	0.01194	0.13489	–1.11450		*(1, 1, 1)*	*0.01644*	*0.13746*	*–1.07682*
	(2, 1, 0)	*0.01197*	*0.13489*	*–1.11453*		(2, 1, 0)	0.01606	0.13748	–1.07643
	(0, 1, 1)	0.00800	0.13516	–1.12857		(0, 1, 1)	0.01240	0.13774	–1.09076
	(0, 1, 2)	0.01018	0.13501	–1.11273		(0, 1, 2)	0.01390	0.13764	–1.07424
11th Meeting dt: 1/31/2009	(1, 1 , 0)	0.01399	0.13635	–1.11110	12th Meeting dt: 4/21/2009	*(1, 1 , 0)*	*0.13825*	*0.04968*	*–3.13047*
	(1, 1, 1)	*0.14393*	*0.12705*	*–1.23436*		(1, 1, 1)	0.13478	0.04978	–3.10840
	(2, 1, 0)	0.01477	0.13629	–1.09385		(2, 1, 0)	0.13479	0.04978	–3.10842
	(0, 1, 1)	0.01171	0.13650	–1.10879		(0, 1, 1)	0.12354	0.05010	–3.11354
	(0, 1, 2)	0.01381	0.13636	–1.09287		(0, 1, 2)	0.13153	0.04987	–3.10466

Continued—

Table 6—(*Continued*)

13th Meeting dt: 8/17/2009	*(1, 1 , 0)*	*0.06720*	*0.04619*	*–3.27606*	14th Meeting dt: 9/29/2009	*(1, 1 , 0)*	*0.06769*	*0.04613*	*–3.27876*
	(1, 1, 1)	0.06343	0.04628	–3.25398		(1, 1, 1)	0.06392	0.04622	–3.25668
	(2, 1, 0)	0.06343	0.04628	–3.25398		(2, 1, 0)	0.06392	0.04622	–3.25668
	(0, 1, 1)	0.06304	0.04629	–3.27161		(0, 1, 1)	0.06359	0.04623	–3.27437
	(0, 1, 2)	0.06321	0.04629	–3.25374		(0, 1, 2)	0.06367	0.04623	–3.25642
15th Meeting dt: 11/25/2009	(1, 1 , 0)	0.03374	0.02303	–4.66820	16th Meeting dt: 1/30/2010	(1, 1 , 0)	0.00034	0.02552	–4.46231
	(1, 1, 1)	*0.04222*	*0.02293*	*–4.65897*		*(1, 1, 1)*	*0.01869*	*0.02529*	*–4.46279*
	(2, 1, 0)	0.03382	0.02303	–4.65024		(2, 1, 0)	0.00273	0.02549	–4.44666
	(0, 1, 1)	0.02798	0.02310	–4.66226		(0, 1, 1)	–0.00008	0.02553	–4.46189
	(0, 1, 2)	0.03341	0.02303	–4.64982		(0, 1, 2)	0.00255	0.02550	–4.44648
17th Meeting dt: 3/27/2010	(1, 1 , 0)	0.01046	0.02080	–4.87189	18th Meeting dt: 5/24/2010	(1, 1 , 0)	0.00964	0.02086	–4.86571
	(1, 1, 1)	0.00939	0.02081	–4.85276		(1, 1, 1)	0.00657	0.02089	–4.84457
	(2, 1, 0)	0.00679	0.02084	–4.85014		(2, 1, 0)	0.00603	0.02090	–4.84402
	(0, 1, 1)	*0.01112*	*0.02079*	*–4.87255*		*(0, 1, 1)*	*0.01032*	*0.02085*	*–4.86640*
	(0, 1, 2)	0.00715	0.02083	–4.85050		(0, 1, 2)	0.00633	0.02090	–4.84433
19th Meeting dt: 8/2/2010	*(1, 1 , 0)*	*–0.00154*	*0.02598*	*–4.42718*	20th Meeting dt: 9/29/2010	(1, 1 , 0)	0.08047	0.02095	–4.85707
	(1, 1, 1)	–0.00550	0.02603	–4.40519		(1, 1, 1)	0.11470	0.02056	–4.87697
	(2, 1, 0)	–0.00542	0.02603	–4.40526		*(2, 1, 0)*	*0.12227*	*0.02047*	*–4.88556*
	(0, 1, 1)	–0.00164	0.02598	–4.42708		(0, 1, 1)	0.05409	0.02125	–4.82879
	(0, 1, 2)	–0.00541	0.02603	–4.40528		(0, 1, 2)	0.09801	0.02075	–4.85828
21st Meeting dt: 30-Nov-2010	(1, 1 , 0)	0.01384	0.03307	–3.94416	22nd Meeting dt: 29-Jan-2011	(1, 1 , 0)	0.03068	0.03460	–3.85360
	(1, 1, 1)	*0.01943*	*0.03298*	*–3.93179*		(1, 1, 1)	0.03703	0.03449	–3.84213
	(2, 1, 0)	0.01873	0.03299	–3.93109		*(2, 1, 0)*	*0.03871*	*0.03446*	*–3.84388*
	(0, 1, 1)	0.01094	0.03312	–3.94123		(0, 1, 1)	0.02427	0.03472	–3.84701
	(0, 1, 2)	0.01602	0.03304	–3.92833		(0, 1, 2)	0.03570	0.03451	–3.84074

Italic values shows ARIMA model fitting.

Table 4

Table 4

Table 5

Table 5

Table 6

Table 6

After calculating the normal/forecasted rates, Aggregated Abnormal Rate (AAR) was calculated as 28.8731 (Table 7 and Figure 3) which shows a positive impact of Monetary Policy announcement on market interest rates. Table 7 shows that there is significant impact of monetary policy on market interest rates within event window form τ-3 to τ+5. Then we analysed the impact of events one by one and Cumulative Abnormal Rate (CAR) was calculated as 28.8731 (Table 8 and Figure 4). Table 10 shows that 19 of 22 events had significant impact on market interest rates at different nine maturities (1/Week, 2/Week, 1/Month, 3/Months, 6/Months, 9/Months, 1/Year, 2/Years and 3/Years).

Table 7

Rates and Individual Day Significance: Jan. 05 to Mar. 11

Days in Eventn Window	Actaul Rate	Normal/Forcasted Rate	Abnormal Rate	AAR	t-value
–5	260.7811	260.8040	–0.0229	–0.0229	–0.2522
–4	260.9136	260.8736	0.0399	0.0170	0.2946
–3	261.6519	260.9367	0.7152	0.7322	**2.4615***
–2	262.1000	260.9869	1.1131	1.8453	**2.4190***
–1	262.8748	261.0326	1.8421	3.6875	**3.6238***
0	265.1158	261.0715	4.0443	7.7318	**7.0607***
1	265.7656	261.1072	4.6583	12.3901	**7.9881***
2	266.4433	261.1392	5.3042	17.6943	**8.2626***
3	265.6098	261.1690	4.4408	22.1351	**11.9749***
4	264.8452	261.1967	3.6485	25.7836	**9.7664***
5	264.3126	261.2231	3.0895	28.8731	**6.7177***

Table 8

Rates and Event Wise Significance: Jan. 05 to Mar. 11

Days in Eventn Window	Actaul Rate	Normal/Forcasted Rate	Abnormal Rate	CAR	t-value
Event 1	75.3522	67.9443	7.4080	7.4080	**18.0585***
Event 2	100.8250	99.3769	1.4481	8.8561	**2.0305***
Event 3	102.2111	102.2166	–0.0055	8.8506	(0.0391)
Event 4	114.2944	115.0654	–0.7709	8.0797	**(3.6975)***
Event 5	115.2628	115.4023	–0.1396	7.9401	(1.4245)*
Event 6	111.2650	109.2789	1.9861	9.9262	**14.0075***
Event 7	112.7933	111.0624	1.7309	11.6571	**12.4643***
Event 8	140.1200	122.2642	17.8558	29.5129	**13.7039***
Event 9	147.7550	150.6632	–2.9082	26.6047	**(2.7448)***
Event 10	164.3444	166.8517	–2.5072	24.0975	**(2.3678)***
Event 11	156.8222	158.5994	–1.7772	22.3203	**(2.5528)***
Event 12	150.8872	150.5597	0.3276	22.6478	0.5155
Event 13	139.3917	138.3434	1.0483	23.6961	**3.2203***
Event 14	141.5072	140.8013	0.7059	24.4020	**5.2880***
Event 15	139.8756	141.9715	–2.0960	22.3060	**(10.5819)***
Event 16	137.5650	137.8600	–0.2950	22.0110	–1.6912
Event 17	138.0600	138.6838	–0.6238	21.3872	**(2.6103)***
Event 18	135.9483	136.4884	–0.5401	20.8471	**(2.4462)***
Event 19	138.8070	135.4828	3.3243	24.1713	**38.5478***
Event 20	141.1389	140.3797	0.7592	24.9305	**2.3864***
Event 21	146.1483	143.3243	2.8241	27.7546	**11.7370***
Event 22	150.0389	148.9204	1.1185	28.8731	**4.9310***

Fig. 3. AAR Withing Event Window

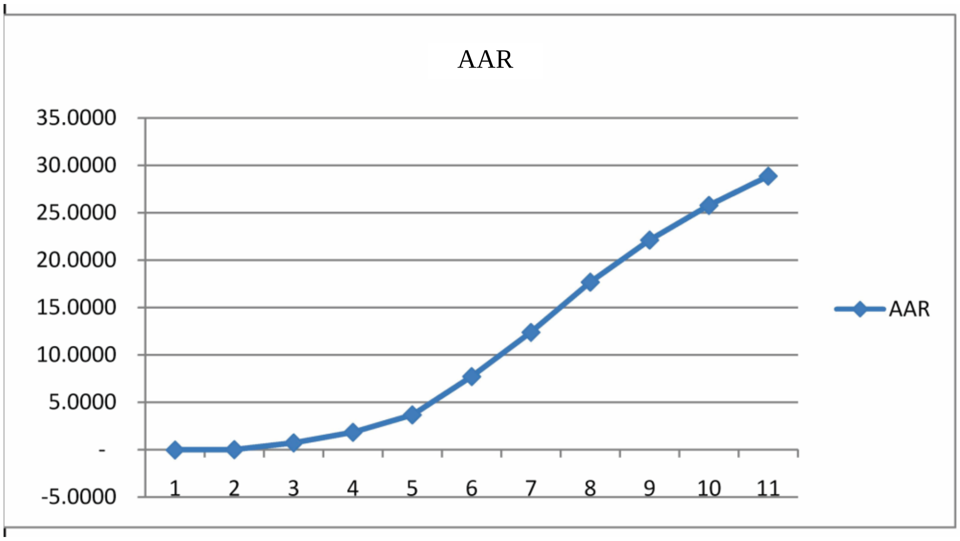
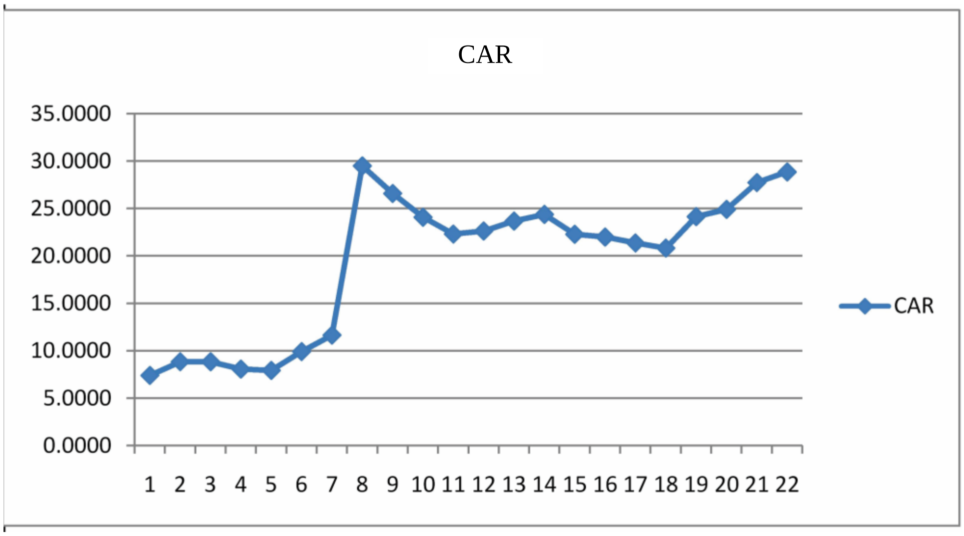


Fig. 4. CAR Across Event Window



5. CONCLUSION

This study investigated the impact of MP announcements on market interest rates at different nine maturities (1/Week, 2/Week, 1/Month, 3/Months, 6/Months, 9/Months, 1/Year, 2/Years and 3/Years) in Pakistan. The Event window of 11 days and an estimation window of 250 days were constructed. ARCH effect is analysed in market interest rates at each maturity by using Breusch Pagen ARCH Test. Furthermore, GARCH model was applied where ARCH effect was observed to forecast the normal rate. The study could not find significant ARCH effect in market interest rates at (1/Year, 2/Years and 3/Years) maturities and ARIMA model was applied to calculate the normal rates from estimation window (t-250). The AAR and CAR at 28.8731 showed an impact of monetary policy announcements on market interest rates at different nine maturities. The null hypothesis of zero abnormal rates was rejected since the results were found in critical region under normal distribution. Our results are in line with Pederson (1997), Patelis (1997), Hardy (1998), Kaketsis and Sarantis (2006). A positive change was observed for three days before and after MP announcements. At 4th day, there was a slight positive change at 1st maturity (1-Week) and rates were normal at 5th day at 1st maturity. However, these rates were normal after 5th day at all of the remaining maturities. It looks that the market participants anticipates the bank's changes in policy rate quickly.

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Policy of Inflation Targeting in the Presence of Fiscal Deficit and External Debt: Opt or Not to Opt

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I. INTRODUCTION

The debate on controlling inflation at the minimum possible level was started since the articles by Kydland and Prescott (1977) and Barro and Gordon (1983). Rogoffs (1985) gave the idea of conservative central banker whose primary goal is to control inflation irrespective of what is going on with other macroeconomic variables. Similarly stabilisation policies, policy of monetary targeting, interest rate, and targeting inflation are other policies to control inflation. New Zealand was the first country to start policy of inflation targeting in 1989 followed by other countries, such as Canada, UK, Sweden, Finland, Australia, Spain etc.

Policy of inflation targeting is a commitment to maintain inflation at the announced level. Interest rate is the main variable used in controlling inflation in the policy of inflation targeting. However, central bank resists to increase interest rate of the proportion of dollar denominated debt is higher in total public debt. In higher dollar denominated debt country problem starts with an increase in interest rate because it pressurises foreign exchange market[1] which leads to depreciation of currency. Depreciation leads to further increase in prices[2] [for more details see e.g., Sims (2005) and Blanchard (2004)]. Thus in high fiscal deficit[3] and public debt countries it will be difficult for central bank to control inflation using interest rate as an instrument. Moreover, reliance on seigniorage[4] is quite high in Pakistan due to low tax collections/base, thus inflation targeting gives less opportunity to use inflation tax for revenue collection, which directly effects the revenue collection from seignorage.[5]

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[1]Since flexible exchange rate is a prerequisite to the policy of inflation targeting, thus increase in interest rate increase the fiscal deficit and hence debt repayment and servicing, which pressurises the foreign exchange market eventually results in the depreciation of exchange rate.

[2]This phenomenon is knows as exchange rate pass through. Chaudhari and Khan (2001) and Hyder and Shah (2004) does not find evidence that depreciation causes inflation in Pakistan.

[3]Interestingly fiscal policy, which plays an important role in the policy of inflation targeting, especially for developing countries like Pakistan, is ignored in the models of inflation targeting [Fraga, *et al*. (2003)].

[4]It is the net revenue derived from the issuing of currency. It is also known as inflation tax.

[5]This, in a way, plays positive role in curbing inflation, which sometimes known as mini budget as well.

Based on the above theoretical explanation, we established two links in the paper; (i) short run association between real interest rate and real exchange rate; and (ii) short run association between real exchange rate and prices. If the association is true then inflation targeting is perverse for developing countries [Blanchard (2004)].

Following this introduction, Section II reviews functioning of inflation targeting and its prerequisites; Section III explains fiscal constraints countries can face in pursuing the policy of inflation targeting; Section IV describes data and methodology; results are explained in Section V; and Section VI draws important conclusions of the paper.

II. INFLATION TARGETING: HOW DOES IT WORK?

Economists generally agree that high inflation distorts decisions of private agents to make investment, savings, wage contracts, etc., which slows down the process of economic growth. Moreover, to get short term gains politicians (policy-makers) increase the money supply to decrease the unemployment in the short run. Although, it is true that unemployment decreases initially but eventually entire change in money supply results in increase in inflation [for more details, see Grauwe and Polan (2005); and Kemal (2006)]. The policy of getting temporary gains by increasing money supply results in the problem of dynamic consistency or time consistency.[6] To overcome this problem several solutions are suggested, including inflation targeting is the one which is adopted by several countries including New Zealand, Australia, Sweden, England etc.

The process of inflation targeting starts with an announcement of targeted inflation for the next period by the government and the Central Bank. Period could range from one year to two years or even three years depending on the situation and confidence they have in the markets and markets have in them. Independence of central bank is one of the prerequisites of the policy of inflation targeting. After the announcement of inflation for the next period, independent central bank, which has instrumental independence, is responsible for achieving the target. Generally, interest rate is used to curtail inflation at its targeted level. In case, central bank fails to achieve the targets then she should provide her strategy to curtail inflation to the public openly. The transparent way of functioning will increase the credibility and accountability of the central bank.

Central bank generally decides on the future course of monetary policy after assessing the inflation forecasts based on different indicators. These forecasts could be based on models such as structural models, VAR models and/or survey of market based inflation expectations [Croce and Khan (2000)]. However, there are certain issues for the authorities that include, which measure of inflation to use, what target level of inflation to choose,[7] whether to adopt inflation target point or target ranges[8] and policy horizon[9] (Ibid).

[6]Agents tend to believe that actual inflation will be higher than the announced inflation because authorities have a reputation to increase excess money supply after announcing it because the policy they announced at time t does not remain optimal at time t+1, which leads to policy/dynamic/time consistency problem.

[7]Most industrialised countries chose 1–3 percent [Croce and Khan (2000)]. Masoon, Savastano, and Sharma (1998) argued that developing countries do not have optimal inflation rate and thus they also have a problem that what level of inflation to target.

[8]It is more difficult to target points but it is also difficult to define the range, if the range is too small then it will have the same problem as target points [Croce and Khan (2000)].

[9]How fast the adjustment would be whenever inflation deviates from its long run target [Croce and Khan (2000)].

The second prerequisite for the policy of inflation targeting is the flexible exchange rates. However, due to the degree of pass-through from exchange rate changes to prices, which is higher in the developing countries, leads to considerable inflation inertia (Ibid). Moreover, developing countries have higher rates of inflation which is difficult to forecast. It is also difficult for central bank to maintain inflation at its targeted level if it is very high. Therefore, it is suggested to decrease the inflation first, say to single digit level, and then start inflation targeting. Another problem we can have in developing countries is the non-availability of optimal level of inflation. Central bank independence is the major issue in the developing countries (Ibid). Interestingly, even in the presence of all these difficulties (Ibid) suggests that inflation targeting is a good policy for the developing countries because it offers a number of operational advantages and it compels policy-makers to deepen reforms, enhance transparency, and improve the fiscal stance; it also holds out the promise of eventual convergence to international levels of inflation.

III. FISCAL CONSTRAINTS

Reliance on tax and non-tax revenues is different in developed and developing economies. Direct taxes is the major sources of tax revenues in developed countries while, indirect taxes are the major source of tax revenues in developing countries. Although share of direct taxes in total tax revenues has been more than two fold in the last 20 years but still tax base is very low. Various tax holidays, non-effective implementation of GST, tax evasion/avoidance, depreciation allowance, excessive tax returns, and deduction and exemptions are the major hurdles in collecting tax revenues. The above mentioned hurdles play vital role in shaping fiscal policy to curb fiscal deficit and hence less borrowing from the State Bank of Pakistan especially. Thus fiscal policy plays important role in conducting optimal monetary policy.

Benigno and Woodford (2006) build a model based on three different assumptions of fiscal policy: i.e., (i) little distortion is required to raise additional government revenue, (ii) only distorting sources of revenue exist but distorting taxes are adjusted optimally, and (iii) tax rates are exogenous and cannot be expected to change in response to change in monetary policy. Considering all the three cases (Ibid) concluded that optimal monetary policy can be implemented in the form of flexible inflation targeting. Moreover, they also concluded that an optimal policy commitment will be a credible commitment by the central bank if inflation is returned to its long-run target level fairly promptly after it diverts from the long run target, which can thus justifies as a temporary departure from the target.

As discussed in previous section that interest rate is the main instrument used in this policy to curtail inflation. Blanchard (2004) argues that increase in interest rate increases the probability of default on the debt if proportion of dollar denominated debt is high in total public debt. Under this hypothesis inflation targeting is clearly a bad policy for the developing countries. Moreover, increase in real interest rate in response to increase in expected inflation leads to real depreciation of exchange rate, which again results in higher inflation due to pass-through effect. In such situation, (Ibid) argues, fiscal policy is the right instrument to decrease inflation not the monetary policy.

(Ibid) studies the case of Brazil, when in 2002 it was expected that the left wing candidate will come to power, led to acute macroeconomic crisis in Brazil. Rate of interest has gone up, dollar debt has increased sharply, which results in the increase in the probability of default on debt. Currency depreciated sharply and inflation surged at that time.[10] He concluded that when fiscal conditions are wrong, i.e., when debt is high, when a high proportion of debt is denominated in foreign currency, when the risk aversion of investors is high then an increase in the interest rate is more likely to lead to depreciation. This implies that policy of inflation targeting is perverse to use in curtailing inflation.

In most of the developing countries the decisions of the central bank is still governed by government to finance the fiscal deficit [Croce and Khan (2000)]. Under the IMF's stabilisation programme many countries had reduced their fiscal deficits but still there are large public debts and government borrowings which prevent central bank to perform their duties independently. In the presence of huge public debt central bank hesitates to increase the interest rate when it is required to curtail inflation (Ibid). Thus public sector borrowing should be non-existent if we need to adopt inflation targeting [Masson, Savastano, and Sharma (1998)].

(Ibid) also argue that the government should have a broad revenue base and should not rely on the revenues from seigniorage; domestic financial markets should have enough depth to absorb the placement of public and private debt instruments; and the accumulation of public debt should be sustainable and not unduly constrain monetary policy. In most of the developing countries inflation tax is a norm to generate revenues because of low tax base. Moreover, reliance of fiscal deficit is mostly on monetary policy, which thus gives rise to inflationary pressures that prevents central bank to achieve their target and thus get high rates of inflation. At high rates of inflation, fiscal and monetary policy tends to become virtually inseparable (Ibid). Controlled (administered) prices are an important component of change in prices (Ibid). Due to these administered prices, markets cannot function properly and policy of inflation targeting could have adverse results instead of positive results.

Contrary to the above mentioned studies, external financing to finance fiscal deficit reduces the chances of crowding out, prices remain stable and do not change the interest rate structure in the home country [Kemal (1991)]. Thus, if this is true then using interest rate to control inflation will not adversely affect the inflation under the policy of inflation targeting.

IV. DATA AND METHODOLOGY

Monthly data on exchange rate, interest rate (money market rate), Pakistan CPI, US CPI (proxy to world CPI) are taken from the various issues of International Financial Statistics. Since flexible exchange rate is the pre-requisite to the policy of inflation targeting thus data is taken from July 2000 when Pakistan was moved to flexible exchange rate system to September 2010.

[10]However, after he got elected people realised that whatever they were thinking was not the case, the economy came back to its steady path. Central bank at that time did not increase the real interest rate, which was the right policy to do.

$$RER = \frac{ER * CPI^*}{CPI} \qquad \textit{(Real Exchange Rate)}$$

$$\pi = \frac{CPI_t - CPI_{t-1}}{CPI_{t-1}} \qquad \textit{(Inflation Rate)}$$

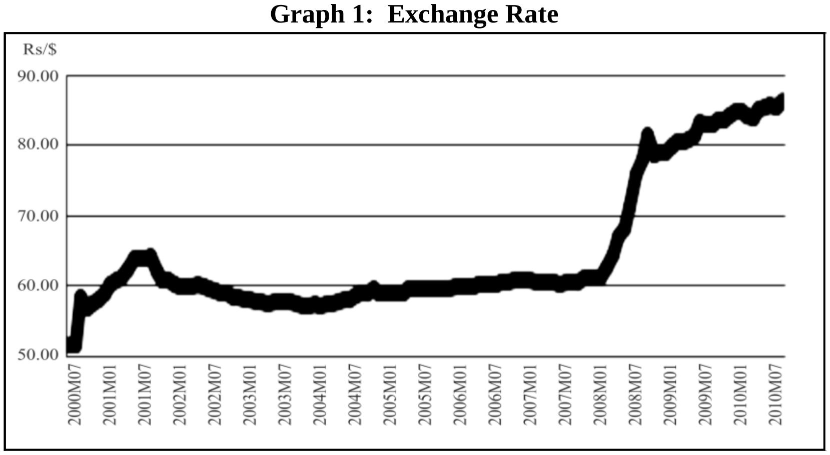
$$R = I - \pi \qquad \textit{(Real Interest Rate)}$$

where, *RER, ER, CPI, R, I,* π, represent real exchange rate, nominal exchange rate, consumer price index, real interest rate, nominal interest rate, and inflation rate, respectively. Subscript t and t–1 represent current and lag periods, respectively.

As Blanchard (2004) mentioned that policy of inflation targeting is not good for those developing countries where the external debt has higher proportion in the public debt. Share of Pakistan external debt was remained higher in 1970s but had continuously declining trend over the time period. External debt was 31.8 percent of GDP in 2010 and Government domestic debt was 31.7 percent of GDP. Due to high public debt, government major share of expenditure goes to debt servicing. It is seen that in certain years if we subtract debt servicing from budget deficit, we have fiscal surplus instead of deficit (also known as primary surplus), e.g., in the year 2009 and 2010 we had 5.3 percent and 6.3 percent of fiscal deficit respectively, while our debt servicing was 7.4 percent and 7.1 percent respectively. Thus it is a double blow for the State Bank of Pakistan if they want to control inflation.

Exchange rate initially rose very fast from Rs 51.79/$ to Rs 64.0/$ in one year but then remained quite stable for the next seven years (see Graph 1). It then hiked in 2008 when it depreciated by 25 percent in 8 months, from February 2008 to October 2008. Besides these two main incidents the value of exchange rate against dollars has been continuously depreciating since 2000 at the rate of 5 percent per annum[11] (approx). However, interestingly real exchange rate tells us a different story. Apart from the two incidents of huge depreciation real exchange rate appreciated continuously in the last ten years. Total appreciation in the real exchange rate was 14.5 percent compared to 40 percent depreciation in nominal exchange rate.

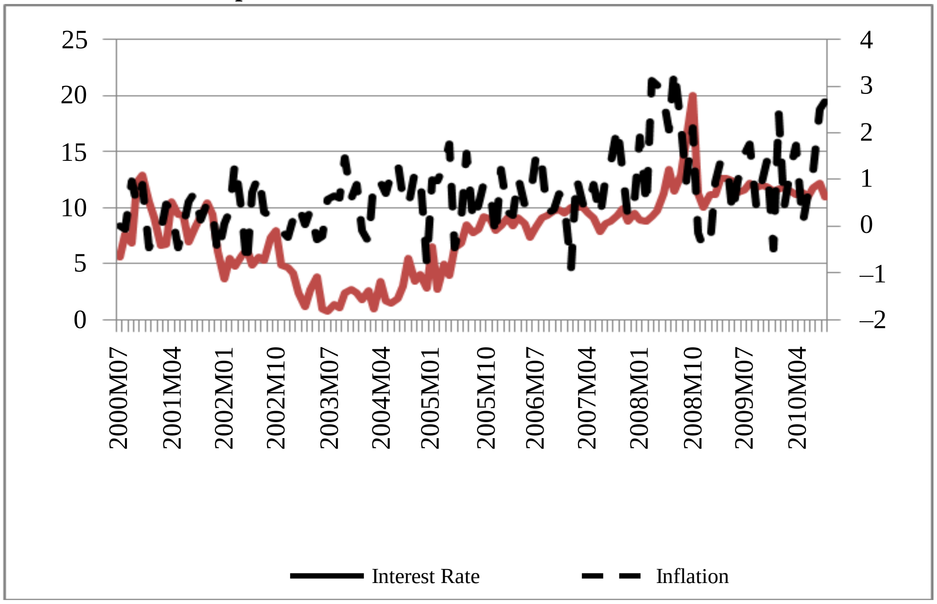
Graph 1: Exchange Rate



[11]Calculated using compound growth rate formula.

Inflation and interest rate, both have positive (long term) trend over the time period. This might imply that interest rate was used to control inflation and it might have reduced the increase in inflation but failed to reduce the inflation. Inflation kept on increasing at the rate of 9 percent per year for the last ten years.

Graph 2: Interest Rate and Inflation in Pakistan



Although the exchange rate is the price of goods in the world market but in comparison to 9.21 percent rate of inflation per annum, exchange rate was only devalued at the rate of 4.98 percent. One can argue that exchange rate is determined by the relative prices of domestic and foreign country. The answer lies in the appreciation in the real exchange rate by 1.36 percent per annum in the last ten years. This implies overvaluation of exchange rate even though it has increased substantially in the last ten years. Variability in real exchange rate was more than nominal exchange rate and variability in interest rate was lower than the variability in prices.

Methodology

Discussion in Section III clearly states that in dollar denominated debt country interest rate increases the pressure on foreign exchange market leaves real exchange rate to depreciate. Depreciation in real exchange rate raises the price level (known as pass-through effect). Thus in order to curtail inflation when it is expected to increase, increase in interest rate leads to increase in inflation, which is contrary to the thrust of the policy of inflation targeting. Thus, we check two hypothesis: (i) short run association between real interest rate and real exchange rate, which tells us whether increase in real interest rate depreciate the currency; and (ii) short run association between real exchange rate and price, which tell us whether the pass-through hypothesis is true. To check both, we used Vector Autoregressive (VAR) approach.

VAR is a theoretical approach which does not consider too many structural variables. It relies on the previous information of the variables. In a simultaneous equation models, each dependent variable is regressed on its own lags and the lags of all the other variables in the model. Thus it is a pure statistical model which does not require very expert knowledge on the subject. Since all the explanatory lag variables are exogenous and there is no dependency among the explanatory variables within the system thus there is no problem of simultaneity and identification, hence we can estimate the system of equations by ordinary least square (OLS) method. Mathematically, VAR model can be expressed as;

$$y_t = \alpha + \beta_1 y_{t-1} + \beta_2 y_{t-2} + \varepsilon_t,$$

y_t is a vector of k variables, which is 2 in our case, α is a constant and thus vector of k-variables (2 in our case), β is a matrix of kxk parameters and ε_t is the error term, vector of k-variables (2 in our case). VAR model can also be expressed in matrix form, for two variable case;

$$\begin{bmatrix} y_{1t} \\ y_{2t} \end{bmatrix} = \begin{bmatrix} \alpha_1 \\ \alpha_2 \end{bmatrix} + \begin{bmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{bmatrix} \begin{bmatrix} y_{1t-1} \\ y_{2t-1} \end{bmatrix} + \begin{bmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \end{bmatrix}$$

The first step in using VAR model is to check the integration of the variables. If the variables are integrated of order one [I(1)] then we need to transform the variables into I(0) and run VAR model on it. Battery of tests are available in the literature to check the stationarity of the data. ADF, Philip-Perron and KPSS tests are among the most common tests used in the empirical literature of stationarity.

$$(i)\ \Delta y_t = \rho y_{t-1} + \beta \sum_{i=1}^{n} \Delta y_{t-i} + \nu_t$$

$$(ii)\ \Delta y_t = \alpha + \rho y_{t-1} + \beta \sum_{i=1}^{n} \Delta y_{t-i} + \nu_t$$

$$(iii)\ \Delta y_t = \alpha + \delta t + \rho y_{t-1} + \beta \sum_{i=1}^{n} \Delta y_{t-i} + \nu_t$$

Three different ADF test can be applied to check the unity root in the data. The main purpose is to check the value of ρ. If ρ=1, series has unit root, i.e., non-stationary and if $\rho \neq 1$, then the series can be a stationary series. However we can include constant and trend in the equation. Moreover, lagged differences are used to capture the serial correlation in the data. Optimal lag levels are checked using Akaike Information Criteria (AIC);

$$AIC = 2k - 2\ln(L)$$

Where k is the number of parameters and L is the maximised value of likelihood function for the estimation model. The most minimum value of AIC implies the best lag length.

Phillips-Perron test is similar to ADF test, in which we can use constant and trend and we can leave them out. However, we do not use lagged differences in it. However, the test statistic is different that ADF test statistics. PP test statistic is based on the Newey-West (1987) heteroscedasticity and autocorrelation consistent covariance matrix estimator.

V. EMPIRICAL RESULTS

As a first step we checked the order of integration of all the three variables; real interest rate, real exchange rate, and prices for each country by using ADF test. All the three variables are integrated of order one (see Table 1). Thus we took the first difference of the variables (all the variables are in log form) to make them non-stationary and used in the VAR model.

Table 1

ADF Results for Stationarity

Variables	Constant	Constant + Trend	Lags
Ln(RER)	–0.37	–4.76**	1
Δ Ln(RER)	–9.52*	–9.46*	1
Ln(1+r)	–1.86	–2.40	2
Δ Ln(1+r)	–9.06*	–9.08*	2
Ln(CPI)	3.52	–0.51	1
Δ Ln(CPI)	–3.44	–8.55*	2

Note: * and ** indicate significance level at one percent and five percent respectively.

VAR is a simultaneous equation model which contains the exogenous variables. However, our objective is to check the impact of real interest rate on real exchange rate and impact of real exchange rate on prices. Thus we have only reported results of the effect of real interest rate on real exchange rate and ignored the other part of the equation. Similarly, we've only reported the results for the effect of real exchange rate on prices and ignored the other equation.

VAR results of real exchange rate and real interest rate association are given in Table 2. AIC in minimum when we use Lags 1–4, lag 6 and lag 12. R-square of the model is very good, which shows the strong explanatory power of the model. The results are not in the line of our proposed hypothesis that real interest rate pressurises the foreign exchange market. Similar to Kemal and Haider (2004) real interest rate does not affect real exchange rate in the short run. In this model real exchange rate is very strongly associated to its first lag.

VAR results of real exchange rate pass-through hypothesis from real exchange rate to prices are reported in Table 3. AIC is minimum when we used Lags 1–4 and Lag 12. Interestingly prices are strongly associated with its own first period lag and there is no pass through effect of real exchange rate to prices in the short run. However, there is an interesting result that lag 3 of real exchange rate is negatively associated with prices. This implies that real exchange rate appreciation leads to increase in prices after three months or real depreciation in exchange rate leads to decrease in prices after three months. Is it due to the definition error of the real exchange rate because domestic CPI comes in the denominator? R-square shows strong explanatory power of the model.

Table 2

Results of VAR: Real Interest Rate (LR)—Real Exchange Rate (LRER)

	LRER
LRER(–1)	1.129
	[10.8142]*
LRER(–2)	–0.214
	[–1.37166]
LRER(–3)	0.061
	[0.39296]
LRER(–4)	–0.010
	[–0.08379]
LRER(–6)	–0.013
	[–0.19837]
LRER(–12)	0.022
	[0.68125]
LR(–1)	–0.001
	[–0.35156]
LR(–2)	–0.002
	[–0.55371]
LR(–3)	0.003
	[0.70201]
LR(–4)	0.003
	[0.88655]
LR(–6)	–0.003
	[–1.01270]
LR(–12)	–0.002
	[–0.68338]
C	0.103
	[1.33449]
R-squared	0.980
Adj. R-squared	0.977
F-statistic	389.184*
Log likelihood	342.491*
Akaike AIC	–5.991
Schwarz SC	–5.672

Note: Value in the parenthesis are t-values.

*Indicates significance level at the one percent level of significance.

Table 3

Results of VAR: Prices (LP) – Real Exchange Rate (LRER)

	LP
LP(–1)	1.184*
	[11.3382]
LP(–2)	–0.138
	[–0.86282]
LP(–3)	–0.001
	[–0.00776]
LP(–4)	–0.082
	[–0.77733]
LP(–12)	0.043
	[1.48251]
LRER(–1)	0.111
	[1.66195]
LRER(–2)	0.027
	[0.25786]
LRER(–3)	–0.232**
	[–2.24093]
LRER(–4)	0.064
	[0.92062]
LRER(–12)	–0.005
	[–0.25923]
C	0.123
	[1.17189]
R-squared	0.999
Adj. R-squared	0.999
F-statistic	13978.020
Log likelihood	395.589
Akaike AIC	–6.930
Schwarz SC	–6.661

Note: Value in the parenthesis are t-values.

* and **indicates significance level at the one and five percent level of significance respectively.

VI. CONCLUSIONS

Theoretically fiscal imbalance can create severe problems for central bank to control inflation under the policy of inflation targeting. Following Blanchard (2004) the two most important linkages were tested in this study, i.e., increase in real interest rate depreciated the currency and depreciation in real exchange rate leads to increase in prices.

VAR model is used to check the short run association among variables. It is concluded that real exchange rate is not significantly associated to the real interest rate in the short run. Moreover, exchange rate pass through effect to prices is not present in Pakistan's case. Thus inflation targeting can be a policy to curtail inflation. However, we need to see the association between the interest rate and inflation, since interest rate is the main variable used to control inflation. Furthermore, State Bank needs to reduce the inflation to at least single digit level so that it is easy to control.

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Relationship between Trade Openness and Inflation: Empirical Evidences from Pakistan (1976–2010)

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1. INTRODUCTION

Inflation has always been an important issue for the policy-makers as it creates uncertain situation in the economy that may badly affect economic growth. Therefore, high and stable economic growth in addition with low inflation is the main objective of macroeconomic policies. Strict monetary policy with fiscal consolidation appears to have contributed to low price levels. The concern with inflation has not only to balance whole macroeconomic situation, but also from the fact that increase in inflation rates hurts the poor severely as their consumption basket becomes significantly decreased.

A general rise in prices in the economy is usually called inflation. Inflation was occurred due to some demand and supply side factors. Inflation can be resulted due to supply shocks of different food items and world wide oil prices. Rising oil prices always increase prices of almost all other commodities for consumers. These supply shocks are volatile and can occur huge changes in food and oil prices.

There are following demand side issues which increase price level in Pakistan. Firstly, increased local demand due to foreign remittances and demand management policies outpaced the local production, establishing positive output gap, which in turn put burden on prices to increase. Growth in private consumption remained above 10 percent during 2003 to 2006, showing symptoms of demand side burdens on prices. [Khan, Bukhari, and Ahmed (2007)]

Secondly, the widening gap among local demand and production was filled by growth in total imports; it was increases above 40 percent in FY05 and by 24 percent in FY06 as compare to that gap of imports, exports increased by only10 percent in FY05 and 13 percent in FY06.[1] Which result into increase in trade deficit and high expected inflation in future?

Thirdly, broad fiscal policy enhances local demand and add burden on current account deficit. This means, it increases gap among saving and investments, which has to be financed. Moreover, financing of fiscal deficit through money creation adds inflationary burden. On the other side, government borrowing from State Bank of

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[1]*Economic Survey 2005-06.*

Pakistan (SBP) also increased, which have serious effects on price level. Fourthly, broad monetary policy with high growth rate in money supply and loose credit policy was also contributing to large prices. [Khan, Bukhari, and Ahmed (2007)]

The extensive survey of International Monetary Fund, suggests that excessive credit growth in developing countries can have bad impacts on real variables. Increasing import prices is also a major reason in enhancing inflation and in this scenario the depreciating exchange rate can put upward pressure on prices.[2] Similarly, Khan and Qasim (1996) and Hasan, *et al*. (1995) suggested that indirect taxes are also the basic reason of inflation in Pakistan.

Trade Openness is defined as a "phenomena of sharp economic integration between countries capture through trade liberalisation, investment and capital flows, as well as technological changes"[3]. Trade Openness association with falling prices is the most popular propositions found in international trade and there has been unique turn in favor of higher economic integration of world. Openness suggests the economic benefit from international trade, international capital transactions, and the international exchange of knowledge and information. The lower the hurdles to international trade transactions the higher level of integration and benefits.

The new growth theory suggests that openness widens the market, induct an increase in development, reallocates employment to new activities that need more human capital and enhances knowledge flow between countries. Other than benefits, some expenses are also attached with it. A main problem arises from decreasing trade hurdles is the loss in tariff revenue that is 10-20 percent of government revenue in developing economies. If tariffs are decreased or vanished, these economies will have to implement other taxes in order to keep their budgets at desire level.

Objectives of the Study: The main objective of this research is to determine the nature of the relation among inflation and trade openness for Pakistan. The core focus of this study is to apply the cointegration approach of Johansen (1998) and Johansen and Juselius (1990) in order to examine whether the Romer's findings (1993), that the negative link among inflation and trade openness, holds for Pakistan or not.

Hypothesis: The null hypothesis (H0) of this study is to estimate the existence of Romer's Hypothesis in Pakistan and alternative hypothesis (H1) is otherwise.

2. REVIEW OF LITERATURE

Romer (1993) tested the hypothesis that there was negative relationship between trade openness and inflation. Romer's regressing inflation on openness for cross sectional data of 114 economies over the Post-Bretton Woods period.[4] He assessed the strong relationship between inflation and openness in politically unstable countries with independent central banks.

Lane (1997) emphasised on different channel through which openness and inflation related, especially the degree of imperfect competition, degree of central bank independence, political instability and price rigidity in the non-traded sector.15-years average annual data from 1973 to 1988 have undertaken for cross sectional analysis using

[2]IMF (2004).
[3]Torres (2001).
[4]From 1973 to the early 1990s.

OLS and finding shows the statistically significant negative link between openness and inflation.

Terra (1998) challenged Romer's empirical findings using regression on 20 sample countries which were dividing into 4 groups according to indebtness level. The time frames used in study were pre-debt crisis[5] and debt crisis period[6] for severely, moderately and less debted countries. Negative but significant link between inflation and openness was found among severely indebted countries in Latin America but that was not exists in moderately and less debted countries.

Bleaney (1999) estimated relationship between inflation and trade-openness for 100 countries through regression from 1973-88 and 1988-98. Results indicated the negative correlation between inflation and openness for cross-sectional data of 1970s and 1980s that has disappeared in 1990s. The same results were obtained if per capita income levels, population, area and exchange rate regimes were control.[7]

Cavallari (2001) inserted the relation of trade openness and inflation in monopolistic production model and unionised labour market of domestic sector. The result of theoretical model showed that trade openness can affect inflation in a positive or negative way and final result depends on level of concentration of wage bargaining in country. Results indicated that in countries where wage bargaining concentrated there did not exists any relation among openness and inflation. However, in countries where wage bargaining decentralised, there exists negative link between openness and inflation.

Alfaro (2001) estimated panel data of 146 countries from 1973-1998 by using fixed effect of country and time effect regression among openness and inflation. Results indicated that in the short run, there was no influence of openness on inflation and fixed exchange rate was an important factor to reduce inflation. In the long run, she concluded that negative and statistically significant relationship existed among openness and inflation.

Temple (2002) tried to establish relation of trade openness and the 'Phillips curve' for 44 countries from 1973-1990.[8] Regressions results indicated that Phillips' curve will be more inclined in open economies. Ashra (2002) used multiple regressions by taking panel data from 1980 and 1990 of 15 countries to discuss relation between inflation and openness. He concluded that inflation was effected by openness no matter either an economy possessing hyper-inflation or it is big.

Jin (2002) focused on the openness-growth and openness-inflation relations for "Korea" by applying variance decompositions (VDC's)[9] and impulse response functions (IRF's)[10] which were based on moving averages of quarterly data from 1960-1 to 1997-3.

[5]1973–1980.

[6]1982–1990.

[7]As a result of disinflation in industrial countries, the negative correlation between per capita GDP and inflation was strong in 1989-98, whereas it was weak in 1973-88.

[8]Phillips curve slope attached with openness is depend on small open economy system with nominal rigidity.

[9]Shows the quantity of information of each variable contributes to the other variables in a vector autoregression (VAR) models. It determines how much error variance of each variable can be explained by exogenous shocks to other variables.

[10]Impulse response functions show the effects of shocks on the adjustment path of the variables. It shows how an unexpected change in one variable at the beginning affects another variable with the passage of time. In time series analysis it is important in determining the effects of external shocks on the variables of the system.

Results of IRF's indicated that openness has inverse impacts on output growth but no long run effects, it further showed that financial market and trade openness has inverse effects on the output growth and prices. Results of VDC's showed that effects of openness were significant and increase in openness reduced tariffs and hence lower import prices.

Bowdler (2003) used cross sectional data of 20 countries to test the short term inclination of Phillips' curve relates positively with trade openness. He concluded that if cambial regime taken into consideration then degree of trade openness in a country exerted positive effect on inclination of Phillips' curve. Sachsida, Carneiro, and Loureiro (2003), used fixed and random effects model in order to verify the Romer's findings by using the data of 152 countries for the period of 1950 to 1992. They concluded that negative relation among openness and inflation was neither specific to countries nor to certain time period.

Agarwal and Narayanan (2003) used the dataset of 53 developing countries located at five different regions for the period of 1975 to 2002. GMM Findings showed that openness had significant negative effect on inflation after 1989. The analysis of pre 1989 data showed that only fixed exchange rate regime had significant negative effect.

Gruben and McLeod (2004) used panel regression for controlling country specific effects and confirmed about negative relation among inflation and trade openness. The time varying coefficients suggested that countries with more openness to trade enjoyed greatest deduction in their inflation during the 1990s. Empirical specification also provided coefficient of variation for inflation, that after 1985 the more open economies have less volatile inflation.

Kim and Beladi (2005) examined the relation among inflation and trade openness for 62 economies which consists of 28 OECD and 34 developing economies and selected on the basis of central bank dependency index form 1947 to 2002. Panel analysis indicated positive relation among prices and openness for advanced economies such as U.S., Belgium, and Ireland and inverse relation for developing countries as in line with Romer's (1993).

Nunziata and Bowdler (2006) hypothesised negative relation among openness and probability of huge increase in prices using data from 19 OECD economies from 1961–93. A range of probit regressions shown empirical support for greater openness reduces the probability of an inflation start even after controlling variables. The openness impact on lagged GDP growth and inflation in U.S. were positive but statistically insignificant.

Bowdler and Malik (2006) suggested that openness may change structure of consumption and production of goods whose prices were more stable internationally by using panel data of 96 countries from 1961-2000. Results of ordinary least squares suggested that opening of economy more sharply than the average has experienced huge deductions in inflation. Sachsida (2006) estimated relation among inflation and trade openness to verify Romer hypothesis for 152 countries with division in 7 different groups from 1950-1992. Fixed and random effect results given support to Romer's that inverse relation among inflation and openness were restricting neither to subset of economies nor to time period.

Chung-Shu Wu and Jin-Lung Lin (2006) investigated openness-inflation relationship using panel data of 13 countries that included Asian 4 Newly Industrialised

Economies (NIE's)[11] and the G7[12] from 1973 to 2001. Panel regression results clear that models with or without constant constraint give different relationships between openness and inflation. With restricted constant terms, the results were similar to Romer's (1993) however, if relax that restrictions, empirical results does not show a certain relationship. They concluded that openness has significant negative relationship with inflation for NIEs, but has mixed results for G7.

Aisen and Veiga (2006) analysed panel data of more than 100 countries from 1975 to 1999 and found that less economic openness along with higher degrees of political instability generated more volatile inflation rates. Results indicated that higher openness was related to lower inflation but this cannot be found in all countries at all times and they also supported the existence of import price effect.

Hanif and Batool (2006) tested Romer's hypothesis for Pakistan using time series data from 1973 to 2005. They found that real gross domestic product, monetary growth, interest rate, wheat support price and openness (the ratio of growth in trade to GDP) has inverse effect on inflation in Pakistan. Results from Regression Analysis clear that supply factors were important than monetary factors in the process of inflation.

Gopal (2007) discussed the effect of openness on tariff structure, export competitiveness, prices and economic growth for 11 countries of Latin American region[13] during 1985-2003. Ordinary least square results indicated the existence of significant positive relation and higher openness between Latin American countries would enhance to upgrade institutions. The opening up of markets could play vital role in decreasing economic rents atteched with economic and institutional arrangements.

Evans (2007) focused on level of imperfect competition that affects the relation among openness and inflation both within a country and between countries by using 2 country overlapping generations (OLG)[14] model from 1982-2005. Results indicated that level of imperfect competition among the producers plays a substitute for market power enjoyed by country's monetary authority in obtaining monopoly rents available in international structure.[15]

Badinger (2007) assessed the relation among inflation and openness measured in terms of financial openness using cross-sectional data of 91 countries from 1985-2004. 2SLS results indicated that larger trade and financial openness reduced central bank's independency which yield to less inflation that is attached with larger output-inflation tradeoff.

Daniels and Vanhoose (2007*)* considered open economy with degree of income-tax progressivity influenced on the interaction between openness, central bank independence and prices by using data of 17 countries from 1979 to 1999. Regression analysis of cross-country inflation provided favor inverse relationship between inflation

[11]Hong Kong, Korea, Mexico, Philippines, Singapore, and Taiwan.

[12]Canada, France, Germany, Italy, Japan, U.K. and the United States.

[13]Consist of various sub regional groups: Mexico, Central America (Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua and Panama), and the Caribbean 13 countries; South America contains the Andean Community (Colombia, Ecuador, Bolivia, Peru) and Mercosur (Argentina, Brazil, Uruguay, Paraguay and Venezuela) and Chile.

[14]In which agents live countable time span long enough to live one period at least with the next generations of agents.

[15]That is, greater level of imperfect competition among producers decreases the benefits from inflation generated by country's monetary authority.

and income tax progressive system. OLS Results indicated that higher openness and central bank independency reduced the income-tax progressivity effects on price levels.

Berument, Dogan, and Tansel (2008) assessed the role of openness on inflation for 4 MENA countries[16] through EGARCH model[17] from 1952 to 2006 by using export and import openness separately. Results suggested that increase in export openness[18] reduces inflation volatility for all MENA countries. However, increment in import openness[19] reduces price level for Jordan and Morocco but increases for Algeria and Turkey. The effect of inflation on openness was positive for Jordan, Morocco and Turkey and statistically significant just for Morocco.

Menghan (2008) estimated short and long run effect of openness on inflation through changes in productivity and interest rate by using industrial panel data of 20 industries in each of 6 OECD countries[20] from 1980 to 2006. Results indicated that openness reduced inflation rate, productivity and mark up in short run while; long run results were ambiguous.

Furuoka and Mun Ho (2009) examined relation between openness, unemployment and inflation by choosing 3 Asian economies[21] with different degrees of openness from 1980 to 2005. OLS results indicated that as country opened up to world by rising the quantity of imports then coefficient of Phillips curve slope become smaller. They concluded that more open countries tend to have flatter Phillips curve with higher sacrifice rate.

Lin (2010) investigated relation among trade openness and inflation of 106 countries using quantile regression from 1970-2007. Results reflected inverse impact of openness on inflation when price level was larger but no effect when it was less. He concluded that relation among openness and inflation appeared to be strengthening in larger prices period and was extremely robust to consider 1980s debt crisis and control the exchange-rate regime.

Mukhtar (2010) applied multivariate cointegration approach and vector error correction model to examine the Romer's hypothesis for Pakistan. He estimated time series data from 1960 to 2007 on budget deficit (BD), GDP, trade openness (TO), exchange rate (ER) and inflation (CPI). The empirical findings show that there was significant inverse long run relation among prices and openness which confirmed the existence of Romer's hypothesis in Pakistan.

Zakaria (2010) empirically examined relation among trade openness and prices in Pakistan using annual time series data from 1947 to 2007. Generalised Method of Moments (GMM) results shown that positive relation holds among openness and inflation in Pakistan and the control variables i.e. money supply, fiscal deficit, exchange rate depreciations, foreign inflation, terms of trade, foreign debt and democracy significantly affect inflation.

[16]Middle East and North African (Algeria, Jordan, Morocco and Turkey).

[17]GARCH models assumed that positive and inverse error terms effect on volatility. From empirical point exponential GARCH (EGARCH) volatility performs asymmetrically to the sign of shocks.

[18]Export-GDP ratio.

[19] Import-GDP ratio.

[20]USA, Japan, Canada, Portugal, Finland and Australia.

[21]Japan (9.8 percent), South Korea (32.9 percent) and Malaysia (77.2 percent).

Evans (2011) proposed that trade openness enhanced country's incentive to create inflation by estimating data through regression from 1973 to 1987 and 1988 to 2002. He concluded that openness was inflationary between developed countries in which monetary policy can roughly approximated by controlling for imperfect competition and inelasticity of labor supply within country.

3. THEORETICAL FRAMEWORK AND METHODOLOGY

Now, we designed the suitable model and explain how the variables are constructed and described the sources from where the data has been taken. After that explain the econometric methodology for estimation and interpretation of results.

3.1. Methodology

Inflation is a complex phenomena and it is not easy to establish an empirical model for a country. However, it is possible to find the key variables effecting the inflation in Pakistan. The most common empirical methodology for examining the trade openness and inflation relation had been to apply single equation model for inflation, treating trade openness as an independent variable with others.

Solomon and deWet (2004) use four variable single equation model where budget deficit (BD), gross domestic product (GDP) and exchange rate (ER) were treated as independent variables and inflation (CPI) as an dependent variable. Solomon and de Wet (2004) model is also used by Mukhtar (2010) in his study. To this, we add real agriculture value added (Agr), financial market openness (FMO), money and quasi money (M2), trade openness (TO) import openness (IO) and export openness (EO) as an independent variable with Gross Domestic product (GDP) and Exchange Rate (ER) are used in Real Terms. We also include Two Dummy Variables of 1982 and 1990 in Solomon and de Wet (2004) model for changes in Exchange Rate Regimes and Financial and Structural Reforms respectively.

In order to obtain the objectives of a study, model is expressed as follows;

$$CPI_t = \beta_0 + \beta_1 RealAgr_t + \beta_2 RealER_t + \beta_3 LnRealGDP_t + \beta_4 TO_t + \beta_5 FMO_t + \beta_6 LnM2_t + \mu_t \quad \ldots \quad \text{(a)}$$

Where,

CPI shows *Inflation rate*
Real Agr shows *Real Agriculture Value added*
Real ER shows *Real Exchange Rate*
Ln RealGDP shows Natural logarithm of *Real Gross Domestic Product*
TO shows *Trade Openness*
FMO shows *Financial Market Openness*
LnM2 shows *Money and Quasi money*
TO shows *Trade Openness*

$$CPI_t = \beta_0 + \beta_1 RealAgr_t + \beta_2 RealER_t + \beta_3 LnRealGDP_t + \beta_4 IO_t + \beta_5 FMO_t + \beta_6 LnM2_t + \mu_t \quad \ldots \quad \text{(b)}$$

Where, *IO* shows *Import Openness.*

$$CPI_t = \beta_0 + \beta_1 RealAgr_t + \beta_2 RealER_t + \beta_3 LnRealGDP_t + \beta_4 EO_t + \beta_5 FMO_t + \beta_6 LnM2_t + \mu_t \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (c)$$

Where, *EO* shows *Export Openness.*

3.2. Data Sources

In this study we have taken annual time series data that covers the period of 1976 to 2010 from various sources including

- International Financial Statistics of International Monetary Fund (IMF's).
- World Development Indicators (WDI).
- Statistical Appendix 2010 of State Bank of Pakistan (SBP).

In independent variables, natural logarithms of real GDP and Money and Quasi Money are taken because the data is in Rs millions while, all others variables are taken as % of GDP except exchange rate and inflation rate which are index numbers with base year 2005.

3.3. Selection and Construction of Variables

Following are the variables used in this study

Table of Variables Descriptions

Code	Variables	Definitions	Formula	Units	Source of Data and Definitions
Agr	Real Agriculture Value added	Includes forestry, hunting, fishing, cultivation of crops and livestock production. Value added is whole sector output after adding all outputs and subtracting inputs. It is estimated without making reductions for depreciation or depletion of fabricated assets and degradation of natural resources.	All outputs -Intermediate inputs (Not deducting depreciation of fabricated assets and degradation of natural resources)	% of GDP	WDI, World Bank national accounts data, and OECD National Accounts data files.
ER	Real Exchange Rate	The rate at which one currency will be exchanged for another. It is also considered as the value of one country's currency in terms of another currency	(Market rate)*Foreign Inflation ÷ Domestic Inflation	Index Number with base Year 2005	International Monetary Fund, International Financial Statistics.
FMO	Financial Market Openness	Scenario where existing administrative and market restrictions on capital movement across borders have been vanished. When capital account liberalization implements, it should create 'Openness', then 'financial integration' will gradually be obtained.[Robert stehrer]	FDI (Net Inflows)	% of GDP	Statistics & DWH Department, SBP.

Continued—

Table of Variable—(*Continued*)

GDP	Real Gross Domestic Product	The market amount of goods and services produced by a country in a given year.	Nominal GDP ÷ Domestic Inflation	Rs Million	International Monetary Fund, International Financial Statistics and data files.
TO	Trade Openness	Value to which countries allow trade with other countries. Broad economies generally have higher opportunities, at the same time they also face competition from others economies Trade Openness is the sum of exports and imports of goods and services measured as a share of gross domestic product.	(Exports + Imports) ÷ GDP	% of GDP	WDI, World Bank national accounts data, and OECD National Accounts data files.
Δ CPI	Consumer Price Index	The annual percentage change in the value of fixed basket of goods and services that may be fixed or changed after specified periods.	$LnCPI_t - LnCPI_{t-1}$	Index Number with base Year 2005.	International Monetary Fund, International Financial Statistics
M2	Money and Quasi Money	Includes currency outside banks, demand deposits other than those of central government, the time, savings, and foreign currency deposits of resident sectors other than central government.		Rs Million	International Monetary Fund, International Financial Statistics.
IO	Imports Openness	The value of all goods and services received from the rest of the world.	(Imports of goods & services ÷ GDP) *100	% of GDP	WDI, World Bank national accounts data, and OECD National Accounts data files.
EO	Exports Openness	The value of all goods and services provided to the rest of the world.	(Exports of goods & services ÷ GDP) *100	% of GDP	WDI, World Bank national accounts data, and OECD National Accounts data files.

3.4. Estimation Techniques

Usually many macroeconomic variables are non-stationary for this purpose we can apply *unit root testing technique* in order to see that whether the variables are stationary or not. Then, the variables which are stationary at I (1) we have used Johansen (1998) and Johansen and Juselius (1990) *Maximum Likelihood Cointegration Technique and Vector Error Correction Model* in our study to check the long run relationships in between them.

3.4.1. *Univariate Analysis*

(a) Unit Root Test

Many variables are non stationary for this we can use Unit Root Test in order to verify its order of integration. Then, only those variables are incorporated in the study which is stationary at 1st difference I (1).

(b) Augmented Dickey- Fuller Test (ADF)

The Augmented version of Dickey Fuller Test is used for larger and complicated models which adjust the DF test from serial correlation in the error term μt by putting lagged values of dependent variable ΔYt.

3.4.2. *Multivariate Analysis*

In order to find the existence and number of long-run relationship(s) the econometric framework we used in the study for analysis is the Johansen (1998) and Johansen and Juselius (1990) *Maximum Likelihood Cointegration Approach*. Two or more series are cointegrated if they observe same kind of stochastic behavior. It is statistical property of time series variables and uses when all the variables are stationary at I (1).

The cointegration approach in a multivariate system is similar to the ADF test, but requires the use of vector autoregressive (VAR). A vector autoregressive (VAR) model with a lag length of 1 was used to test for the number of cointegrating relationships between the variables. When two series are cointegrated it suggests that even both processes are non stationary, there is some long run relationship linking both series so that it is stationary. The AIC or SBC is used to determine the number of lags in the cointegration test (order of VAR). [22]

There are two likelihood ratio test statistics in the Johansen (1998) and Johansen and Juselius (1990) Maximum likelihood Cointegration Approach; the trace and the Maximum Eigenvalue both can be used to determine the existence of number of cointegrating vectors and they don't always indicated the same number of cointegrating vectors. The distribution of both test statistics is non-standard. The Trace test is a joint test with null hypothesis of number of cointegrating vectors is less than or equal to r, against alternative hypothesis that there are more then r cointegrating vectors. The Maximum Eigenvalue test conducted separate tests on each eigenvalue with null hypothesis that there are r cointegrating vectors exist against the alternative hypothesis that there exists (r + 1).

The Johansen's maximum eigenvalue and trace tests indicate the cointegrating vector (eq's) in model and reject the null hypothesis of no cointegration at 5 percent significance level. Then consider the 1st cointegrating equation having normalised coefficients of all variables with standard error (S.E) in parentheses and calculate T value by dividing coefficient with S.E. T value greater then 2 indicate the significance of those variables at 5 percent confidence level.

3.4.3. *Vector Error Correction Model*

A main quality of cointegrated variables is that their time paths are effected by the extent of any deviation from the long-run equilibrium [Anders (2004)]. The error correction mechanism (ECM) term presents the percentage of correction to any deviation in the long-run equilibrium price in a single period and also represents how fast the deviations in the long-run equilibrium are corrected. Depending on the presence of how many cointegrating vectors, we can then test for the short run dynamics using a vector

[22]Gujarati, N. Damodar, *Basic Econometrics* (Fourth Edition).

error correction model. A vector error correction model (VECM) is a process with the quality of deviation from present state means its long-run link will put into its short-run dynamics i.e., how changes in trade openness in short run contributed to its long run relation with inflation.

4. ESTIMATION RESULTS

The first step in cointegration analysis is to test the stationarity of variables. Table 2 in Appendix presents the Results of Augmented Dickey Fuller Test. It shows that all the variables incorporated in this study are found to be stationary at first difference I(1).

To obtain optimal lag length for cointegration analysis, basically two criteria are used namely the AIC and the SBC. The SBC has suggested lag length of 1 as optimal, while the AIC indicates 3 as an optimal lag length. However, we have selected optimal lag length 1 as suggested by the SBC because when we use the lag length 3 for cointegration analysis we find no cointegrating vectors under both Trace and Max-Eigen statistics. While with lag length 1, we may obtain same and different numbers of cointegrating vectors under both these statistics.

First, we explain the results of inflation rate with openness by using the proxy of Trade ratio (Expors + Imports) from equation (a). The cointegration relationships between inflation rate, Real Agr, Real ER, Real GDP, FMO, M2 and TO has been investigated assuming linear trend in data with an intercept in cointegrating equation using the estimation technique. Table 3 in Appendix reports Johansen (1998) and Johansen and Juselius (1990) Maximum Likelihood Cointegration Results. The Trace statistics (λ trace) and Maximum-Eigenvalue (λ max) statistics indicate that there is Four cointegrating vectors in seven time series under both statistics.

We can reject the null hypothesis of no cointegrating vector in favour of four cointegrating vectors under Trace and Maximum-Eigenvalue statistics at 5 percent level of significance. Under the assumption of no deterministic trend in data and intercept and no trend in cointegration equation, we can obtain the equation which is normalised for inflation to obtain meanings from the coefficients are given below;

$$CPI_t = -0.532275 + 0.046969 RealAgr_t + 0.011581 RealER_t - 0.164388 LnRealGDP_t$$

T Val (0.2212) (2.84315) (4.19565) (0.60310)

$$+0.026124 TO_t + 0.119921 FMO_t - 0.023952 LnM2_t$$

(6.514713) (6.32156) (0.34168)

Normalised coefficients with *T* value shows that except two variables all the independent variables reflect significant and standarised relationships at 5 percent level of significance. The coefficient of Trade Openness carries a positive sign and statistically significant at 5 percent level of significance, which shows that a 1 percent increase in trade openness brings about 0.02612 percent increase in inflation rate. This finding is supported by the empirical results of Kim and Beladi (2005), Pehnelt (2007), Gopal (2007), Evans (2007), Razin and Loungani (2007), Berument, Dogan, and Tansel (2008) and Zakaria (2010). There is significant positive long run relationship among inflation and trade openness in Pakistan and coefficient cleared that 1 percent increment in trade openness increases the inflation by 0.02612 percent. Which confirms the rejection of our null hypothesis.

The coefficient of real GDP carries a negative sign but statistically insignificant at 5 percent level of significance and shows that a 1 percent increase in real GDP brings about 0.164388 percent decrease in inflation rate. This finding is in line with Agarwal and Narayanan (2003) which shows that GDP has a significant negative effect without dummies for country, time and exchange rate regimes. Mukhtar (2010) also supported the significant negative relationship between inflation rate and GDP such that a 0.42 percent decrease in the inflation is associated with a 1 percent increase in GDP. While, Menghan (2008) found a positive long run relationship between GDP and prices.

The coefficient of real ER carries a positive sign and statistically significant at 5 percent level of significance, which shows that a 1 percent increase in real ER brings about 0.011581 percent increase in inflation rate. This finding is not supported by the results of Agarwal and Narayanan (2003) that the fixed exchange rate regime has significant negative effect on inflation if the dataset is analysed in two different time spans indicating that it is a short-run phenomenon. But, Mukhtar (2010) found a significant positive relationship between inflation rate and ER such that a 0.388 percent increase in the inflation is associated with a 1 percent increase in ER. Rogoff (1985) proposed that increased inflation has an extra cost and the optimal rate chosen by monetary authorities was lesser as the deteriorating effect on exchange rate increases.

The coefficient of real Agr carries a significant positive sign at 5 percent level of significance and shows that a 1 percent increase in real Agr brings about 0.046969 percent increase in inflation rate. This finding is in line with Hanif and Batool (2006) that growth in support prices of wheat is found to be positive and significant. And, Ashra (2002) also supported that rate of growth of agricultural output have statistically significant impact on the local inflationary process.

The coefficient of money and quasi money carries a negative sign but statistically insignificant at 5 percent level of significance, which shows that a 1 percent increase in money and quasi money brings about 0.023952 percent decrease in inflation rate. But, Agarwal and Narayanan (2003) and Ashra (2002) found a significant positive robust effect of the money growth on inflation and supports the theoretical arguments of the monetarists. Broad monetary policy increases GDP and depreciates the exchange rate, and the latter adjustment puts up import prices and inflation in proportion to the openness of the economy [Romer (1993)].

The coefficient of FMO carries a significant positive sign at 5 percent level of significance and shows that a 1 percent increase in FMO brings about 0.119921 percent increase in inflation rate. Our results are not supported by Jin (2002) which shows significant negative short-run effects of financial market openness on the growth rates of the price level. And, Badinger (2007) also found that increase in financial openness by one percentage point leads to a decrease in inflation by 0.36 percent.

Vector error correction mechanism (VECM) term represents the speed of adjustment back to the long run relationship among the variables. Table 4 in Appendix presents the results of the error correction model for Pakistan under study for Inflation with Trade Openness. The estimated coefficients show the immediate impact of different independent variables i.e., (real agriculture value added, real exchange rate, financial market openness, real GDP, trade openness, money and quasi money) on Inflation Rate. The ECM term for Pakistan is –0.028037 which is negative but insignificant in the analysis at 5 percent level of significance and suggests that inflation is corrected by 2.8037 per annum. In the short run, it can be observed that fluctuation exists in general. While, all adjustments take place with in the same or following time periods, implying that the system settles down quickly.

The coefficient of the ECT of inflation variable carries the negative sign and statistically insignificant at 5 percent level with the speed of convergence to equilibrium of 2.8037 percent. This means that, whenever there is any disturbance in the system in the long run, in every short-run period, a 2.8037 percent correction to disequilibrium will take place. More specifically, ECT coefficient shows that a deviation from the long run equilibrium value in one period is corrected in the next period by the size of the coefficient. This indicates the stability of the model.

While, FMO and M2 are statistically insignificant and TO is statistically significant but they carry a positive sign. This means that, in case of any disturbance, divergence from the equilibrium path will take place and the whole system cannot be brought to equilibrium position in each case.

Then, we explain the results of inflation rate with openness by using the proxy of Import ratio from equation (b). The cointegration relationships between inflation rate, Real Agr, Real ER, Real GDP, FMO, M2 and IO has been investigated assuming linear trend in data with an intercept in cointegrating equation using the estimation technique. Table 5 in Appendix reports Johansen (1998) and Johansen and Juselius (1990) Maximum Likelihood Cointegration Results. The Trace statistics (λ trace) and Maximum-Eigenvalue (λ max) statistics indicate that there is Five and Three cointegrating vectors respectively in seven time series.

We can reject the null hypothesis of no cointegrating vector in favour of five and three cointegrating vectors under Trace and Maximum-Eigenvalue statistics at 5 percent level of significance. Under the assumption of no deterministic trend in data and intercept and no trend in cointegration equation, we can obtain the equation which is normalised for inflation to obtain meanings from the coefficients are given below;

$$CPI_t = 5.861244 + 0.083002 RealAgr_t + 0.051451 RealER_t - 1.356627 LnRealGDP_t$$

T Val (1.30466) (2.62664) (7.24647) (2.59487)

$$+0.078529 IO_t + 0.226791 FMO_t + 0.162824 LnM2_t$$

(6.858427) (4.760495) (1.14500)

Normalised coefficients with T value shows that except M2 all the independent variables reflect significant and standardised relationships at 5 percent level of significance. The coefficient of Import Openness carries a positive sign and statistically significant at 5 percent level of significance, which shows that a 1 percent increase in import openness brings about 0.078529 percent increase in inflation rate and confirmed that if imports share rises in total trade then it positively effect inflation.

These results are not in line with the empirical results of Berument, Dogan, and Tansel (2008) as coefficients of Import openness is negative which suggests that higher import openness decreases inflation volatility for Jordan and Morocco and this effect is statistically significant just for Jordan. However, it is positive for the other two countries but statistically significant just for Turkey. While, Wu and Lin (2006) supports positive relationships between import openness and inflation without constant constraint.

But, Agarwal and Narayanan (2003) shows the mixed results that before 1989 only fixed exchange rate regime had significant negative effect on inflation and after 1989 openness had significant negative effect on inflation. There is positive long run relationship among inflation and import openness in Pakistan and coefficient cleared that 1 percent increment in import openness increases the inflation by 0.078529 percent. Which reflects that imported inflation increases in Pakistan because of increase in demands of imports and confirmed the rejection of our null hypothesis.

The coefficient of real GDP carries a negative sign and statistically significant at 5 percent level of significance, which shows that a 1 percent increase in real GDP brings about 1.356627 percent decrease in inflation rate. This finding is supported by Agarwal and Narayanan (2003) which shows that GDP has a significant negative effect without dummies for country, time and exchange rate regimes. And, Mukhtar (2010) also support a significant negative relationship between inflation rate and GDP such that a 0.42 percent decrease in the inflation is associated with a 1 percent increase in GDP. While, Menghan (2008) found positive long run relationship between GDP and prices.

The coefficient of real ER carries a positive sign and statistically significant at 5 percent level of significance, which shows that a 1 percent increase in real ER brings about 0.051451 percent increase in inflation rate. This is not supported by Agarwal and Narayanan (2003) that the fixed exchange rate regime has significant negative effect on inflation if the dataset is analysed in two different time spans indicating that it is a short-run phenomenon. But, Mukhtar (2010) supports our results that there exists significant positive relationship between inflation rate and ER such that a 0.388 percent increase in the inflation is associated with a 1 percent increase in ER. Rogoff (1985) proposed that increased inflation has an extra cost and the optimal rate chosen by monetary authorities was lesser as the deteriorating effect on exchange rate increases.

The coefficient of real Agr carries a significant positive sign at 5 percent level of significance and shows that a 1 percent increase in real Agr brings about 0.083002 percent increase in inflation rate. This finding is in line with Hanif and Batool (2006) that growth in support prices of wheat is found to be positive and significant. And, Ashra (2002) also supported that rate of growth of agricultural output have statistically significant impact on the local inflationary process.

The coefficient of money and quasi money carries a positive sign but statistically insignificant at 5 percent level of significance, which shows that a 1 percent increase in money and quasi money brings about 0.162824 percent increase in inflation rate. Our results are supported by Agarwal and Narayanan (2003) and Ashra (2002) that a significant positive robust effect of the money growth on inflation which also supports the theoretical arguments of the monetarists. Broad monetary policy increases GDP and depreciates the exchange rate, and the latter adjustment puts up import prices and inflation in proportion to the openness of the economy [Romer (1993)]. This shows that money remains an important factor of the inflationary process in Pakistan.

The coefficient of FMO carries a significant positive sign at 5 percent level of significance and shows that a 1 percent increase in FMO brings about 0.226791 percent increase in inflation rate. Our results are not supported by Jin (2002) which shows significant negative short-run effects of financial market openness on the growth rates of the price level. And, Badinger (2007) also found that increase in financial openness by one percentage point leads to a decrease in inflation by 0.36 percent.

Vector error correction mechanism (VECM) term represents the speed of adjustment back to the long run relationship among the variables. Table 6 in Appendix presents the results of the error correction model for Pakistan under study for Inflation with Import Openness. The estimated coefficients show the immediate impact of different independent variables i.e.; (real agriculture value added, real exchange rate, financial market openness, real GDP, import openness, money and quasi money) on Inflation Rate. The coefficient of the ECT of inflation variable carries the positive sign and statistically insignificant at 5 percent level and suggests that long-run equilibrium conditions of inflation does not influence the short-run dynamics in Pakistan with import openness which indicates the instability of the model.

While, the coefficients of the ECTs of import openness, FMO, Agr and M2 carries a positive sign but except import openness all others are statistically insignificant at 5 percent level of significance. This means that, in case of any disturbance, divergence from the equilibrium path will take place and the whole system cannot be brought to equilibrium position in each case.

Lastly, we explain the results of inflation rate with openness by using the proxy of Export ratio from equation (c). The cointegration relationships between inflation rate, Real Agr, Real ER, Real GDP, FMO, M2 and EO has been investigated assuming linear trend in data with an intercept in cointegrating equation using the estimation technique. Table 7 in Appendix reports Johansen (1998) and Johansen and Juselius (1990) Maximum Likelihood Cointegration Results. The Trace statistics (λ trace) and Maximum-Eigenvalue (λ max) statistics indicate that there is same Five cointegrating vectors in seven time series.

We can reject the null hypothesis of no cointegrating vector in favour of five cointegrating vectors under both Trace and Maximum-Eigenvalue statistics at 5 percent level of significance. Under the assumption of no deterministic trend in data and intercept and no trend in cointegration equation, we can obtain the equation which is normalised for inflation to obtain meanings from the coefficients are given below;

$$CPI_t = -1.186288 + 0.008447 RealAgr_t - 0.007104 RealER_t + 0.158709 LnRealGDP_t$$

T Val (0.74645) (0.87443) (3.01016) (0.807602)

$$+0.039428 EO_t + 0.025796 FMO_t - 0.053897 LnM2_t$$

(9.00182) (1.92107) (1.03608)

Normalised coefficients with *T* value shows that only Real ER and EO reflects insignificant relationships at 5 percent level of significance. The coefficient of Export Openness carries a positive sign and statistically significant at 5 percent level of significance, which shows that a 1 percent increase in export openness brings about 0.039428 percent increase in inflation rate. This finding is not supported by empirical results of Berument, Dogan, and Tansel (2008) as export openness reduces inflation for all Middle East and North African (MENA) countries. While, Agarwal and Narayanan (2003) shows the mixed results that before 1989 only fixed exchange rate regime had significant negative effect on inflation and after 1989 openness had significant negative effect on inflation.

But, Ashra (2002) shows that openness has significant positive effects on inflation no matter either an economy is experiencing hyper-inflation or it is large. There is positive long run relationship among inflation and export openness in Pakistan and coefficient cleared that a 1 percent increment in export openness increases the inflation by 0.039428 percent.

The coefficient of real GDP carries a positive sign and statistically insignificant at 5 percent level of significance, which shows that a 1 percent increase in real GDP brings about 0.158709 percent increase in inflation rate. These results are supported by Menghan (2008) which shows positive long run relationship between GDP and prices. While, Agarwal and Narayanan (2003) shows that GDP has a significant negative effect without dummies for country, time and exchange rate regimes. Mukhtar (2010) also found a significant negative relationship between inflation rate and GDP such that a 0.42 percent decrease in the inflation is associated with a 1 percent increase in GDP.

The coefficient of real ER carries a negative sign and statistically significant at 5 percent level of significance, which shows that a 1 percent increase in real ER brings about 0.007104 percent decrease in inflation rate. This finding is supported by Agarwal and Narayanan (2003) that the fixed exchange rate regime has significant negative effect on inflation if the dataset is analysed in two different time spans indicating that it is a short-run phenomena. But, Mukhtar (2010) found a significant positive relationship between inflation rate and ER such that a 0.388 percent increase in the inflation is associated with a 1 percent increase in ER. Rogoff (1985) proposed that increased inflation has an extra cost and the optimal rate chosen by monetary authorities was lesser as the deteriorating effect on exchange rate increases.

The coefficient of real Agr carries a positive sign but statistically insignificant at 5 percent level of significance and shows that a 1 percent increase in real Agr brings about 0.008447 percent increase in inflation rate. This finding is in line with Hanif and Batool (2006) that growth in support prices of wheat is found to be positive and significant. And, Ashra (2002) also supported that rate of growth of agricultural output have statistically significant impact on the local inflationary process.

The coefficient of money and quasi money carries a negative sign but statistically insignificant at 5 percent level of significance, which shows that a 1 percent increase in money and quasi money brings about 0.053897 percent increase in inflation rate. While, both Agarwal and Narayanan (2003) and Ashra (2002) found a significant positive robust effect of the money growth on inflation and supports the theoretical arguments of the monetarists. Broad monetary policy increases GDP and depreciates the exchange rate, and the latter adjustment puts up import prices and inflation in proportion to the openness of the economy [Romer (1993)].

The coefficient of FMO carries a positive sign but statistically insignificant at 5 percent level of significance and shows that a 1 percent increase in FMO brings about 0.025796 percent increase in inflation rate. Our results are not supported by Jin (2002) which shows significant negative short-run effects of financial market openness on the growth rates of the price level. And, Badinger (2007) also found that increase in financial openness by one percentage point leads to a decrease in inflation by 0.36 percent.

Vector error correction mechanism (VECM) term represents the speed of adjustment back to the long run relationship among the variables. Table 8 in Appendix presents the results of the error correction model for Pakistan under study for Inflation with Export Openness. The estimated coefficients show the immediate impact of different independent variables i.e., (real agriculture value added, real exchange rate, financial market openness, real GDP, export openness, money and quasi money) on Inflation Rate. The ECM term for Pakistan is –0.153528 which is negative and insignificant at 5 percent level of significance in the analysis and suggests that inflation is corrected by 15.3528 per annum. In the short run, it can be observed that fluctuation exists in general. While, all adjustments take place with in the same or following time periods, implying that the system settles down quickly.

The coefficient of the ECT of inflation variable carries the negative sign and statistically insignificant at 5 percent level with the speed of convergence to equilibrium of 15.3528 percent. This means that, whenever there is any disturbance in the system in the long run, in every short-run period, a 15.3528 percent correction to disequilibrium will take place. More specifically, ECT coefficient shows that a deviation from the long run equilibrium value in one period is corrected in the next period by the size of the coefficient. This indicates the stability of the model.

While, the coefficients of the ECTs of export openness carries a positive sign and real ER carries a negative sign but they both are statistically significant at 5 percent level of significance. While, all others variables carries a negative sign and statistically insignificant. This means that, in case of any disturbance, divergence from the equilibrium path will take place and the whole system cannot be brought to equilibrium position in each case.

5. CONCLUSION

The paper empirically explores the relationship between trade openness and inflation in Pakistan using annual time series data for the period of 1976 to 2010. Since Pakistan's economy has a considerable degree of trade openness, the local price level cannot remain immune from abroad shocks. The expected empirical findings shows that there is a significant positive long-run relationship between inflation and trade openness, import openness and export openness which rejects the existence of Romer's hypothesis in Pakistan.

The positive insignificant effect of money and quasi money on inflation with import openness proxy is somehow follows the monetarists who argue money to be the most important variable influencing the inflationary process. An increase in the development level of the country and a shift from fixed to flexible exchange rate regime are also found to put up the country's inflation rate.

The study also shows the significant positive effect of financial market openness (FMO) on inflation with trade and import openness proxy as capital account liberalisation implements which should create openness, then 'financial integration' will gradually be obtained. As, Pakistan has rich agriculture base with large share of agri-products in exports and real agriculture value added also shows the significant positive effect on inflation with trade and import openness proxy.

The study shows the significant positive effect of Real ER on inflation with trade and import openness proxy. This implies that it is not advisable for policymakers to implement a flexible exchange rate system because that could lead to a major depreciation that would create inflationary problems. The challenges for the future is to find ways of combine flexible exchange rate with low inflation in Pakistan.

The positive relationship between openness and inflation is bound to have vast reaching implications for policy makers in Pakistan having some for the development purposes. Specifically, it will have implications for the optimum trade policy (inward looking versus outward looking policies) and the optimal capital accumulation strategy. Large inflation discourages local capital accumulation, while high capital accumulation is needed for development. So, it will turn out that outward looking trade policy may not be reliable as it is inflationary.

Finally, the short-run analysis by using a VECM suggests that long-run equilibrium condition does not influence the short-run dynamics by using the Import Openness proxy. However, the result for Trade and Export Openness proxy confirms that the Inflation Rate has an automatic adjustment mechanism and that the economy responds to deviations from equilibrium in a balancing manner. Since, inflation is one of the hurdle on the way of development for the country, it should also be controlled by non monetary and non fiscal measures e.g. increase in volume of production, rationing policy, sound managerial and financial system, etc.

Appendix

Table 1

Descriptive Statistics

Variables	Mean	Standard Deviation
Real Agriculture Value-added	26.193	3.534
Real Exchange Rate	46.919	13.829
Ln Real Gross Domestic Product	10.35244	0.59623
Financial Market Openness	0.951	0.907
Ln Money and Quasi money	13.2679	1.422302
Trade Openness	34.372	3.163
Inflation Rate [ΔCPI]	0.08082	0.03492
Export Openness	13.923	2.462
Import Openness	20.449	2.800

Table 2

Results of Unit Root Test

	Level		1st Difference		
Variables	Intercept	Trend and Intercept	Intercept	Trend and Intercept	Order of Cointegration
Real Agriculture	–1.084	–2.460	–5.518*	–5.419*	I (1)
Value added	(–2.95) 5%	(–3.55) 5%	(–2.95) 5%	(–3.55) 5%	
	Lag (1)	Lag (1)	Lag (0)	Lag (0)	
Real Exchange Rate	–1.720	–0.764	–5.247*	–5.530*	I (1)
	(–2.95) 5%	(–3.55) 5%	(–2.95) 5%	(–3.55) 5%	
	Lag (1)	Lag (1)	Lag (0)	Lag (0)	
Financial Market	–1.939	–3.380	–3.876*	–3.826*	I (1)
Openness	(–2.95) 5%	(–3.55) 5%	(–2.95) 5%	(–3.55) 5%	
	Lag (2)	Lag (2)	Lag (0)	Lag (0)	
Real Gross	–0.947	–2.237	–5.790*	–5.777*	I (1)
Domestic Product	(–2.95) 5%	(–3.55) 5%	(–2.95) 5%	(–3.55) 5%	
	Lag (1)	Lag (1)	Lag (0)	Lag (0)	
Trade Openness	–2.757	–2.775	–5.824*	–5.720*	I (1)
	(–2.95) 5%	(–3.55) 5%	(–2.95) 5%	(–3.55) 5%	
	Lag (1)	Lag (1)	Lag (0)	Lag (0)	
Export Openness	–2.249	–2.298	–5.017*	–5.041*	I (1)
	(–2.95) 5%	(–3.55) 5%	(2.95) 5%	(–3.55) 5%	
	Lag (1)	Lag (1)	Lag (0)	Lag (0)	
Import Openness	–1.727	–1.622	–6.167*	–6.110*	I (1)
	(–2.95) 5%	(–3.55) 5%	(–2.95) 5%	(–3.55) 5%	
	Lag (1)	Lag (1)	Lag (0)	Lag (0)	
ΔCPI/Inflation	–2.416	–2.620	–8.529*	–8.446*	I (1)
	(–2.95) 5%	(–3.55) 5%	(–2.95) 5%	(–3.55) 5%	
	Lag (2)	Lag (2)	Lag (0)	Lag (0)	
Money and Quasi	–1.217	–2.940	–3.607*	–3.766*	I (1)
Money	(–2.95) 5%	(–3.55) 5%	(–2.95) 5%	(–3.55) 5%	
	Lag (1)	Lag (1)	Lag (0)	Lag (0)	

Table 3

Results of Johensen Cointegartion Test with TO

Trend assumption: No deterministic trend (restricted constant)
Series: CPI AGR ER FMO GDP TO M2
Exogenous series: D1 D2
Lags interval (in first differences): 1 to 1

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistics	0.05 Critical Value	Prob.**
None *	0.880748	215.8707	134.6780	0.0000
At most 1 *	0.746474	145.6958	103.8473	0.0000
At most 2 *	0.689734	100.4103	76.97277	0.0003
At most 3 *	0.593131	61.78952	54.07904	0.0088
At most 4	0.429886	32.11385	35.19275	0.1035
At most 5	0.258014	13.57053	20.26184	0.3200
At most 6	0.106674	3.722527	9.164546	0.4550

Trace test indicates 4 cointegrating eqn(s) at the 0.05 level.
* denotes rejection of the hypothesis at the 0.05 level.
**MacKinnon-Haug-Michelis (1999) p-values.

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.880748	70.17490	47.07897	0.0000
At most 1 *	0.746474	45.28554	40.95680	0.0153
At most 2 *	0.689734	38.62077	34.80587	0.0167
At most 3 *	0.593131	29.67567	28.58808	0.0362
At most 4	0.429886	18.54332	22.29962	0.1543
At most 5	0.258014	9.848002	15.89210	0.3484
At most 6	0.106674	3.722527	9.164546	0.4550

Max-Eigenvalue test indicates 4 cointegrating eqn(s) at the 0.05 level.
* denotes rejection of the hypothesis at the 0.05 level.
**MacKinnon-Haug-Michelis (1999) p-values.

Table 4

Vector Error Correction Estimates with TO

Error Correction:	D(CPI)	D(AGR)	D(ER)	D(FMO)	D(GDP)	D(TO)	D(M2)
CointEq1	–0.028037	–0.935177	–27.50890	2.738435	–0.057268	29.00586	0.057424
SE	(0.08290)	(2.63073)	(7.52778)	(1.40009)	(0.11616)	(5.25239)	(0.16119)
t-statistics	[–0.33821]	[–0.35548]	[–3.65432]	[1.95591]	[–0.49302]	[5.52241]	[0.35624]
R-squared	0.423517	0.348996	0.556352	0.351405	0.325431	0.700060	0.271009
Adj. R-squared	0.161479	0.053085	0.354694	0.056589	0.018808	0.563723	–0.060351
Sum Sq. Resids	0.017156	17.27705	141.4653	4.893570	0.033684	68.87007	0.064866
S.E. Equation	0.027925	0.886183	2.535792	0.471630	0.039129	1.769310	0.054300
F-statistic	1.616244	1.179395	2.758887	1.191945	1.061340	5.134790	0.817869

Table 5

Results of Johensen Cointegartion Test with IO

Trend assumption: No deterministic trend (restricted constant)
Series: CPI AGR ER FMO GDP IO M2
Exogenous series: D1 D2
Lags interval (in first differences): 1 to 1

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistics	0.05 Critical Value	Prob.**
None *	0.867646	224.8148	134.6780	0.0000
At most 1 *	0.764597	158.0797	103.8473	0.0000
At most 2 *	0.709751	110.3466	76.97277	0.0000
At most 3 *	0.565693	69.52506	54.07904	0.0012
At most 4*	0.499353	42.00292	35.19275	0.0079
At most 5	0.366420	19.17173	20.26184	0.0701
At most 6	0.117143	4.111529	9.164546	0.3958

Trace test indicates 5 cointegrating eqn(s) at the 0.05 level.
* Denotes rejection of the hypothesis at the 0.05 level.
**MacKinnon-Haug-Michelis (1999) p-values.

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.867646	66.73508	47.07897	0.0001
At most 1 *	0.764597	47.73309	40.95680	0.0075
At most 2 *	0.709751	40.82153	34.80587	0.0085
At most 3	0.565693	27.52215	28.58808	0.0679
At most 4*	0.499353	22.83119	22.29962	0.0421
At most 5	0.366420	15.06020	15.89210	0.0672
At most 6	0.117143	4.111529	9.164546	0.3958

Max-Eigenvalue test indicates 3 cointegrating eqn(s) at the 0.05 level.
* denotes rejection of the hypothesis at the 0.05 level.
**MacKinnon-Haug-Michelis (1999) p-values.

Table 6

Vector Error Correction Estimates with IO

Error Correction:	D(CPI)	D(AGR)	D(ER)	D(FMO)	D(GDP)	D(IO)	D(M2)
CointEq1	0.027670	0.223952	–4.571406	0.815417	–0.025212	7.818929	0.058026
SE	(0.02780)	(0.89074)	(3.07097)	(0.48254)	(0.03925)	(1.51724)	(0.05339)
t-statistics	[0.99534]	[0.25142]	[–1.48859]	[1.68983]	[–0.64236]	[5.15338]	[1.08688]
R-squared	0.435245	0.349867	0.356825	0.328866	0.329130	0.655134	0.303403
Adj. R-squared	0.178538	0.054352	0.064473	0.023805	0.024189	0.498376	–0.013232
Sum sq. resids	0.016807	17.25394	205.0881	5.063619	0.033499	50.06104	0.061983
S.E. equation	0.027639	0.885590	3.053225	0.479755	0.039022	1.508477	0.053079
F-statistic	1.695496	1.183921	1.220533	1.078035	1.079322	4.179282	0.958211

Table 7

Results of Johensen Cointegartion Test with EO

Trend assumption: No deterministic trend (restricted constant)
Series: CPI AGR ER FMO GDP EO M2
Exogenous series: D1 D2
Lags interval (in first differences): 1 to 1

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistics	0.05 Critical Value	Prob.**
None *	0.885132	240.9189	134.6780	0.0000
At most 1 *	0.806458	169.5078	103.8473	0.0000
At most 2 *	0.721359	115.3132	76.97277	0.0000
At most 3 *	0.637892	73.14469	54.07904	0.0004
At most 4*	0.508247	39.62288	35.19275	0.0156
At most 5	0.282838	16.20021	20.26184	0.1652
At most 6	0.146544	5.229223	9.164546	0.2592

Trace test indicates 5 cointegrating eqn(s) at the 0.05 level.
 * Denotes rejection of the hypothesis at the 0.05 level.
**MacKinnon-Haug-Michelis (1999) p-values.

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.885132	71.41110	47.07897	0.0000
At most 1 *	0.806458	54.19465	40.95680	0.0010
At most 2 *	0.721359	42.16848	34.80587	0.0056
At most 3 *	0.637892	33.52182	28.58808	0.0107
At most 4*	0.508247	23.42267	22.29962	0.0347
At most 5	0.282838	10.97099	15.89210	0.2540
At most 6	0.146544	5.229223	9.164546	0.2592

Max-Eigenvalue test indicates 5 cointegrating eqn(s) at the 0.05 level.
 * denotes rejection of the hypothesis at the 0.05 level.
**MacKinnon-Haug-Michelis (1999) p-values.

Table 8

Vector Error Correction Estimates with EO

Error Correction:	D(CPI)	D(AGR)	D(ER)	D(FMO)	D(GDP)	D(EO)	D(M2)
CointEq1	–0.153528	–4.233552	–39.13288	–1.464104	–0.085179	14.03171	–0.129073
SE	(0.10783)	(3.54291)	(9.65583)	(2.02344)	(0.15620)	(4.06751)	(0.21581)
t-statistics	[–1.42377]	[–1.19494]	[–4.05277]	[–0.72357]	[–0.54534]	[3.44971]	[–0.59809]
R-squared	0.464447	0.351718	0.599227	0.256195	0.330313	0.521688	0.282571
Adj. R-squared	0.221013	0.057045	0.417058	–0.081898	0.025910	0.304273	–0.043533
Sum sq. resids	0.015938	17.20481	127.7938	5.611915	0.033440	22.67709	0.063837
S.E. equation	0.026915	0.884328	2.410147	0.505061	0.038987	1.015272	0.053867
F-statistic	1.907900	1.193586	3.289396	0.757764	1.085118	2.399505	0.866504

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On Measuring Inclusiveness of Growth in Pakistan

SAIMA ASGHAR and SAJID AMIN JAVED

1. INTRODUCTION

Increasing level of inequalities in societies has diverted the attention of policy makers towards the new development paradigm of "Inclusive Growth" across the developing world especially. Despite the achievement of reduction in extreme poverty 60.3 percent of the population still lives under $2-a-day poverty line in Pakistan. Gini coefficient increased from 30.3 percent (1993), to 33 percent (2006)[1] indicating that growth has been uneven and the gap between haves and have-nots widened over the time. A small segment of the population is benefiting fruits of growth to a large extent leaving large segment of the society deprived of basic needs; 51 percent of the population is suffering from severe deprivation of education and 29 percent with health.[2] The prevailing inequalities in Pakistan have resulted in 31.5 percent[3] loss in human development which could have been improved otherwise. Different socio-economic indicators show that the disadvantage groups including poor, people living in rural areas have not benefited proportionally from economic growth.[4] Income inequalities can hamper the growth through lowering the impact on poverty reduction of a given rate of growth, and thereby reduce the growth. Furthermore inequalities can operate through political (in)stability and social cohesion channels to dissuade economic growth [Ali and Son (2007)]. In this back drop, reducing inequalities has become a major concern of development policy across the globe especially so for developing countries generating interest in inclusive growth. Inclusive growth ensures fair and equal access to all stratum of society, including disadvantaged and marginalised, to opportunities created [Ali and Son (2007)].

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[1]*World Development Indicators* Online World Bank.

[2]*Human Development Report* (HDR) 2010.

[3]Loss in HDI shows; total loss in achieving potential level of; human development that could be achieved if there was no inequality in distribution of: income, years of schooling and expected length of life. HDR 2010.

[4]*Pakistan Economic Survey* 2010.

Creation of economic opportunities and ensuring equal access to opportunities by all groups of society is essential and prerequisite for socio-economic development. An enabling environment is a pre-condition to allow all individuals to equally participate with growth process. Equity in the provision of public services particularly education, health and employment opportunities is required failing to which can worsen the situation. In last two decades the economic growth achieved in Pakistan has not been successful in engulfing the poor-rich gap and resulted in ever increasing inequalities. Until the fruits of development are not shared with and by all segments of society sustainable development, with its ultimate objective of poverty reduction, cannot be achieved. In recent years, Pakistan has increased its pro-poor expenditures to improve health, and education conditions, with major focus on skill development for productive labour force, and provide social safety net to the vulnerable groups.[5] Different policies and programmes are in progress to achieve these objectives. Consistent with the definition and measurement approach of inclusive growth adopted by *"Ali and Son"* this study aims to assess the inclusiveness of growth in context of education and employment opportunities, and evaluate equity thereof, in Pakistan using cross-sectional data from Pakistan Living Standards and Measurement Survey (PLSM) for the period 1998-99 and 2007-08. The study empirically evaluates the change in and access to both education and employment opportunities available to the population and how equitably these opportunities are distributed. We find that growth process has increased the inequalities both in education and employment opportunities over the study period. Average opportunities available to population increased for education while a decline in average employment opportunities is documented in 2007-08 as compared to 1998-99. Equity Index of Opportunities (EIO) improved at primary level, remained stagnant for secondary level, and decreased for literacy rate over the time. Moreover, EIO for employment opportunities, suggesting equitable distribution for employment and paid employment registers a decrease and turn inequitable when calculated based on average monthly income.

The concept of inclusive growth has not been a part of much academic debate in Pakistan therefore this study draws the attention of policy makers towards the new development paradigm which focuses on income as well as non-income dimensions of progress for poverty and inequality reduction. The findings of this work will provide the basis to gauge the overall opportunities generated in last decade. It will assist to; identify the problem of current growth process which has increased the inequality, so that targeted policies could be designed for efficient allocation of resources. Rest of the paper is organised in five sections wherein Section 2 lays conceptual foundation of inclusive growth while Section 3 provides literature review. Data and Methodology adapted to measure inclusive growth is discussed in Section 4 and Section 5 furnishes empirical illustration. Section 6 concludes the paper and draws some policy implications.

2. INCLUSIVE GROWTH—THE CONCEPT

Nevertheless there is no agreed and common definition of inclusive growth; the concept however, is understood to refer to "*growth coupled with equal opportunities*." Inclusive growth is one which emphasises that economic opportunities created by growth are available to all, particularly the poor [Rauniyar and Kanbur (2009)]. Growth will be

[5] *Pakistan Economic Survey* 2010-11.

inclusive when the benefits will reach to poor, marginalised and socially excluded groups in any society. It should bring social development and empower the weaker groups in the society to gain access to assets and opportunities. Equitable distribution of assets and opportunities leads to sustainable economic growth and ultimately result in reduction of poverty and inequality. The new development approach of inclusive growth emphasise that, for poverty reduction, public policies should focus on multidimensional approach which expands socio-economic opportunities as well as ensures equal access of all segments of society to these opportunities under the framework of accelerated economic growth [Naqvi (2010)]. It not only considers the pace but also the pattern of growth simultaneously.

Inclusive growth aims on ensuring that the economic opportunities created by growth are available to all, particularly the poor, to the maximum extent possible (Asian Development Bank). While United Nations Development Programme (UNDP) emphasised inclusive growth as growth with low and declining inequality, economic and political participation of the poor in the growth process, and benefit-sharing from that process. Inclusive growth involves a long term perspective and focuses on generating decent employment in order to increase the income of excluded groups [Ianchovichina and Lundstrom (2008)]. Growth allowing every individual (group) of society participate in, and contribute to the growth process on an equal footing regardless of their individual circumstances is called to be growth with inclusiveness [Ali and Zhuang (2007)].

3. LITERATURE REVIEW

Inclusive growth has become an important development policy of many developing countries. Different definitions and measurement concepts of inclusive growth exist in the literature. Stephan Klasen (2010), defines inclusive growth as non-discriminatory and disadvantage-reducing growth, which focuses on two characteristics; one on process, in the sense that the actual growth include many people who participate in growth (i.e. inclusive growth is based on inputs from a large number of people), second; on outcomes of the growth process (i.e. inclusive growth benefits many people). The author argues that inclusive growth adds much beyond the existing pro-poor growth concepts. According to author *"income growth is inclusive when it; allows participation and contribution by all members of society, with particular emphasis on the ability of the poor and disadvantaged to participate in the process of growth (the non-discriminatory aspect of the growth), and associates with declining inequality in non-income dimensions of wellbeing that are particularly important for promoting economic opportunities, including education, health, nutrition, and social integration (the disadvantage-reducing aspect of inclusive growth)".*

Rauniyar and Kanbur (2009) conclude that a growth that is accompanied by declining income inequality is inclusive in nature. The authors highlighted different factors essential for inclusive growth and development including; sustainable and equitable growth that is broad-based across sectors and regions creating more employment opportunities for poor and vulnerable groups, improved quality of infrastructure, rural infrastructure and agricultural technologies to provide rural population economic opportunities, social protection for disadvantaged groups, legal identity, capacity building, rule of law and enabling environment for business and investment and public private partnership to promote equity and inclusiveness.

Lanchovichina and Lundstrom (2008) asserts that sustainable growth should be broad-based across sectors and inclusive of the vast majority of country's labour force. This concept of growth focuses on productive employment as a means of increasing incomes of excluded groups rather than on direct income distribution. The authors applied inclusive growth analytics to Zambia and conclude that poor education and health, access to capital and credit, infrastructure and government failure are the constraints to productive employment and inclusive growth.

Yoko (2009), focus on gender dimensions of growth process and concludes that despite the improvement in education, and to some extent health outcomes, women's improved capabilities are not translated into an equal participation between men and women in economic and political activities. Gender gaps in access to resources and opportunities remain significant particularly in South Asia, which are caused and reinforced by interlinked cultural, social, and economic factors. Based on empirical evidence the author argues that; educating public, enforcing antidiscrimination legislations, promoting economic development to generate economic opportunities and improving women's capabilities and access to the opportunities, are the key ingredients for greater progress toward gender equality and inclusive growth.

Mendoza and Thelen (2008), point out the barriers that poor people face in accessing and actively participating in markets as producers and consumers. Lack of access to credit, limited investment in human capital, including skills and entrepreneurship training, and geographical obstacles, according to authors, can be major causes of exclusion of the poor people from labour and various product markets. The paper also describes the role of markets in promoting economic growth and its benefits to those who are able to access and participate successfully.

Ali (2007) establishes higher demand of coupled with higher wages for skilled workers backed by rising importance of new technologies and foreign direct investment has resulted in increased income inequalities in Asia over the time. Further, according to author, with the decline in effective delivery of public services non-income inequalities have also risen. Creation of economic, social and political opportunities, equal access to opportunities and provision of social protection scheme to the vulnerable groups will promote inclusive growth in the region. The author also emphasised the importance of measuring inclusive growth in term of average opportunities available and distribution of these opportunities.

Ali and Son (2007), in a very influential work, examined that to what extent social opportunities are distributed across different income groups and how this distribution changes over time. The originality of paper lies in devising methodology to measure inclusive growth. This approach relies on a social opportunity function, similar to the idea of a social welfare function. Growth is considered inclusive, according to authors, if it increases the social opportunity function, which in turn, depends on two factors namely average opportunities available to the population, and how equitably these opportunities are shared among the population. This paper also provides empirical application of the proposed approach to Philippines to analyse the access to and equity of opportunities in education and health facilities. The authors conclude that government health facilities are more utilised by the people at the lower income distribution, whereas private health facilities which are superior in quality tend to be highly inequitable in favour of rich. Further primary and secondary level education opportunities are more inequitable over the time period 1998 to 2004.

Ali and Zhuang (2007), emphasise that inclusive growth is not based on a redistributive approach but its goal should be the high and sustainable growth to create productive and decent employment opportunities as well as social inclusion to ensure equal access to opportunities. Further the authors emphasised that social inclusion could be achieved by investing in education, health and other social services to enhance human capacities, promoting economic and social justice and provision of social safety nets to prevent extreme deprivation.

4. DATA AND METHODOLOGY

Cross-sectional data from Pakistan Social and Living Standards Measurement Survey (PSLM) 1998-99 and 2007-08 is used to gauge the inclusiveness of Growth in Pakistan. Baseline comparison will be made with the 1998-99 dataset. PSLM survey provides various micro level household based socio-economic indicators including education, employment, health, income, expenditure etc. These two datasets provide information of more than, 16000 (1998-99) and 15000 (2007-08) households, from all over the Pakistan including urban and rural areas of the four provinces and Islamabad; however military restricted areas are not included in the surveys. Based on Ali and Son (2007) measurement approach a social opportunity curve and index is calculated for 1998-99 and 2007-08 PLSM data to gauge access to education and employment opportunities. The idea of a social opportunity function is similar to social welfare function. It states that inclusive growth leads to the maximisation of social opportunity function and growth inclusiveness could be measured in terms of increasing the social opportunity function, which depends on two factors: (i) average opportunities available to the population, and (ii) how the available opportunities are shared or distributed among the population. This social opportunity function gives greater weight to the opportunities enjoyed by the poor: the poorer a person is, the greater the weight will be. Such a weighting scheme will ensure that opportunities created for the poor are more important than those created for the non-poor i.e., if the opportunity enjoyed by a person is transferred to a poorer person in society, then social opportunity must increase making growth more inclusive.

Suppose there are n persons in the population with incomes $x_1, x_2, ..., x_n$, where x_1 and x_n are poorest and richest person respectively. Social opportunity function then, based on social welfare function, can be defined as:

$$O = O\,(y_1, y_2, \ldots\ldots, y_n) \qquad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \qquad (1)$$

Where y_i is the opportunity enjoyed by the ith person who has income x_i and where y_i can take binary values of 0 and 100 indicating that ith person is deprived of or enjoys a certain opportunity respectively. The average opportunity for the population is then defined as:

$$\bar{y} = \frac{1}{n} \sum_{i=1}^{n} yi \qquad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \qquad (2)$$

It also represents the percentage distribution because y_i takes the binary values of 0 and 100. This idea will be operational if the problem is formulated in continuous distribution. Suppose the population is arranged in ascending order of their incomes and $\bar{y}_p$ is the average opportunity enjoyed by the bottom p percent of the population, where p varies from 0 to 100 and $\bar{y}$ is the mean opportunity available to whole population, then $\bar{y}_p$ will be equal to $\bar{y}$ when p = 100 (which covers the whole population). As $\bar{y}_p$ varies with p, a curve $\bar{y}_p$ could be drawn for different values of p, which is a concentration curve of opportunity when the individuals are arranged in ascending order of their incomes called the opportunity curve. The higher the curve, the greater is the social opportunity function. The index calculated based on area under the opportunity curve will capture then magnitude of the change in opportunity distributions.

$$\bar{y}^* = \int_0^1 \bar{y}_p \, dp \qquad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \qquad (3)$$

$\bar{y}^{*}$, in Equation 3, is proposed opportunity index (hereafter OI) where the greater value of $\bar{y}^*$ denote that opportunities available to population are greater. If everyone in the population enjoys the same opportunity then $\bar{y}^*$ should be equal to $\bar{y}$ but deviation of $\bar{y}^*$ from $\bar{y}$ provide the distribution of opportunities across the population. Thus based on the assumptions of the opportunity curve an equity index of opportunity (hereafter EIO) is also proposed which could be determined as:

$$\varphi = \bar{y}^* / \bar{y} \qquad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \qquad (4)$$

$$\Rightarrow \qquad \bar{y}^* = \varphi \bar{y}$$

In order to achieve inclusive growth $\bar{y}^*$ should be increased over time and to understand the dynamics of inclusive growth both sides of equations are differentiated

$$\Rightarrow \quad d\bar{y}^* = \varphi d\bar{y} + \bar{y} d\varphi \qquad \text{(Differentiating both sides)} \qquad \ldots \quad \ldots \qquad (5)$$

Here $d\bar{y}^*$ measures the change in the degree of growth inclusiveness while $\varphi d\bar{y}$ is the contribution to inclusiveness of growth by increasing the average opportunity in the society when the relative distribution of the opportunity does not change. $\bar{y} d\varphi$, in Equation 5, denotes the contribution of changes in the distribution when the average opportunity does not change.[6] Access to and equity of education and employment opportunities and how this access and equity of opportunities has changed over time in Pakistan is assessed by employing the above given methodology.

5. EMPIRICAL ILLUSTRATION

Empirically, inclusiveness of growth can be measured by two approaches; (i) partial approach which is derived through "opportunity curve" and; (ii) full approach in which a quantified index is calculated from the area under the opportunity curve. In first approach slope of the opportunity curve determines that either opportunities are distributed equitably or inequitably among the population at a given point in time. If the curve slopes downward, it suggests that opportunities are equitably distributed among the population, i.e. lower income groups of the population have more opportunities than the groups with higher level of income. Whereas an upward slope of the curve suggests that

[6]Detailed mathematical derivations of the methodology are available on demand.

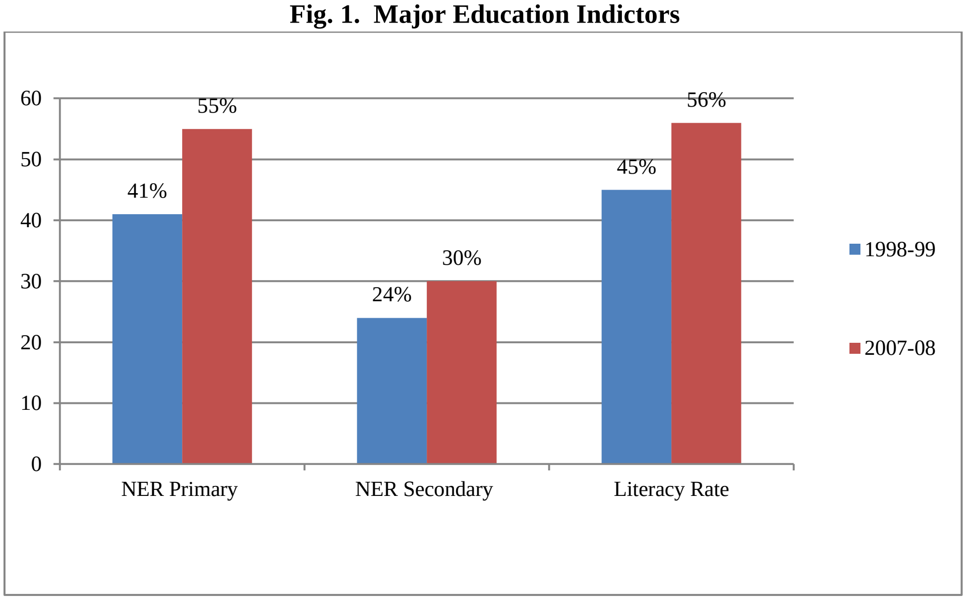
distribution of opportunities is inequitable and population with higher level of income have more opportunities. Further if the curve shifts upward over the time period at all levels of income distribution then growth is considered inclusive. Partial approach determines the pattern of growth only. However in order to quantify the precise magnitude of the change in distribution of opportunities and equity level over time this work also employs second approach and OI is calculated. The greater value of OI shows greater level of opportunities available to population hence inclusive growth.

In order to assess the equity of education and employment opportunities over the time period of 1998-99 to 2007-08 following section provides the results determined through both measurement approaches, i.e., partial and full approach. The calculations presented are based on statistics calculated from datasets provided by PLSM surveys of 1998-99 and 2007-08.

5.1. Access to and Equity of Education Opportunities

This section provides the average access to and equity of education opportunities for major indicators including Net Enrolment Rate (NER)[7] at primary and secondary levels as well as Literacy Rate (LR). Figure 1 shows Net Enrolment Rate at Primary,[8] Secondary[9] level and Literacy Rate,[10] for Pakistan for the years 1998-99 and 2007-08.

Fig. 1. Major Education Indictors



Source: Authors' own calculations based on 1998-99 and 2007-08 PSLM survey.

[7]NER (Net Enrolment Rate) refers to the proportion of students enrolled in a specific level of education with required age of that level of education.

[8]NER at Primary Level: (Number of children aged 5-9 years attending primary level (classes 1-5) divided by total number of children aged 5-9 years) multiplied by 100.

[9]NER Secondary Level: (Number of children aged 10-14 years attending secondary level (classes 6-10) divided by number of children aged 10-14 years) multiplied by 100.

[10]Literacy is taken as the ability to read and write with understanding and Literacy Rate is the population that is literate, expressed as a percentage of the total population (Presented literacy rate is for 15-60 years aged population).

Figure 1 exhibits an increase in NER and LR for Pakistan over the time period 1998-99 to 2007-08 at levels of education. However access to primary level of education for children at their required age is higher than that of secondary level of education. More than 41 percent of children aged 5-9 years attended primary level of education in 1998-99 which increased to 55 percent in the year 2007-08. Similarly 24 percent of children aged 10-14 years were enrolled at secondary[11] level of education in 1998-99 while the proportion increased to 30 percent in the year 2007-08. Fifty six percent of the population aged 15–60 years is literate[12] as compared to 45 percent in 1998-99. Above figure shows improvement in access to education opportunities, however difference in access to education opportunities are expected to vary between different income groups.[13]

To assess the access of different groups of population to education opportunities we apply above proposed methodology and determine the inclusiveness of growth in education opportunities at all levels of income. Figures 2, 3, and 4 represent opportunity curves,[14] over the time period 1998 to 2008, of access to education opportunities for different age groups of the population. Growth is argued to be inclusive if Opportunity Curve shifts upward at all points indicating that everyone in society is enjoying an increase in overall opportunities available for the whole society. However the degree of inclusiveness depends on; how much the curve is shifting upward and in which part of the income distribution the shift is taking place. It is evident that when the entire population of children aged 5-9 years (or 10–14 years) is covered i.e., variable-arranged in ascending order of their income—in the horizontal axis is 100), the opportunity curve coincides with the average access to primary (or secondary) level of education. The upward shift of the curves represent that, overall average level of education opportunities has increased over the study period (1998-99–2007-08) and growth is inclusive (Figure 2). However negligibly slight increase in secondary level opportunities is observed (Figure 3). Upward slope of these curves shows that distribution of education opportunities at primary and secondary level of education over the time period, 1998–2008, is not equitable i.e., children belonging to higher level of income groups have greater access to education opportunities as compared to bottom end of the income distribution. Figure 2 clearly shows that; $d\bar{y} > 0$ since, average opportunity in primary education has expanded over the period among children aged 5–9 years.

[11]NER at middle level (aged 10–12) is 18 percent and at Matric Level (aged 13-14) is 11 percent (Government of Pakistan).

[12]A person is literate if he/she can read and write with understanding.

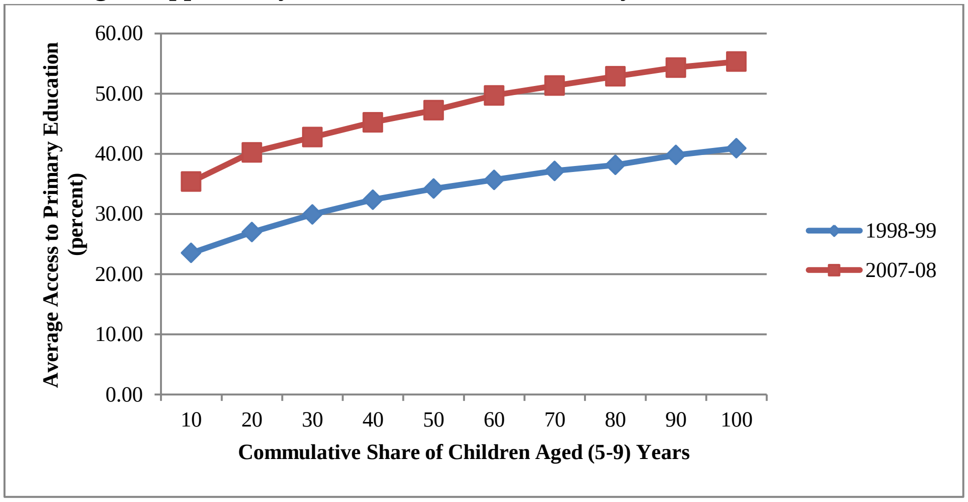
[13]Ali and Son (2007).

[14]Horizontal axis of opportunity curves represent the population arranged in ascending order of per capita yearly income level of their household.

Notes:

1. Per capita Income level is determined by dividing the total yearly income of household with total number of person of that household.
2. Total yearly income variable is based on multiple PIHS indicators that provide information on total income received from all members of the household from; employment activities, pensions, remittances, selling goods/property, revenues generated from rent or profit or any other source.

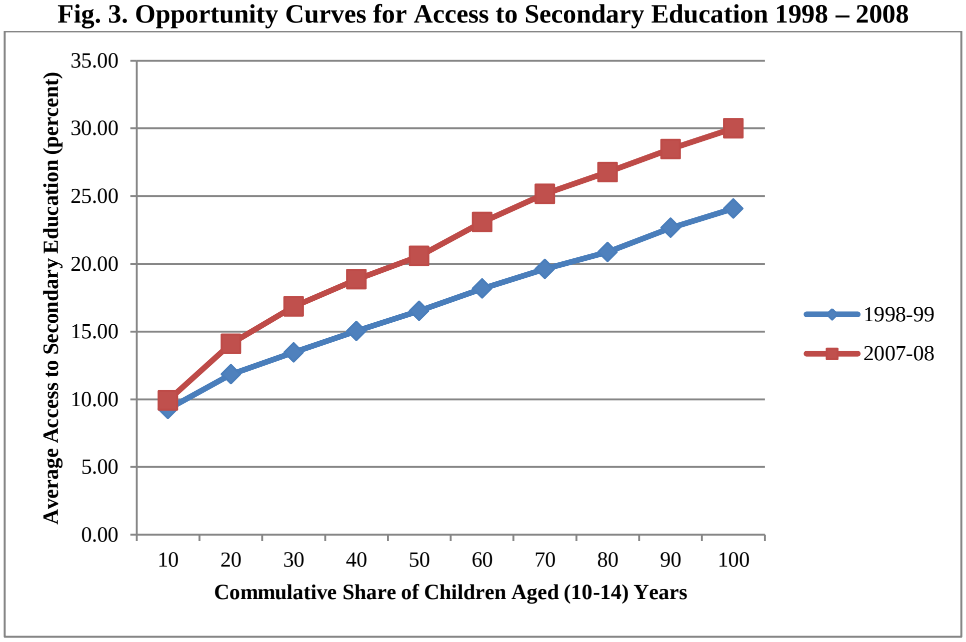
Fig. 2. Opportunity Curves for Access to Primary Education 1998 – 2008



Source: Authors' own calculations based on 1998-99 and 2007-08 PSLM surveys.

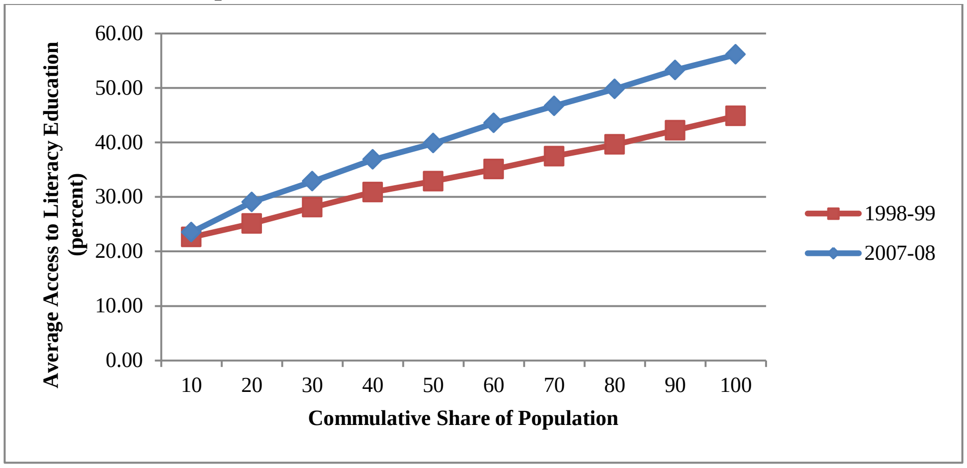
Figures 3 and 4 show that average access to secondary level education opportunities for children aged 10–14 years and literacy rate is increased ($d\bar{y}$ > 0). However this increase is lower and more inequitable as compared to the primary level of education. This is also evident from increasing gap between the two opportunity curves with increasing level of income. Here shift in curves is greater for children belonging to households with higher income level. Similar patterns are observed for literacy rates in Figure 4 for segregated population groups based on income.

Fig. 3. Opportunity Curves for Access to Secondary Education 1998 – 2008



Source: Authors' own calculations based on 1998-99 and 2007-08 PSLM survey.

Fig. 4. Opportunity Curves for Literacy Rate (15 – 60) Years Aged Population 1998 – 2008



Source: Authors' own calculations based on 1998-99 and 2007-08 PSLM survey.

5.1.1. *Access to Education Opportunities: Opportunity Indices*

The opportunity curves depicted above provide only partial ranking of education opportunities. Opportunity Index ($\bar{y}^*$) (OI) and Equity Index of Opportunity (φ) (EIO) are also estimated to quantify the precise magnitude of changes in opportunities and equity level over time and results are reported in Table 1, The results will help to evaluate and quantify the changes in access to education opportunities over the time.

Table 1

Opportunity Index for Access to Education Opportunities 1998–2008

Population Share (Percent)	Primary		Secondary		Literacy	
	1998-99	2007-08	1998-99	2007-08	1998-99	2007-08
10	23.54	35.38	9.27	9.92	22.62	23.53
20	26.98	40.24	11.84	14.09	25.13	29.05
30	29.92	42.77	13.45	16.85	28.09	32.85
40	32.38	45.24	15.04	18.85	30.88	36.85
50	34.20	47.25	16.52	20.57	32.88	39.83
60	35.68	49.72	18.17	23.08	35.09	43.55
70	37.16	51.34	19.61	25.17	37.45	46.68
80	38.15	52.88	20.87	26.77	39.61	49.81
90	39.79	54.33	22.65	28.47	42.21	53.28
100	40.93	55.31	24.08	30.01	44.84	56.13
Opportunity Index ($\bar{y}^*$)	*33.87*	*47.45*	*17.15*	*21.38*	*33.88*	*41.16*
Equity Index of Opportunity (φ)	*0.83*	*0.86*	*0.71*	*0.71*	*0.76*	*0.73*
Comments	Not Equitable	Not Equitable	Not Equitable	Not Equitable	Not Equitable	Not Equitable

Source: Authors' own calculations based on 1998-99 and 2007-08 PSLM Survey.

Table 1 shows that EIO for education indicators at all levels remained below 1 for the time period 1998–2008 confirming inequitable distribution of education opportunities. It is evident from the results that the value of EIO for primary level education has improved from 0.83 to 0.86 (i.e., $d\varphi > 0$). EIO for secondary level of education, however, remained unchanged. Notably EIO for literacy rate has decreased ($d\varphi < 0$) from 0.76 to 0.73 documenting increasing inequalities in access to education. In order to achieve inclusive growth OI ($\bar{y}^*$)should increase, which is possible by increasing; (i) the level of opportunities $\bar{y}$ (ii) the Equity Index of Opportunities φ or (iii) both (i) and (ii). Since $d\bar{y}^* > 0$, for primary, secondary levels of education and literacy rate is suggestive that growth is inclusive.

But most importantly, distribution of opportunities is not equitable at all levels and both pre-requisite of inclusive growth are met only for primary level of education opportunities whereas in the case of secondary level education $\bar{y}^*$ (OI) shows a slight increase but no change is observed in EIO. Results are even more unsatisfactory for literacy rate with decline in EIO. These results are suggestive that over study period (1998–2008) polices were more focused towards increasing the overall average opportunities at primary level of education as compared to secondary level of education. Further to mention equity aspect of the policies could not find much attention and population from bottom groups remain ignored and still lags behind resulting in improved average access to education opportunities at required age but huge disparities prevails across different income groups. Especially at secondary level of education very small change in OI can be seen with more inequitable distribution.

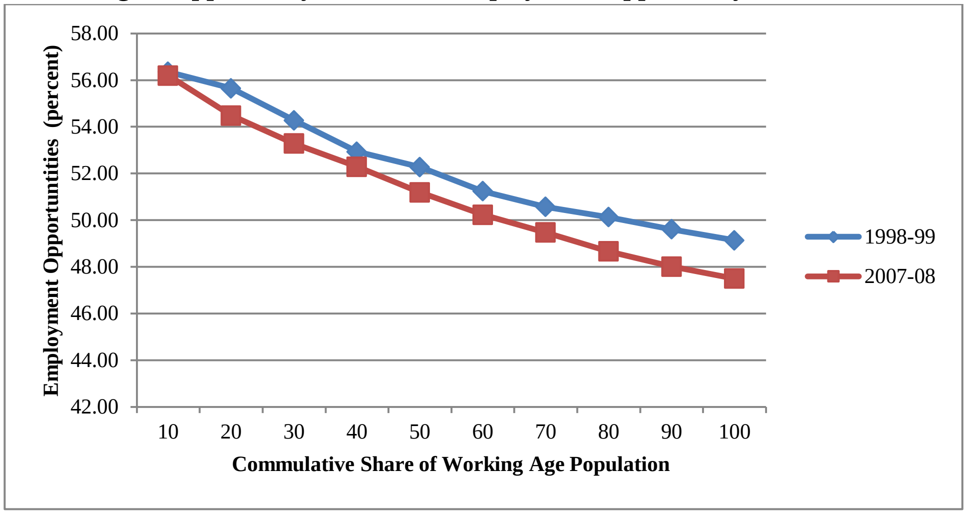
5.2. Access to and Equity of Employment Opportunities

This section provides equity and inclusiveness of employment[15] opportunities over the time period 1998–2008. This analysis, based on working age population (15+ years), aims to determine the efficacy of economy to create more job opportunities for population with greater possibility to be a part of labour force. An employed person could be categorised as paid or self-employed but a significant proportion of these employed persons is also engaged as unpaid family worker. This section also measures the equity of paid employment and monthly income earned through employment activities over the specified time period. Figure 5 shows the opportunity curves for employment opportunities available to the working age population.[16] The curves show that across all income groups the share of the working age population that is in employment has decreased over the time. It is also evident that average employment opportunities are slightly decreased but the distribution of these opportunities is equitable. This suggests that the population belonging to the bottom end of income distribution have more job opportunities than the non-poor.

[15]Any person who worked for at least one hour for pay, profit or family gain during the month preceding the survey is considered as employed.

[16]Population aged 15 years and above is considered as working age population (results are still valid if population aged 15 years and above currently attending school is excluded from base population).

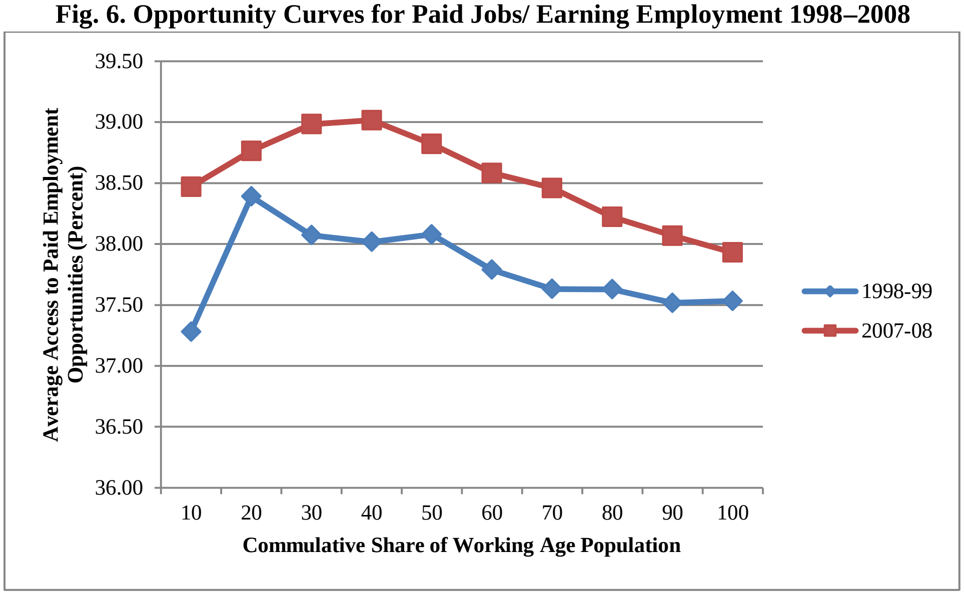
Fig. 5. Opportunity Curves for Employment Opportunity 1998–2008



Source: Authors' own calculations based on 1998-99 and 2007-08 PSLM survey.

Although working age population belonging to bottom end of the income distribution has more job opportunities but a significant proportion of total employed persons were engaged as unpaid family worker therefore analysis is extended to paid employment.[17] The shift in opportunity curve taken place in Figure 6 shows that the paid employment opportunities have increased over the time, and distribution of these opportunities is equitable and inclusive.

Fig. 6. Opportunity Curves for Paid Jobs/ Earning Employment 1998–2008

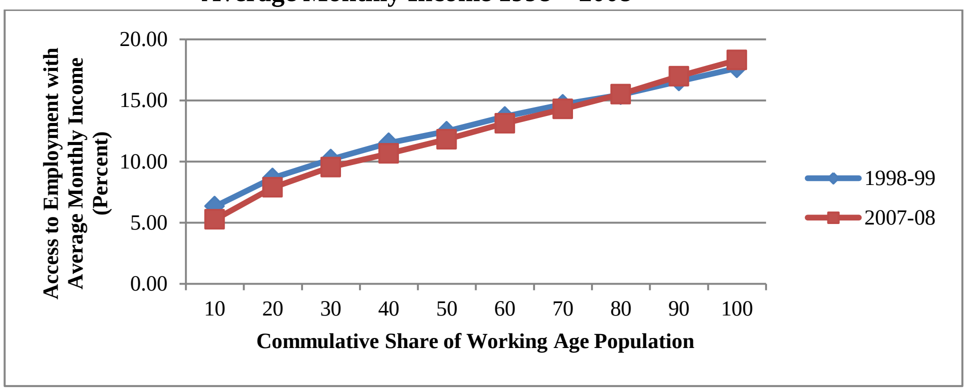


Source: Authors' own calculations based on 1998-99 and 2007-08 PSLM survey.

[17]All employment activities (self-employment, paid employee) which resulted in earnings received in cash or in kind i.e. unpaid family worker are not included in this category.

Stagnant but equitable nature of employment opportunities urge the need to determine the equity of monthly income earned through these employment opportunities over the time so that nature of employment could be determined. Figure 7 shows opportunity curves for employment with average[18] monthly income over the time. It shows the distribution of employment opportunities with average income earned across different income groups and suggests that distribution of employment opportunities with average monthly income has slightly decreased and remained inequitable over the time. Population belonging to bottom end of income distribution has lesser share of employment opportunities in context of average monthly income earned and is engaged in low earnings or unpaid employment activities (evident from Figures 5 and 6). For population belonging to higher income groups, on the other hand, this distribution has slight upward shift over the time.

Fig. 7. Opportunity Curves for Employment Opportunities with Average Monthly Income 1998 – 2008



Source: Authors' own calculations based on 1998-99 and 2007-08 PSLM survey.

5.2.1. *Access to Employment Opportunities: Opportunity Indices*

Table 2 depicts precise magnitude of equity and changes in employment opportunities over time period 1998–2008. The results document a slight decline in overall employment to population ratio while slight increase is observed in paid employment opportunities. Decrease in $\bar{y}^*$ (from 49.13 to 47.49) confirms that employment growth is not inclusive however it is equitable (φ>1). Increasing value of OI for paid employment in Table 2, along with decreased OI for employment, indicates that more of the unpaid family workers are now entered to the category of paid/earning workers and this shift has taken place at all levels of income distribution (φ>1). In spite equitable distribution of employment opportunities the equity and inclusiveness of growth in monthly income earned through these employment opportunities is another important dimension to be explored, which will also assist to evaluate the nature of jobs being created in the economy. The results for this exploration are provided in last two columns of Table 2.

[18]Median of monthly incomes earned through employment activities by all employed persons is considered as average monthly income of the population. For 1998-99 average monthly income was Rs 2500 and for 2007-08 it was above Rs 4500.

Table 2

Opportunity Index for Access to Employment Opportunities 1998— 2008

Population Share (Percent)	Employment		Paid Employment		Employment with Average Monthly Income	
	1998-99	2007-08	1998-99	2007-08	1998-99	2007-08
10	56.35	56.20	37.28	38.47	6.34	5.27
20	55.65	54.48	38.39	38.76	8.66	7.89
30	54.28	53.28	38.07	38.98	10.19	9.54
40	52.93	52.29	38.02	39.02	11.52	10.65
50	52.27	51.19	38.08	38.82	12.48	11.83
60	51.24	50.23	37.79	38.58	13.68	13.13
70	50.57	49.47	37.63	38.46	14.67	14.29
80	50.13	48.66	37.63	38.22	15.46	15.52
90	49.61	48.01	37.52	38.07	16.58	16.98
100	49.13	47.49	37.53	37.93	17.65	18.29
Opportunity Index ($\bar{y}^*$)	52.22	51.13	37.79	38.53	12.72	12.34
Equity Index of Opportunity (φ)	1.06	1.08	1.01	1.02	0.72	0.67
Comments	Equitable	Equitable	Equitable	Equitable	Not Equitable	Not Equitable

Source: Authors' own calculations based on 1998-99 and 2007-08 PSLM Survey.

From the findings of study, it is evident that overall employment opportunities with average monthly income have increased (17.65 to 18.29 percent), but distribution of these opportunities is neither equitable nor inclusive. Growth is inclusive if $d\bar{y}^* > 0$, above table shows that OI index for employment opportunities with average income level has decreased to 12.34 in 2007-08 from 12.72 in 1998-99. Furthermore, working age population belonging to higher income groups of the society shares larger proportion of job opportunities with monthly income at or above average level whereas lesser share is left for lower quintiles. Above findings highlight that population belonging to lower end of income distribution shares a larger proportion of employment opportunities but with an inequitable distribution of monthly earnings from employment opportunities. On the whole efficacy of economy has not improved to absorb the increasing proportion of working age population and more of the jobs created are with lower earnings.

6. CONCLUSION

Inclusive growth aims to accelerate economic growth process and expand socio-economic opportunities along with ensuring that opportunities created are available to all segments of society, particularly to the disadvantaged and marginalised, hence leading to inequalities decline. This paper assesses the inclusiveness of growth in terms of education and employment opportunities for Pakistan using data from 1998-99 and 2007-08 PSLM surveys. Findings presented are based on two approaches; firstly Opportunity Curves are drawn to provide partial ranking of opportunities; secondly, Opportunity Index (OI) and Equity Index of Opportunities (EIO) are calculated to quantify the amount of changes in opportunities and equity level over time. The results are suggestive that over the time period 1998–2008 increased education opportunities are inclusive but distributed inequitably. We find that overall level of primary education and equity index is improved however only a slight increase in access to secondary education opportunities is documented over the study time without any change in equity index. Most importantly EIO for literacy level is decreased indicating an increase in inequalities.

Furthermore, it is evident from the findings that proportion of paid employment activities increased over the time with more opportunities for lower income groups of the society however these jobs are below average level of earnings. Population belonging to higher income groups of the society shares larger proportion of employment opportunities with earnings at or above average level. Policies must be devised to; focus on more equitable distribution of primary and secondary level of education opportunities and also highlight the urgency to improve the overall access to secondary and higher level of education which will also improve the access of lower income groups of the society to decent employment opportunities. In order to actively engage all groups of the society in growth process policies should be tailored towards lower income groups of the society with more employment avenues and higher levels of education so that they could have greater access to economic opportunities which will ultimately lead to poverty reduction and hence more sustainable development.

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Macro Level Determinants of Poverty: Investigation Through Poverty Mapping of Districts of Pakistan

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1. INTRODUCTION

Successful intervention for social protection of the vulnerable poor first necessitates the identification of the most deprived areas of the country and then an analysis of the factors underlying the prevalence of poverty. A disaggregated, spatial investigation of poverty shows severe regional disparities in the incidence of poverty in Pakistan and often leads us to question whether the determinants of poverty are region based. If so, it behoves us to question whether certain regions are destined to be chronically poorer or is it possible to influence poverty and inequality through planned interventions.[1] Using potential and actual measures of income and wealth, Jamal (2003) shows how regional poverty and inequality has persisted in Pakistan between 1981and 1998; if anything, the gaps between the provinces have increased.

Sen's (1985) capability approach highlights that poverty is multi-dimensional, and indeed there is increasingly a consensus forming in literature that poverty cannot be reduced to a single index. Although income and consumption based indexes are still used and defended by some,[2] others argue that well-being is not completely dependent on these economic measures. Data on income and expenditure tends to be noisy, is often misreported and the link between income and well-being is not always clear. Welfare functions, based on socio-economic factors such as nutrition, wealth, sanitation, education, infrastructure and access to opportunities, are used commonly to explain the incidence of poverty.[3] For this reason, and also due to paucity of relevant data, conventionally used poverty lines based on consumption expenditure are rejected—any threshold for poverty is normative and vulnerable to inflation and shocks, and recent data on alternative measures such as calorie intake has not been available. Instead, this paper develops and uses two indices to determine spatial poverty: one quantifying wealth and asset ownership and the other being a measure of basic household needs.

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[1]Amjad and Kamal (1997).

[2]Glewwe and Gaag (1988), Zaidi and Klaas de Vos (2001).

[3]See Henninger (1998), Ravallion (1996), Bellido, *et al*. (1998), Hayati, *et al.* (2006), Booysen, *et al.* (2008), Esposito and Chiappero-Martinetti (2010), Jamal (2009).

The study of the extent and nature of poverty in Pakistan is not a new one. Studies have used both basic needs and calorie-intake measures. Within these some provincial level studies also concentrate on the rural-urban or male-female dimension of the poverty severity front.[4] Cheema, *et al*. (2008) use district representative data from the Multiple Indicators Cluster Survey 2003-04 for Punjab and find concentration of high poverty regions in the South and West of Punjab. Jamal (2009) does the same for Pakistan using household data from PSLM 2004-05 to show that over half of Pakistan's population belongs to poor households. Both Jamal and Cheema make use of Principal Component Analysis (PCA) to form poverty measures. Jamal's study reflects the exacerbation in poverty and inequality when seen in context of an older analysis by Ghaus-Pasha and Jamal (2001) who use a poverty line measure and are able to demonstrate that 30 percent of the population is poor, with an overwhelming 70 percent of them chronically poor.

The contribution of this paper, apart from using recent data (PSLM 2007-08) for a country-wide analysis, is that it delves into uncovering the determinants of poverty econometrically. These determinants will have important poverty alleviation policy implications.

The organisation of the paper is as follows: Section 2 describes the data employed, Section 3 details the methodology used, while results of poverty mapping and regression analysis are in Section 4. Section 5 concludes the paper with a discussion on possible policy implications of the results.

2. DATA

The data employed for the study is The Pakistan Social and Living Standards Measurement Survey (PSLM) 2008-09. PSLM is the latest household survey for Pakistan which is representative at the district level, covering both rural and urban areas, and is complete for all four provinces. PSLM provides a set of representative, population based estimates of social indicators which help in assessing the well-being of the population. Since the PSLM is designed to assess the Millennium Development Goals, it provides a range of health, education and physical environment indicators. For the purpose of this study, these indicators are used in constructing the Asset index and Basic Needs index.

The data for the econometric part of the study is gathered from multiple sources. Since the analysis is conducted at the district level, some of the variables are computed from PSLM 08-09 such as urbanisation and dependency ratios for districts. Employment rates are obtained from the Labour Force Survey 2007-08. Additionally, some variables[5] are obtained from Provincial Development Reports of the four provinces and the Population Census of 1998. (Appendix A details the sources of data for the variables employed in the study).

3. METHODOLOGY

Previous studies on Pakistan have largely focused on identifying micro level determinants with households as the unit of analysis,[6] with fewer studies focusing on the

[4]Jamal (2009), Malik (1996), Ali and Tahir (1999).
[5]Number of schools, number of hospitals, number of factories and road density.
[6]Jamal (2004).

macroeconomics factors contributing towards varying poverty levels in different regions.[7] We take a different approach by using the household level data to estimate our poverty indices and then attempting to identify the macro level factors that determine these estimates.

3.1. Constructing Indices

The first part of the study entails ranking the districts in terms of poverty along multiple definitions of poverty. As discussed above, income measures can be noisy due to the shocks or cyclical changes in earnings of individuals. It also tends to be deliberately misreported at times due to concerns with tax authorities. Therefore, we concentrate on the wealth and living status of the households which reflects both aggregate income and smoothed out consumption. This will be carried out through the construction of two indices: Asset index and a Basic Needs index using the Principal Component Analysis (PCA) technique. The factors that are included in the construction of both indices will be averaged at the district level from the household level data to arrive at an estimate for each district. This averaging out will also serve the purpose of dealing with a criticism of the PCA approach i.e. the failure of PCA to properly deal with categorical, hence non-normal, variables in the construction of indices.[8] In this process, the categorical variables, such as those for asset ownership are converted in to averages and therefore into non-categorical values for the district. These indices will serve as the basis of our analysis in the next part and also allow us to map wellbeing at the district level.

Asset index covers a range of durable assets that the household might own (variables used detailed in Table 1 and Table 2). These include assets contributing to a better living environment such as a fan, assets for transportation purposes (motorbike) and assets for communication purposes (television, telephone). Additionally, house ownership is also considered. Ownership of land, livestock etc., is not considered because such variables bias the index between the rural and urban households, since rural households tend to own such assets for sustenance purposes. The Asset index therefore presents a holistic view of asset ownership of the households.

Table 1

Variables used in the Construction of the Asset Index

Variables	Value
Does the household own the house?	=1 if yes, 0 otherwise
Does the household possess an electric fan?	=1 if yes, 0 otherwise
Does the household possess a radio/cassette player?	=1 if yes, 0 otherwise
Does the household possess a television?	=1 if yes, 0 otherwise
Does the household possess a refrigerator?	=1 if yes, 0 otherwise
Does the household possess a cooler?	=1 if yes, 0 otherwise
Does the household possess an air conditioner?	=1 if yes, 0 otherwise
Does the household possess an iron?	=1 if yes, 0 otherwise
Does the household possess a computer?	=1 if yes, 0 otherwise
Does the household possess a bicycle?	=1 if yes, 0 otherwise
Does the household possess a motorcycle/scooter?	=1 if yes, 0 otherwise

[7]Akhtar and Ahmad (2003).
[8]Kolenikov and Angeles (2009).

Table 2

Variables used in the Construction of the Basic Needs index

Variables	Value
Housing Characteristics/Physical Environment	
What type of toilet facility does the household have?	=1 if flush system, 0 otherwise (Averaged at district level)
What is the main source of drinking water for the household?	=1 if any other source, =2 if Tanker Trunk, water fetcher. =3 if river, stream or pond, =4 if Open well =5 if covered well, =6 if water motor, =7 if hand pump, =8 if tap (outside home),=9 if tap (inside home)
What is the main source of fuel for cooking?	=1 if electricity, gas or oil, 0 otherwise (Averaged at district level)
What is the main source of fuel for lighting?	=1 if electricity or gas, 0 otherwise (Averaged at district level)
Does the household have access to telephone?	=1 if mobile or landline, 0 otherwise (Averaged at district level)
What is the material used in construction of the walls of the house?	=1 if burned bricks/blocks, 0 otherwise (Averaged at district level)
What is the material used in construction of the roof of the house?	=1 if RCC/BCC or cement, 0 otherwise (Averaged at district level)
Health Indicators	
Attended births in the district	Number of births in the last 3 years attended by doctor, nurse or trained midwife/Total number of births in the last 3 years
Immunisation Rate of the district	Number of children aged 6 and below immunised/Total number of children aged 6 and below
Education Indicators	
Gross Primary enrolment rate of the district	Number of children enrolled in primary schools/Total number of children aged between 3 and 10 years
Gross Secondary enrolment rate of the district	Number of children enrolled in secondary schools/Total number of children aged between 9 and 15 years
Adult Literacy Rate (Female) of the district	Number of females aged 17 and above who can read and write in any language with understanding/Total Number of females aged 17 and above
Adult Literacy Rate (Male) of the district	Number of males aged 17 and above who can read and write in any language with understanding/Total Number of males aged 17 and above

The Basic Needs index looks at three broad dimensions. Firstly, the physical environment of the households, which includes variables pertaining to the type of dwelling, water and sanitation and access to utilities like electricity and gas. Secondly, immunisation rates amongst children and proportion of attended births are taken as indicators of health. Lastly, educational levels are estimated both by flow measures i.e., enrolment rates at primary and secondary levels and stock measures i.e., male and female adult literacy rates.

3.2. Regression Analysis

In the second part of the study, OLS regression technique will be employed to identify macroeconomic determinants of poverty at a district level for Pakistan. The following specification will be separately estimated with the two indices calculated above as the dependent variable in each:

$$I_i = \alpha_0 + \sum \beta X + \sum \theta Y + \sum \gamma Z + \delta d_i + \varepsilon_i \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (1)$$

Where I_i is the index value for district *i*, *X* is a vector of social service variables in the district, *Y* is a vector of variables capturing the physical development of the district, *Z* is a vector of demographic factors and *d* are provincial dummies. α_0, β, γ and δ are regression parameters while ε is the error term of the regression.

Difference across provinces can be an important determinant of varying degrees of acquisition of assets and level of well-being of inhabitants even when other factors are similar. Therefore, provincial dummies with Balochistan as the base category are included in the analysis. It is expected that given the lack of development of the province, the districts of other three provinces will have better indices and hence a positive coefficient.

Social services span indicators related to health and educational facilities available in the district. On the educational side, these have been incorporated by using the number of government schools both at the primary and secondary level and health dimension by the number of government hospitals in the district. We take the average number of people per school and people per hospital and hence expect that there would be a negative relation to the dependent variable. Since health and education provisions are expected to impact the current working population with lag, we employ the 1998 census values in the regression analysis. We are not using conventional measures for health and education such as literacy and immunisation rates of the district because these measures have already been used in the construction of basic needs index.

To capture the demographic profile of the district we factor in the overall employment opportunity in the district as indicated by the employed people as a proportion of the total labour force. High employment rates will reflect in better living standards and asset acquisition capabilities and so should result in higher value of indices for these districts. The urbanisation rate is the number of households living in the urban area in a district as a ratio of the total number of households in the district. On the one hand, it can lead to better standard of living and easier access to assets; while on the other it can cause congestion and result in a larger number of people contesting over a few resources. Hence, the expected sign of the coefficient on the variable is ambiguous.

Further, the dependency ratio (we take the conventional definition: number of people below16 and above the age of 60 as a ratio of people between 16 and 60 in each household) is included to ascertain if there is any variation in the indices due to the differing burden on the earning hands in a district. Other things remaining the same, the greater the number of mouths to feed, on average, as compared to the hands contributing to the livelihood, the less likely is the household to have a higher level of standard of living and asset accumulation.

The physical dimension will capture factors like industrial development and road access.[9] We use the number of registered factories in the district to proxy for industrial development—this is expected to have a positive relation with the indices. Finally, the ease of access to and from the district is important to the overall development of the district both in terms of facilitating enterprise and businesses and in guaranteeing ready availability of goods. One way of capturing this is the road density of the district, measured by the kilometres of metalled roads as a ratio of the total area of the district.

4. RESULTS

4.1. Spatial Mapping

The construction of the two indices allows us to identify the deprived districts of Pakistan. Poverty maps—the spatial representation of wellbeing and poverty, represented in this case through our basic needs and asset ownership indices—are powerful tools to identify clusters, trends and patterns [Davis (2002)]. They are especially helpful for development practitioners and policy makers in identifying the regions where intervention is needed most and to then track the impact of the said intervention.

Figures 1 and 2 in Appendix C are the poverty maps representing the Basic Needs and Asset indices, respectively. Most of the districts of Punjab and Khyber Pakhtunkhwa lie in the top two quartiles for the Asset index. Likewise, most of the districts lying in the 3rd and 4th quartiles belong to Balochistan and Sindh. This clustering is further intensified for the Basic Needs index, with most of the relatively well-off districts lying in Punjab only and almost 90 percent of the districts from the bottom quartile belonging to Balochistan. Table 3 details the top and bottom ten districts for both indices.[10] The Federal Capital Territory Islamabad ranks the highest from either angle.[11] Its index value for the Asset index (10.53) is almost twice that of the next district in ranking.

As can be seen, seven out of the top ten districts in the basic needs index are from Punjab, two from KPK and one is from Sindh. Interestingly only two of the provincial capitals—Lahore and Karachi—appear in the top ten districts while Quetta is ranked at 20th and Peshawar at 15th. On the other hand, none of the districts of Sindh or Punjab appear in the bottom ten districts, where nine out of the bottom ten districts are from Baluchistan, the remaining one being from KPK.

[9]Rupasingha and Goetz (2007).

[10]For complete district wise rankings for both indices, see Appendix B.

[11]Islamabad being capital of the country is not reported as a district by the Punjab Government. Additionally, index values for Islamabad were exceptionally high and appeared to be an outlier. It was therefore excluded from the analysis.

Table 3

Top and Bottom Ten Districts by Basic Needs and Asset Index

Basic Needs Index				Asset Index			
Top Ten		Bottom Ten		Top Ten		Bottom Ten	
District	Index Value	District	Index Value	District	Index Value	District	Index Value
Karachi	5.90	Awaran	–4.21	Lahore	6.53	Lasbilla	–3.054
Lahore	5.58	Qillah Sai	–4.57	Karachi	5.69	Thatta	–3.12
Rawalpindi	5.50	Chagi	–4.74	Peshawar	5.61	Barkhan	–3.13
Jehlum	4.76	Bolan	–4.90	Rawalpindi	5.10	Badin	–3.17
Sialkot	4.74	Barkhan	–4.94	Jehlum	3.62	Chagi	–3.19
Chakwal	4.73	Musakhel	–5.54	Sialkot	3.31	Tharparkar	–3.73
Abbottabad	4.65	Jhal Magsi	–5.59	Quetta	3.01	Musakhel	–3.80
Haripur	4.35	Kohistan	–5.81	Gujrat	2.71	Awaran	–4.15
Gujrat	4.35	Dera Bugti	–5.82	Gujranwala	2.63	Kohlu	–4.42
Gujranwala	4.11	Kohlu	–6.87	Sargodha	2.52	Kohistan	–4.52

For the Asset index seven out of the top ten districts are from Punjab, and one each from the remaining three provinces. Unlike the Basic Needs index all the provincial capitals appear in the top ten districts for the Asset index. Six districts of Punjab are the same as the Basic Needs index, with one exception being Sargodha that appears in the top ten for Asset index in place of Sialkot. For the bottom ten districts, the distribution is skewed towards districts of Baluchistan but not as much as the Basic Needs index. Three districts from Sindh appear in the lowest ten compared to none for the case of Basic Needs index. Just one district appears from KPK and the remaining six are from Balochistan.

Overall, 72 districts remain in the same quartile whether viewed by the Asset index or the Basic Needs index. As compared to the Asset index however, 13 districts shift 1 quartile down in the Basic Needs index while 18 move up one quartile. More interestingly, however, is the move of more than one quartile between the two indices for some districts. Mansehra, for example, ranked in the third quartile according to the Asset index moves up to the top quartile for the Basic Needs index. Likewise, Batagram moves from the bottom quartile of the Asset index up to the 2nd quartile of the Basic Needs index. It is interesting to note that both the districts moving up two quartiles in Basic Needs as compared to the Asset index are from the KPK.

Five districts, namely Khuzdar, Pishin, Sibi, Qillah Abdullah and Tank, fare worse by two quartiles in terms of basic needs as compared to the Asset index. As can be seen, four out of these five districts are from Balochistan and one from KPK. None of the districts of Sindh and Punjab present such a picture and there are no districts in Punjab which shift places by more than two quartiles for any of the indices.

4.1.1. *Spatial Mapping at Provincial Level*

Insight into the spatial mapping of indices at the provincial level would help in providing an overview of the results at a more disaggregated level and recognise areas of concern for respective provincial governments. Table 4 below shows the top and bottom three districts of each province and their overall ranking with respect to the entire country.

Table 4

Province wise Top and Bottom Districts—Asset Index

	Punjab	Rank	Sindh	Rank	KPK	Rank	Balochistan	Rank
Top 3	Lahore	2	Karachi	4	Peshawer	4	Quetta	8
	Rawalpindi	5	Hyderabad	14	Bannu	12	Pashin	20
	Jhelum	6	Nowshero Feroze	18	Abbottabad	21	Qilla Abdullah	30
Bottom 3	Jhang	71	Thatta	102	Upper Dir	98	Musakhel	107
	Muzaffargarh	82	Badin	104	Shangla	100	Awaran	108
	Rajanpur	88	Tharparkar	106	Kohistan	110	Kohlu	109

Districts encompassing the provincial capitals ranked at the top for each province.[12] The top three districts of Punjab are amongst the top ten of the country. In fact, with the exception of Qilla Abdullah in Balochistan, the top three districts of all provinces belong to the overall top quartile of the Asset index. With the exception of Jhang and Muzaffargarh in Punjab, the bottom districts of all provinces lie in the country-wide bottom quartile. The following table lists the corresponding values and districts for the Basic Needs index.

Once again all the provincial capitals appear in the top three districts of each province. For Punjab and Sindh the top three districts in terms of basic needs are the same as those under the Asset index, as opposed to KPK and Balochistan where changes are seen. Top three districts for all provinces belong to the country-wide top quartile except Baluchistan, where Gawadar and Ziarat lie in the third quartile.

Table 5

Province wise Top and Bottom Districts—Basic Needs Index

	Punjab	Rank	Sindh	Rank	KPK	Rank	Balochistan	Rank
Top 3	Lahore	3	Karachi	2	Abbottabad	8	Quetta	20
	Rawalpindi	4	Hyderabad	15	Haripur	9	Gawadar	68
	Jhelum	5	Nowshero Feroze	18	Peshawar	13	Ziarat	76
Bottom 3	D G Khan	66	Thatta	89	Upper Dir	81	Jhal Magsi	107
	Muzaffargarh	70	Badin	91	Shangla	90	Dera Bugti	109
	Rajanpur	82	Tharparkar	95	Kohistan	108	Kohlu	110

None of the lowest three districts of Punjab belong to the country-wide bottom quartile, while the lowest three districts for each of the other provinces lie in it. In the case of both KPK and Sindh, the bottom three districts from the basic needs perspective are the same as those for Asset accumulation. However, there are differences in the rankings by asset accumulation and basic needs for Punjab and Balochistan.

4.2. Regression Results

Estimation of Equation 1 across the two dimensions of poverty under study reveals that the macro determinants of these appear to be similar (results in Table 6).[13] Therefore, we have a combined discussion on the results.[14]

[12]For provincial level analysis the capital, Islamabad, is not considered.

[13]Macro level variables employed in the regression are not available for Balochistan at the district level for the years relevant to the analysis. To overcome the issue of employing out dated data, we use divisional level data for Baluchistan for the year 2006 and therefore include divisions of Balochistan for the purpose of regression analysis, and not districts. The use of divisions rather than districts is reasonable for the case of Balochistan, given the sparsely populated districts in the province relative to other districts of the country. The divisions employed are in line with those defined and used in Burki (2011).

[14]Provincial dummies came out to be insignificant, indicating that differences in provinces are accounted for by the remaining variables. The final results reported do not include the dummies.

Table 6

OLS Regression Results

	Basic Needs Index	Asset Index
Industrialisation	0.004***	0.004***
	(3.29)	(4.33)
Road Density	4.87***	2.65**
	(3.49)	(2.51)
Employment Rate	4.14*	2.01
	(1.97)	(1.26)
Dependency Ratio	–6.15	–1.09
	(–0.58)	(–0.14)
Urbanisation	0.13	0.25
	(0.04)	(0.12)
People to School	0.0002	0.0001
	(0.39)	(0.32)
People to Hospital Beds	0.0002	0.00005
	(0.52)	(0.20)
Constant	–3.02	–2.78
	(–0.54)	(–0.66)
N	65	65
Adjusted R^2	0.38	0.36

t-statistics in parenthesis, *** p<0.01, ** p<0.05, * p<0.1.

Road density across both measures of poverty is positive and highly significant. It appears to be a very important variable in explaining the pattern of poverty in Pakistan. Therefore, we also map road density of Pakistan (Figure 3 in Appendix B) to try to ascertain if it follows a similar pattern to the spatial pattern of the poverty indices. This can help shed further light on the significance of this particular variable in explaining poverty patterns in the country.

With the exception of Punjab and most of KPK, majority of Sindh and all of Balochistan fare poorly in the availability of road network (measured against land area). Note how the road densities correspond to the poverty maps drawn for the Asset and Basic Need indices. If anything, the road density map provides a starker picture. Excepting Lahore, none of the other districts containing the provincial capitals appear in the upper tier of road density. This only serves to highlight the almost privileged position Punjab seems to hold in terms of access by a metalled road network, followed closely by KPK. As discussed earlier, metalled road density is a key measure of infrastructure development in any district. At the micro level it ensures individual access to and from potential markets, thereby boosting economic activities both in terms of business activity and labour mobility.[15] Linkage with the rest of the country is of utmost importance both at the input and the output end for any business to thrive. Therefore, road network is a basic requirement for enterprises. This business activity will in turn not just benefit the individual but will be a source of employment for the entire region/area. Thus, road network has significant positive spillover effects in the district.

[15]See UNESCAP Report (2008), Van de Walle (1999), Bryceson, *et al*. (2006).

For people to work outside their hometowns, commuting with ease is necessary. A good road network will facilitate this and would mean that inhabitants are not just restricted to their native areas in seeking employment. This also becomes an important factor in determining the choice of location for an industry. All inputs (both raw material and labour), as well as the end product, will require, at least, ease of access that a good road network provides.

For an agriculturally biased country like Pakistan, especially for those whose main source of livelihood depends on agricultural produce, good roads also allow the transportation of the produce from one area to the other. Perishable agricultural commodities, unless transported in a timely manner will rot and be wasted leading to high economic costs for the producer. A good transport network would mean that this wastage can be reduced and result in higher incomes for these farmers.

A good road network will in general also mean that products from other areas will reach the district with ease and hence without overhead costs. This results in an increase in the availability and variety of consumer durables, facilitating higher asset accumulation. In general, it also allows easy flow of information and results in an integration of that particular area with the rest of the country which, as discussed, benefits the area in many ways. Hence, it is not surprising that the coefficient on the variable is positive and highly significant in explaining districts with superior Asset and Basic Needs indices.

On the physical development side, industrialisation also comes out to be positive and highly significant in both specifications. It captures the level of industrial development in a district and as discussed earlier will benefit the people of the area both in terms of direct and indirect employment generation. This in turn will have an income enhancing impact which would allow greater acquisition of assets as well as higher spending on well-being of the households.

On the demographic side, only employment comes out to be a significant factor in explaining the variation amongst districts for the basic needs index only. This is not surprising since higher employment will be a result of greater business activity (industrial and/or agriculture) in the region. This seems to be resulting in greater ability to spend on education, health and maintaining better living conditions.

Dependency ratio comes out to be an insignificant factor in explaining the variation in the indices across provinces. This might be attributable to the social structure of the country where children from a very young age in poor households start to work and in turn are no longer a burden on the family. They in fact contribute to the livelihood of the family.

Greater urbanisation can have a dual impact: it can result in easier access to assets but it can also have a detrimental impact on the standard of living due to congestion and higher cost of living. Households living in a more urbanised district might be so hard-pressed to fulfil their basic needs that in spite of ready availability of consumer durables as well as schools and hospitals, their ability to avail these services and enjoy consumer good may not be any better than their counterparts in less urbanised areas. For those, who are able to afford these goods and services, it is likely to have a positive impact. It appears that neither of these countervailing effects overwhelms the other and hence, on average, the extent of urbanisation has no effect.

Finally, social service provision in a district as proxied by the number of people to a hospital and number of people to a school does not explain any variation across districts. This may be due to the quality of public sector services or the possibility that the contribution of the private sector is more meaningful in these areas. District level data on the private sector both for quantity and quality of these services can help us explore this avenue.

5. CONCLUSION

The objective of this paper was to develop a spatial map of poverty for Pakistan based on micro level asset and basic needs indicators. As per *a priori* expectations there is an obvious bias towards the districts of the north (particularly north east), with the exception of the district that contains the largest city of the country (Karachi). Such stark disparities between the provinces, particularly the favourable position held by Punjab, requires investigation into whether it is the result of historical biases, public policy or a combination of both. This would first necessitate looking into the factors influencing well-being in a district.

Econometric analysis indicates that development of infrastructure is a key contributor towards a particular regions relative ability to thrive. This result is further corroborated by the spatial mapping of road density. Once again whether a result of the initial endowment or deliberate public policy, road densities in Punjab are significantly higher than anywhere else in the country, even the district of Karachi.

Econometric results provide a very interesting insight into what potentially influences poverty in Pakistan. Contrary to popular criticism about potential over spending on building infrastructure, it turns out that rather than public sector education and health provision, roads or the lack thereof seem to be the major factor impacting deprivation in the country. Again, as discussed earlier the role of the private sector in social service provision is important to be accounted for in order to present a more complete picture. In addition, active government policy to provide incentives for industries to set up and enterprise to thrive in these marginalised areas would be a step towards pulling these regions out of their current state.

Appendices

APPENDIX A

Variable	Source
Number of Schools	Population Census 1998
Number of Hospitals	Population Census 1998
Urbanisation	PSLM 08-09
Employment Rate	PSLM 08-09
Industrialisation	Provincial Development Statistics
Road Density	Provincial Development Statistics
Dependency Ratio	PSLM 08-09

APPENDIX B

Fig. 1. Spatial Mapping of Asset Index

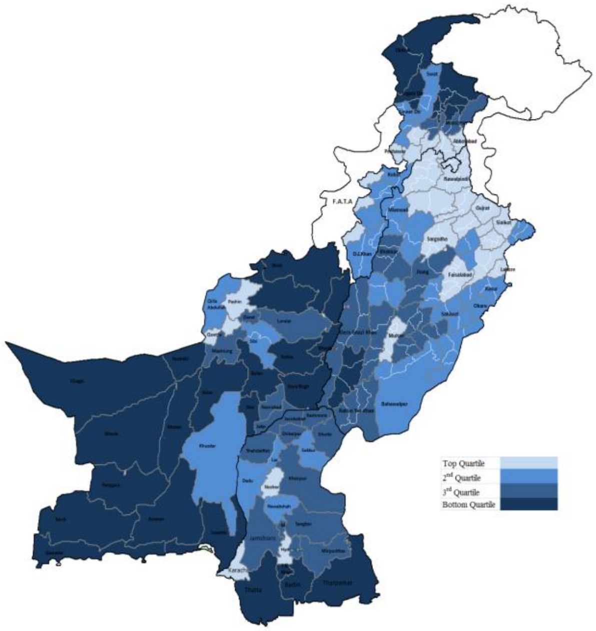


Fig. 2. Spatial Mapping of Basic Needs Index

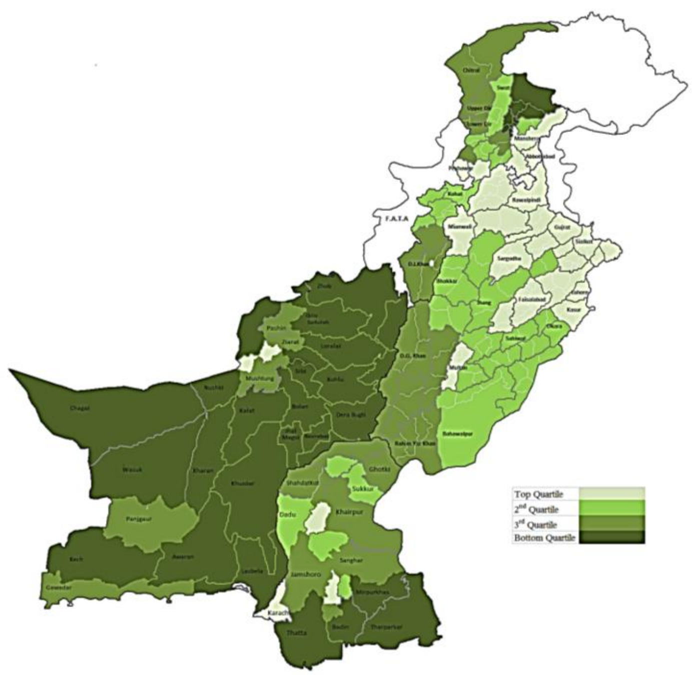
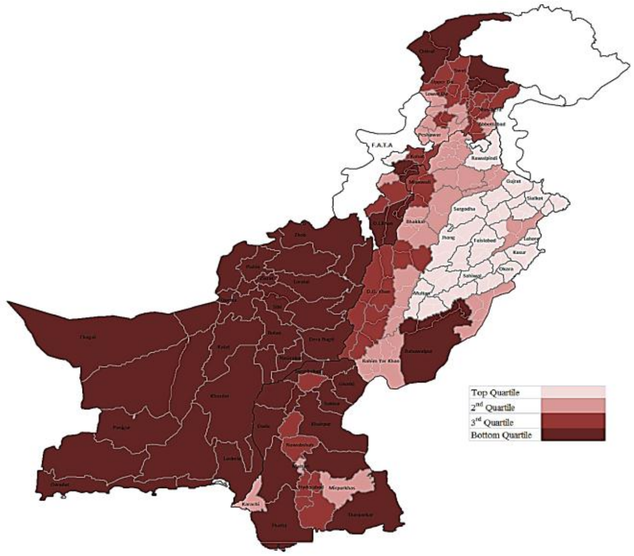


Fig. 3. Spatial Mapping of Road Density



APPENDIX C

Asset Index Values

1	Islamabad	10.53398	38	Khushab	0.578715	75	Jamshoro	–0.8139
2	Lahore	6.531246	39	Mianwali	0.523907	76	Manshera	–0.88276
3	Karachi	5.690967	40	Hafizabad	0.424956	77	Tando Allah	–0.88932
4	Peshawar	5.605258	41	Kasur	0.275251	78	Mastung	–0.89089
5	Rawalpindi	5.09841	42	Karak	0.22588	79	Nasirabad	–1.04458
6	Jhelum	3.62432	43	Dadu	0.198945	80	Lorali	–1.0821
7	Sialkot	3.309069	44	Bahawalpur	0.194226	81	Shahdadkot	–1.12523
8	Quetta	3.006212	45	Nankana Sahib	0.16253	82	Muzaffargarh	–1.12786
9	Gujrat	2.711241	46	Sahiwal	0.120562	83	Zhob	–1.14092
10	Gujranwala	2.63034	47	Okara	0.093955	84	Gwadar	–1.4655
11	Sargodha	2.523592	48	Pakpattan	0.084401	85	Batagram	–1.53491
12	Bannu	2.444482	49	Narowal	–0.04694	86	Panjgur	–1.55675
13	Hyderabad	2.374197	50	Bahawalnagar	–0.11433	87	Kalat	–1.57494
14	Faisalabad	2.346325	51	Nawabshah	–0.12264	88	Rajanpur	–1.59099
15	Haripur	2.195988	52	Layyah	–0.16483	89	Ketch	–1.6377
16	Chakwal	2.193927	53	Lower Dir	–0.2222	90	Tando Muda	–1.69902
17	Nowshero F	1.945039	54	Khuzdar	–0.23433	91	Nushki	–1.8301
18	M Bahuaddin	1.836626	55	Larkana	–0.27378	92	Qillah Saifullah	–2.06641
19	Multan	1.776168	56	Lakki Marwat	–0.33435	93	Kharan	–2.24803
20	Pashin	1.743047	57	D.G.Khan	–0.34163	94	Bolan	–2.33969
21	Abbottabad	1.413793	58	Vehari	–0.40333	95	Jhal Magsi	–2.34866
22	Sheikupura	1.402695	59	Kashmore	–0.43022	96	Washuk	–2.37476
23	Attock	1.371606	60	Shikarpur	–0.44004	97	Chitral	–2.46526
24	Tank	1.350145	61	Sanghar	–0.44522	98	Upper Dir	–2.46611
25	Nowshera	1.277339	62	Khanewal	–0.46102	99	Dera Bugti	–2.96835
26	Mardan	1.276713	63	Khairpur	–0.46932	100	Shangla	–3.03858
27	Hangu	1.245491	64	Ziarat	–0.49268	101	Lasbela	–3.05395
28	Swabi	1.156287	65	Lodhran	–0.52071	102	Thatta	–3.11718
29	Swat	1.100324	66	RahimYar Khan	–0.52165	103	Barkhan	–3.13219
30	Qillah Abd	1.011304	67	Mirpur Khas	–0.54322	104	Badin	–3.17392
31	Charsada	0.967917	68	Bhakhar	–0.58027	105	Chagi	–3.18545
32	T.T.Singh	0.954534	69	Bonair	–0.59717	107	Musakhel	–3.80096
33	D.I.Khan	0.887271	70	Jaccobabad	–0.63845	108	Awaran	–4.14663
34	Sibi	0.878156	71	Jhang	–0.70223	109	Kohlu	–4.42047
35	Malakand	0.866824	72	Maitari	–0.7194	110	Kohistan	–4.51882
36	Kohat	0.847362	73	Ghotki	–0.74046			
37	Sukkur	0.835253	74	Jafarabad	–0.80344			

Well-being Index Values

1	Islamabad	6.234603	38	Karak	0.9754925	75	Jaccobabad	–1.226724
2	Karachi	5.903576	39	Bahawalpur	0.8810728	76	Ziarat	–1.291056
3	Lahore	5.57656	40	Khanewal	0.8675861	77	Pashin	–1.308706
4	Rawalpindi	5.49893	41	Layyah	0.7846873	78	Panjgur	–1.508751
5	Jehlum	4.763879	42	Hangu	0.784137	79	Shahdadkot	–1.599927
6	Sialkot	4.736196	43	Jhang	0.7699276	80	Mastung	–1.624826
7	Chakwal	4.72863	44	Batagram	0.7327576	81	Upper Dir	–1.699977
8	Abbottabad	4.654023	45	Swabi	0.7081991	82	Rajanpur	–1.852241
9	Haripur	4.353773	46	Pakpattan	0.6915661	83	Lasbela	–1.858197
10	Gujrat	4.347954	47	Mardan	0.5673209	84	Ketch	–1.956589
11	Gujranwala	4.110255	48	Malakand	0.5231762	85	Khuzdar	–1.979743
12	Sheikupura	3.291612	49	Dadu	0.4704441	86	Mirpur Khas	–1.980095
13	Peshawar	3.225019	50	Lodhran	0.2889536	87	Jafarabad	–2.019936
14	Faisalabad	3.205434	51	Bahawalnag	0.2612551	88	Sibi	–2.050518
15	Hyderabad	3.087317	52	Shikarpur	0.2332857	89	Thatta	–2.173111
16	M Bahuaddin	3.035786	53	Tando Allah	0.2249512	90	Shangla	–2.420689
17	Attock	2.92887	54	Bhakhar	0.2153661	91	Badin	–2.424553
18	Nowshero F	2.919385	55	Nawabshah	0.1744347	92	Zhob	–2.710144
19	T.T.Singh	2.864092	56	Sanghar	0.1087336	93	Kalat	–2.991286
20	Quetta	2.805496	57	Charsada	–0.013796	94	Nasirabad	–3.023462
21	Nankana Sahib	2.523984	58	Maitari	–0.018679	95	Tharparkar	–3.040952
22	Narowal	2.471714	59	Lakki Marwat	–0.046269	96	Nushki	–3.056986
23	Sargodha	2.42417	60	RahimYar Khan	–0.089535	97	Lorali	–3.207207
24	Nowshera	2.143239	61	Khairpur	–0.205919	98	Qillah Abd	–3.669676
25	Mianwali	2.032709	62	Jamshoro	–0.279425	99	Kharan	–4.034562
26	Kasur	1.939824	63	Ghotki	–0.301621	100	Washuk	–4.11888
27	Multan	1.9387	64	Larkana	–0.305670	101	Awaran	–4.209447
28	Manshera	1.880795	65	Kashmore	–0.379073	102	Qillah Saifullah	–4.571843
29	Sukkur	1.80054	66	D.G.Khan	–0.446036	103	Chagi	–4.743874
30	Khushab	1.794379	67	Bonair	–0.749114	104	Bolan	–4.907412
31	Okara	1.715305	68	Gwadar	–0.750567	105	Barkhan	–4.937888
32	Hafizabad	1.589369	69	D.I.Khan	–0.763493	106	Musakhel	–5.54526
33	Bannu	1.438993	70	Muzaffargarh	–0.871703	107	Jhal Magsi	–5.586706
34	Swat	1.426383	71	Chitral	–0.930833	108	Kohistan	–5.808076
35	Sahiwal	1.374916	72	Tank	–0.997125	109	Dera Bugti	–5.815793
36	Kohat	1.166668	73	Tando Muda	–1.118154	110	Kohlu	–6.865423
37	Vehari	1.074477	74	Lower Dir	–1.183369			

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Assessing Poverty with Non-Income Deprivation Indicators: Pakistan, 2008-09

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1. INTRODUCTION

The multidimensional approach of assessing household or individual welfare or wellbeing is derived from Amartya Sen's capability theory. According to Sen,[1] economic and social arrangements should be evaluated in terms of capabilities enjoyed by those who live in them. In this way, Sen shifts the terms of the poverty debate away from a reliance on income and consumption poverty measures alone, to the consideration of multiple dimensions of people's lives. This conceptual shift is worthy even in instances where the income or consumption approaches prove most useful. For policy perspectives, it is worth highlighting that uni-dimensional measures only advocate the case for transfer policies that alleviate poverty in the short-term, whereas multidimensional measures permit the recommendation of structural socio-economic policies that could alleviate the intergenerational poverty in the long-term.

The traditional uni-dimensional approach, which considers only one variable such as income or consumption, is widely used due to its practicality. The methodology of measuring uni-dimensional poverty has developed considerably and according to Bourguignon (2003) "has reached today a high level of sophistication and operationality". There has also been progress in defining and measuring the multidimensional nature of poverty and ample literature is now available on the conceptual and measurement issues. However, "…challenges remain quite serious if the objective is to reach a degree of operationality (for multidimensional paradigm) comparable to that enjoyed by the income poverty paradigm" [Bourguignon (2003)].

Despite difficulties and arbitrariness in the measurement and aggregation of household multiple deprivations, a multidimensional approach to define poverty has been adopted in many developed and developing countries. The United Nations Development Programme (UNDP) has since 1990 challenged the primacy of GDP per capita as the measure of progress by proposing the Human Development Index (HDI), which combines income with life expectancy and educational achievement. Similarly, the Millennium Development Goals (MDGs), which now dominate the development agenda

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[1]A summary of Amartya Sen's views and the development of that literature over the last 20 years may be found in Sen (1997).

of almost all developing countries, also emphasise multidimensionality in measuring progress in alleviating poverty.

Recently a global exercise was carried out by Oxford Poverty and Human Development Initiative (OPHI) to develop Multidimensional Poverty Index[2] (MPI) for more than 100 countries with the help of 10 non-income deprivation indicators of education, health and standard of living. The results in terms of countries ranking and magnitude of poverty have been published in UNDP Human Development Report 2010.[3] However, there are some concerns regarding the subjectivity in selecting cut-off points for individual indicators as well as for overall index. Moreover, weights to indicators and sectors are also arbitrarily assigned for developing a composite index.[4]

In the context of Pakistan, first attempt to quantify the extent of multidimensional poverty in terms of the popular poverty measures was made by Jamal (2009). He developed poverty indices (headcount, poverty gap, poverty severity) with the help of 15 deprivation indicators of education, housing and household consumption. The author used household data and employed Principal Component Analysis (PCA) technique to develop a composite index of poverty. PCA is a multivariate statistical technique which is used to reduce the number of relationships by grouping or clustering together all those variables which are highly correlated with each other into one factor or component. It is however criticised that traditional PCA is not appropriate technique[5] of data reduction for categorical or binary (have, have not) qualitative variables due to not-normal and highly skewed distribution. The use of household financial poverty level as a component in multidimensional approach was also objected by other critics due to the rising debate on the methodology as well as reliability of household consumption data for estimating monetary poverty incidence.

This research therefore addresses these shortcomings and attempts to assess the magnitude of household multidimensional poverty by combining 16 non-income deprivation indicators through categorical principal component analysis (CATPCA).[6] Indicators of human poverty, poor housing and deprivation in household physical assets are included in estimating popular poverty measures. For assessing the inter-temporal consistency in methodology, poverty measures are also developed for the year 2005.

The next section discusses measurement and aggregation issues and the methodology adopted for this study. Features of the datasets used in this exercise are presented in Section 3. The multiple dimensions of deprivation, considered in the estimation of multidimensional poverty are briefed in Section 4. Section 5 presents the

[2]Very brief description of the methodology used in the estimation of Multidimensional Poverty is provided in Appendix-A. For detail see Alkire and Santos (2010) and Alkire and Foster (2007).

[3]A country briefing for Pakistan's MPI is available at http://www.ophi.org.uk/wp-content/uploads/Pakistan.pdf

[4]See Appendix-A of this study and Technical Note 4 of UNDP Human Development Report, 2010, page 230.

[5]For example, Naveed and Islam (2010) discussed this issue in their paper. They also developed multidimensional poverty for two provinces of Pakistan using Alkire and Foster (2007) methodology.

[6]Standard Principal Components Analysis assumes linear relationships between numeric variables. On the other hand, the optimal-scaling which is used in CATPCA approach allows variables to be scaled at different levels. Categorical variables are optimally quantified in the specified dimensionality. As a result, nonlinear relationships between variables can be modeled.

empirical estimates of multidimensional poverty, while the last section is reserved for some concluding remarks and policy implications.

2. METHODOLOGY FOR MEASURING MULTIDIMENSIONAL POVERTY

The multidimensional nature of poverty refers to the situation when an individual or household experiences a number of cumulative deprivations. These multiple deprivations represent different dimensions (economic well-being, education, health, social exclusion etc.) of human life.

There are two options available to decide when a household or individual is said to be poor in term of multiple deprivations. In the first option, each single indicator is assigned its own threshold value. For instance, Bourguignon and Chakravarty (2003) take as their fundamental and starting point in the development of multidimensional poverty measures that poverty consists of a shortfall from a threshold on each dimension of an individual's well-being. They argue that "the issue of poverty arises because individuals, social observers or policy makers want to define a poverty limit on each individual attribute: income, health, education, etc….".

The concern here is whether a household should be considered poor if it falls short of the thresholds for all attributes, or only falls short of one.[7] In the two attribute case, if attribute 1 (x1) is less than its threshold (z1) and attribute 2 (x2) is also less than its threshold (z2), the status of the household is unambiguously 'poor'. Alternatively, the shortfall might be only in one dimension, in which case the determination would depend on the nature of the relationship between the two attributes. If the attributes are substitutes and an individual has a sufficiently high level of the first attribute above the threshold to more than compensate in terms of welfare for the shortfall in the second attribute, than the person cannot be classified as poor.[8]

The second option refers to the case where to measure multidimensional poverty, a composite indicator incorporating the information from the selected deprivation dimensions or variables is constructed. The studies adopting this methodology combine the individual indicators into one index variable and assign a threshold. If the value of index variable is below this threshold, the household or individual is considered poor. The advantage of this approach is that it is compensatory: a low score on a certain indicator may be neutralised by a high score on another.[9]

Here, two important decisions have to be made. The first decision concerns the weights of the indicators in the composite index, and the second concerns defining the threshold value of the composite indicator used to distinguish between poor and non-poor

[7]For instance, Bourguignon and Chakravarty (2003) suggest that an alternative way to take into account the multi-dimensionality of poverty is to specify a poverty line for each dimension of poverty and to consider that a person is poor if he/she falls below *at least one* of these various lines.

[8]In the literature of multidimensional poverty, the distinction between being poor in more than one and in only one dimension has been referred to as the *intersection* and *union* definitions of poverty. For instance, if well-being is measured in terms of x1 and x2 then a person could be considered poor if x1falls below z1*or* if x2 falls below z2. This case would be defined as a *union* definition of poverty. In contrast, an *intersection* definition would consider an individual as poor only if x1 and x2 both fall below their thresholds.

[9]A good example is the UNDP's Human Development Index (HDI), constructed from indicators of life expectancy, education and standard of living. HDI has received a great deal of attention in the development context.

individuals or households. The weighting problem can be approached in a number of different ways. Besides equal weighting or subjective judgment of experts regarding the importance of each component, the weight structure may be empirically based on relative frequencies of components by using different multivariate statistical techniques.

Use of Principal Components Analysis (PCA) for indexing multidimensional phenomena has been well-established. Principal component analysis is simply a variable reduction procedure that (typically) results in a relatively small number of components that account for most of the variance in a set of observed variables. This technique reduces the number of relationships by grouping or clustering together all those variables which are highly correlated with each other into one factor or component. PCA produces components in descending order of importance, that is, the first component explains the maximum amount of variation in the data, and the last component the minimum. Thus, the first few components (Principal Components) account for a sizeable part of the variation in the data and subsequent components contribute very little.

However traditional PCA is best for continuous and normally distributed data as the technique assumes linear relationship between numeric variables. For category indicator variables, a team of Leiden University has developed Categorical Principal Components Analysis (CATPCA).[10] The technique is now available in SPSS and may be applied for data reduction when variables are categorical (e.g. ordinal) and the researcher is concerned with identifying the underlying components of a set of variables (or items) while maximising the amount of variance accounted by the principal components. The primary benefit of using CATPCA rather than traditional PCA is the lack of assumptions associated with CATPCA. CATPCA does not assume linear relationships among numeric data nor does it require assuming multivariate normal data. Furthermore, optimal scaling is used in SPSS during the CATPCA analysis and allows the researcher to specify which level of measurement (nominal, ordinal, interval/ratio, spline-nominal, and spline-ordinal etc.) in the optimally scaled variables is required.

After having a representation of the data in the component form, every household is ascribed a 'score' on each derived principal components/object using factor loading (variance in the individual attribute) as a weight and then multiplying this score with the standardised value of variables. To obtain an overall score (OS) for household, scores of all principal components are summed up after applying statistical weights (shares in eignvalues).[11]

Once the composite indicator in terms of 'overall score' is obtained for each household, one still has to define a procedure to identify the poor. To determine threshold or poverty cut-off point, another multivariate statistical technique is used. Cluster Analysis allows the classification of similar objects into groups, or more precisely, the partitioning of an original population into subsets (clusters) according to some defined distance measure. On this basis, an overall score of two clusters representing household status (poor and non-poor) is developed. It is found that households are grouped around positive and negative values of an overall score. Therefore, mean value (zero in this case)

[10]Data Theory Scaling System Group (DTSS), Faculty of Social and Behavioural Sciences, Leiden University, The Netherlands.

[11]It is a statistical term. The eigenvectors of a square matrix are the non-zero vectors that, after being multiplied by the matrix, remain parallel to the original vector. For each eigenvector, the corresponding eigenvalue is the factor by which the eigenvector is scaled when multiplied by the matrix.

of the distribution of the composite index is chosen as the cut-off point or as a poverty threshold. In other words, household *i* for which the composite index OS is smaller or equal than zero will be identified as poor.

After having a poverty threshold and the household status in terms of overall score with respect to multiple deprivations, the task then is how to aggregate this information into a single index to proxy the status of a group of individuals. Various poverty aggregates (indices) are used to proxy the status of a group of individuals. A class of functional forms, which has been suggested by Foster, Greer, and Thorbeke (1984), i.e. poverty incidence, poverty gap and poverty severity are widely used in the literature of poverty.[12] Thus, these three aggregate indices are estimated to give a picture of the extent and severity of multidimensional poverty in Pakistan.

3. THE DATASETS

Federal Bureau of Statistics (FBS), Government of Pakistan (GoP) conducts nationwide household surveys—Pakistan Social and Living Standard Measurement (PSLM)—to collect information on socio-economic indicators at district level. These surveys are conducted under the PSLM project which is designed to provide social and economic indicators in the alternate years at provincial and district levels. The project was initiated in July 2004 and will continue up to June 2015. The design of PSLM surveys is based on the Core Welfare Indicator Questionnaire (CWIQ) survey instrument, which essentially collects simple welfare indicators and indicators of access as well as use of and satisfaction with public services.

This study uses unit record data of PSLM survey conducted during the year 2008-09 which covers 77500 households across all provinces of Pakistan. Multidimensional poverty is also estimated from household unit record data of PSLM 2004-05 with the sample size of 76500 for the purpose of comparison.

4. DIMENSIONS AND COMPONENTS OF MULTIDIMENSIONAL POVERTY

The technique presented in the above section is applied to PSLM survey data enumerated during 2008-09 and 2004-05. Therefore, the selection of dimensions or components to derive multidimensional poverty is purely based on the appropriate data available in these household surveys. The selected dimensions and components in constructing indices of multidimensional poverty are briefly described below, while a schematic view of component variables[13] is furnished in Table 1.

The extent of human poverty in the household is represented by current and future levels of education deprivations. Two measures, illiteracy (head of household and spouse) and children out of school are included in this dimension.[14] Children between the ages of 5 to 9, who are not attending school, are taken to compute out-of-school children at the primary level. Moreover, following UNDP-MPI, another indicator of education deprivation is included. Households in which no household member has completed five years of schooling are considered poor.

[12]These measures are defined in Appendix-B.

[13]All these variables are binary. A value of 1 is assigned to poor household and 2 to non-poor households.

[14]Literacy is defined as the “ability of a person to read and write in any language with understanding”.

No information regarding infant or child mortality and malnourishment is available in PSLM surveys. The dimension of health deprivation is therefore missing from the multidimensional poverty analysis due to absence of required information.

Table 1

Variables used to Assess Multi-Dimensional Poverty

Dimensions	Variables
Human Poverty	
	Illiterate Head of Household
	Illiterate Spouse
	No child of primary age (5-9 cohort) is in school
	No household member has completed five years of schooling
Poor Housing	
	Congested Household (Households with only one room)
	Congested Household (Person per room greater 2)
	Household with Inadequate Roof Structure
	Household with Inadequate Wall Structure
	Households with no electricity
	Households using unsafe (not covered) water
	Households with no telephone connection (landline or mobile)
	Households using inadequate fuel for cooking (wood, coal, etc.)
	Households without latrine facility
Economic and Household Assets Poverty	
	Households with no home ownership
	Households with no physical household assets
	Unemployed Head of Household

The housing quality dimension identifies people living in unsatisfactory and inadequate housing structures. It is represented by a series of variables. The housing structure is treated as inadequate if un-baked bricks, earth bound materials, wood or bamboo are used in the construction of a wall or the roof. Housing congestion is represented by households with only one room and number of person per room is greater than 2. Access to basic utilities is an important aspect of everyday lives of people. Deprivation in this respect includes households with no electricity, households using wood or kerosene oil as cooking fuel, households with no safe drinking water availability and households with no landline or mobile telephone facility. Households which are lacking essential facilities such as kitchens, bathrooms and toilets are also seen as an important poverty dimension. Due to data constraints, only households lacking a toilet facility are included in the 'poor housing' dimension of multidimensional poverty.

To capture the poverty in endowments, non-ownership of house and non-ownership of essential household assets[15] are added to the list of variables used to assess the household multidimensional poverty. Further, category of households with unemployed head is also treated as poor and included in this dimension.

5. MAJOR FINDINGS

Table 2 presents the national estimates of multidimensional poverty. In the year 2008-09, about 57 percent of the people of Pakistan were in the state of multiple deprivations.[16] This is indicative of more than 97 million people living in desperate condition and eventually being socially excluded. The magnitudes of multidimensional poverty incidence, poverty gap and poverty severity are substantially high in rural areas. According to the table, rural incidence is about 53 percent against the urban incidence of 26 percent. Similarly, the magnitudes of equity-sensitive poverty indices (poverty gap and poverty severity) for rural areas are almost five times higher when compared to their urban counterparts. Rural multidimensional poverty gap and poverty severity are estimated as eleven and four percent respectively, while comparative figures for urban areas are 3 and 1 percent respectively.

Table 2

National Non-income Multi-Dimensional Poverty Estimates, 2008-09

(Percent)

	Head Count Index [Incidence]	Poverty Gap Index [Depth]	FGT2 Index [Severity]
Pakistan	57.30	12.90	4.85
Urban	25.68	2.87	1.0
Rural	53.35	11.02	4.01

Source: Estimates are based on PSLM (2008-09) unit record data.

Provincial multidimensional poverty estimates for the year 2008-09 are presented in Table 3, while district-wise poverty estimates are tabulated in the Appendix (Appendix C, Table A.1 to A.4). As expected, the lowest and highest incidence of multidimensional poverty is estimated for Punjab and Balochistan provinces respectively. About 79 percent of the population of Balochistan is categorised as poor in terms of multiple deprivations. It is also noted that incidence of rural poverty in Sindh province is higher than rural poverty estimates of Khyber Pakhtunkhwa province.

Table 3

Provincial Non-Income Multi-Dimensional Poverty Incidence, 2008-09

(Percent)

	Overall	Urban	Rural
Punjab	36.93	22.42	43.58
Sindh	47.63	26.66	67.44
Khyber Pakhtunkhwa	56.10	36.53	60.00
Balochistan	78.53	44.83	88.61

Source: Estimates are based on PSLM (2008-09) unit record data.

[15]These assets are Iron, Fan, Sewing Machine, Radio, TV, Chair/Table and Watch/Clock.
[16]These deprivations are listed in Table 1.

Table 4 and Figure 1 show inter-temporal (2008-09 vs. 2004-05) changes in the multidimensional poverty indices. The estimates show a rise[17] of about two percentage point (3.62 percent) in multidimensional poverty. Measures of poverty depth/gap and severity are also showing upward trends. The phenomenon indicates rising inequality among poor. Figure 1 also indicates a significant (about 38 percent) rise in urban multidimensional poverty incidence as compared with 4 percent in rural area during 2005 and 2009.

Table 4

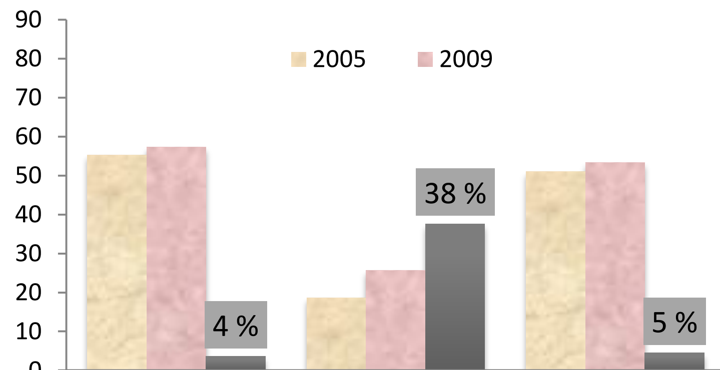
Inter-temporal Multi-Dimensional Poverty—Overall Pakistan

(Percent)

Poverty Measures	2005	2009	Percent Change	Percentage Point Change
Incidence	55.29	57.30	3.63	2.00
Depth	12.40	12.90	4.01	0.50
Severity	4.30	4.85	12.83	0.55

Source: Estimated from Household Surveys, PSLM 2004-05 and 2008-09.

Fig. 1. Inter-temporal Multi-dimensional Poverty Incidence—Overall Pakistan



	Overall	Urban	Rural
2005	55.29	18.66	51.03
2009	57.30	25.68	53.35
% Change	3.63	37.65	4.54

The provincial picture of changes in multidimensional poverty during 2005 and 2009 is portrayed in Table 5. Few important observations emerge from the table. First despite relatively low incidence of poverty, a significant increase in the magnitude is evident in case of Punjab province. Incidence of multidimensional poverty has increased from 32 to 37 which reflect rising inequality or relative poverty in the province. Province of Sindh is also depicting a rise in the poverty, while a decline in relative poverty incidence is observed in case of Khyber Pakhtunkhwa and Balochistan provinces.

[17]Multidimensional poverty is estimated with the help of component/object scores. These scores are derived after adjusting with mean and standard deviation (standardising). Thus, the estimates are reflecting relative poverty (or inequality) with reference to mean and should not be interpreted as an absolute poverty.

Table 5

Provincial Trends in Multi-Dimensional Poverty

(Percent)

Province	2005	2009	Percent Change	Percentage Point Change
Punjab	31.73	36.93	16.38	5.20
Sindh	44.24	47.63	7.67	3.39
Khyber Pakhtunkhwa	58.27	56.10	–3.72	–2.17
Balochistan	79.24	78.53	–0.89	–0.71

Source: Estimated from Household Surveys, PSLM 2004-05 and 2008-09.

6. CONCLUDING REMARKS

The operational emphasis of poverty is understood in terms of deprivation of food and other 'basic' commodities, and therefore, on private income or private consumption shortfalls, mainly due to the advancement and the level of sophistication in measuring and assessing financial poverty. However, vast literature is now available on conceptual and measurement issues of multidimensionality of poverty. Due to this advancement and technical development, non-income indicators of well-being and the multidimensionality of poverty have recently received much attention, especially in developing countries.

This research quantifies the extent of multidimensional poverty in Pakistan in terms of the popular FGT indices (headcount, poverty gap and poverty severity) and using latest available rich household data. Indicators of human poverty, poor housing and lack of physical assets are combined to get a composite index of poverty across multiple deprivations. These non-income indicators are developed using PSLM Surveys for the years 2008-09 and 2004-05. Multivariate statistical tools (Categorical Principal Component Analysis and Cluster Analysis) are used to construct the composite index and to ascertain multidimensional poverty threshold.

The empirical findings reveal that about 57 percent of the people of Pakistan were in the state of multiple deprivations in the year 2008-09. Rural incidence was about 53 percent, while 26 percent of urban population faced extreme poverty in terms of indicators used in the construction of multidimensional poverty. Inter-provincial comparisons regarding the multidimensional poverty incidence reveals lowest poverty incidence in the Punjab province. Balochistan has the highest multidimensional poverty incidences in both urban and rural areas. About 79 percent of the population of Balochistan is categorised as poor in terms of multiple deprivations. Inter-temporal exercise indicates a slight rise in the multidimensional relative poverty.

The findings are useful in the formulation of policies and implementation of strategies to reduce poverty, especially for targeting multi-dimensionally poorest districts and regions. Moreover, the magnitude of poverty indices may be used as a criterion in determining the national and provincial Finance Commission Awards. Poverty estimates will also facilitate provincial governments in future planning and resource allocation.

Appendices

APPENDIX – A

Multidimensional Poverty Index: UNDP Human Development Report, 2010

Alkire and Santos (2010) developed Multidimensional Poverty Index (MPI) for the 2010 *Human Development Report* [UNDP (2010)]. They constructed MPI for more than 100 countries and choose 10 variables for their MPI under the same three headings—health, education and living standards similar to the dimension of UNDP's *Human Development Index* (HDI).

Poverty is measured separately in each of these 10 components. The equally-weighted aggregate poverty measures for each of these three main headings are then weighted equally (one-third each) to form the composite index, also echoing the HDI. A household is identified as being poor if it is deprived across at least 30 percent of the weighted indicators. While the HDI uses aggregate country-level data, the Alkire-Santos MPI uses household-level data, which are then aggregated to the country level.

For the convenience, the methodology as narrated in the Technical note of HDR, 2010 is reproduced below:

"Each person is assigned a score according to his or her household's deprivations in each of the 10 component indicators. The maximum score is 10, with each dimension equally weighted (thus the maximum score in each dimension is 3⅓). The health and education dimensions have two indicators each, so each component is worth 5/3 (or 1.67). The standard of living dimension has six indicators, so each component is worth 5/9 (or 0.56). The health thresholds are having at least one household member who is malnourished and having had one or more children die. The education thresholds are having no household member who has completed five years of schooling and having at least one school-age child (up to grade 8) who is not attending school. The standard of living thresholds relate to not having electricity, not having access to clean drinking water, not having access to adequate sanitation, using "dirty" cooking fuel (dung, wood or charcoal), having a home with a dirt floor, and owning no car, truck or similar motorised vehicle, and owning at most one of these assets: bicycle, motorcycle, radio, refrigerator, telephone or television. To identify the multi-dimensionally poor, the deprivation scores for each household are summed to obtain the household deprivation(c). A cut-off of 3, which is the equivalent of one-third of the indicators, is used to distinguish between the poor and nonpoor. 4 If c is 3 or greater, that household (and everyone in it) is multi-dimensionally poor. Households with a deprivation count between 2 and 3 are vulnerable to or at risk of becoming multi-dimensionally poor".

APPENDIX – B

Poverty Measures

Various poverty aggregates (indices) are used to proxy the status of a group of individuals. A class of functional forms, which has been suggested by Foster, Greer, and Thorbeke (FGT), uses various powers of the proportional gap between the observed and the required expenditure as the weights to indicate the extent of and level of intensity of poverty. The higher the power the greater the weight assigned to a given level of poverty. Therefore, it combines both incidence and intensity.

The following formula is used for measuring various poverty aggregates.

$$P^{\alpha} = (1 / N) \sum [(Z - \text{Score}) / Z]^{\alpha}$$

where;

P^{α} = Aggregation measure
N = Total number of households
Score = Observed household Score
Z = Poverty threshold or poverty line
$\sum$ = Summation for all individuals who are below the poverty line.

Putting $\alpha = 0$, the formula shows the proportion of households whose consumption falls below the poverty line. The poverty incidence (headcount) is the most popular measure used. The formula assigns equal weights to all of the poor regardless of the extent of poverty. Putting $\alpha = 1$, the Proportionate Gap Index or Poverty Gap (PG) is calculated. The PG measures the average distance from the poverty line. Although the PG shows the depth of poverty, it is insensitive to distribution among the poor. Putting $\alpha = 2$, FGT2 index is calculated. This index takes into account inequality amongst the poor and shows the poverty severity by assigning greater weights to those households who are far below the poverty line. Thus, these three aggregate indices (Headcount, Poverty Gap, and Poverty Severity) are computed to give a picture of the extent and severity of multidimensional poverty in Pakistan.

Appendix – C

Table A.1

District-wise Non-Income Multi-Dimensional Poverty Incidence
(Percentage of Population, District of Punjab, 2008-09)

Attock	37.10	Mandi Bahuddin	16.77
Bahawalnagar	55.23	Mianwali	32.17
Bahawalpur	55.68	Multan	46.49
Bhakhar	45.97	Muzaffar Garh	62.65
Chakwal	16.12	Nankana Sahib	30.87
D.G.Khan	67.57	Narowal	26.32
Faisalabad	31.97	Okara	40.08
Gujranwala	13.32	Pakpattan	53.37
Gujrat	10.22	RahimYar Khan	56.92
Hafizabad	32.84	Rajanpur	81.13
Jehlum	12.31	Rawalpindi	24.71
Jhang	47.20	Sahiwal	45.33
Kasur	29.68	Sargodha	25.94
Khanewal	46.44	Sheikupura	28.15
Khushab	32.00	Sialkot	16.22
Lahore	22.58	T.T.Singh	23.27
Layyah	52.78	Vehari	45.18
Lodhran	55.31		

Table A.2

District-wise Non-Income Multi-Dimensional Poverty Incidence
(Percentage of Population, District of Sindh, 2008-09)

Badin	75.06
Dadu	51.28
Ghotki	57.47
Hyderabad	25.21
Jaccobabad	67.82
Jamshoro	64.60
Karachi	22.01
Kashmore	57.83
Khairpur	50.67
Larkana	53.37
Maitari	54.98
Mir Pur Khas	68.04
Nawabshah	52.63
Nowshero Feroze	34.90
Sanghar	51.81
Shahdadkot	65.66
Shikarpur	54.66
Sukkur	53.60
Tando Allah Yar	49.06
Tando Muda Khan	65.86
Tharparkar	93.95
Thatta	75.04

Table A.3

District-wise Non-Income Multi-Dimensional Poverty Incidence
(Percentage of Population, District of Khyber Pakhtunkhwa, 2008-09)

Abbottabad	33.73
Bannu	43.81
Batagram	48.02
Bonair	56.84
Charsada	58.17
Chitral	67.54
D.I.Khan	69.35
Hangu	47.81
Haripur	31.17
Karak	52.73
Kohat	49.65
Kohistan	95.53
Lakki Marwat	57.64
Lower Dir	64.78
Malakand	58.11
Manshera	55.80
Mardan	55.95
Nowshera	39.42
Peshawar	42.05
Shangla	76.50
Swabi	48.30
Swat	73.03
Tank	70.24
Upper Dir	75.10

Table A.4

District-wise Non-Income Multi-Dimensional Poverty Incidence
(Percentage of Population, District of Balochistan, 2008-09)

Awaran	87.93
Barkhan	91.09
Bolan/Kacchi	95.28
Chagi	96.04
Dera Bugti	89.14
Gwadar	55.15
Jafarabad	80.19
Jhal Magsi	95.30
Kalat	88.77
Ketch/Turbat	76.89
Kharan	85.54
Khuzdar	80.60
Kohlu	96.06
Lasbilla	80.91
Lorali	82.68
Mastung	84.32
Musakhel	98.89
Nasirabad	87.06
Nushki	83.30
Panjgur	78.67
Pashin	73.14
Qillah Abdullah	86.49
Qillah Saifuallh	92.13
Quetta	46.40
Sibbi	75.76
Washuk	96.16
Zhob	78.02
Ziarat	93.48

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Does Economic Geography Matter for Pakistan? A Spatial Exploratory Analysis of Income and Education Inequalities

SOFIA AHMED

1. INTRODUCTION

From the industrial revolution to the emergence of the so-called knowledge economy, history has shown that economic development has taken place unevenly across regions. A region's economy is a complex mix of varying types of geographical locations comprising different kinds of economic structures, infrastructure, and human capital. In this context recent literature in regional sciences has highlighted how crucial it is to analyse socio-economic phenomena in the light of spatial concepts such as geography, neighbourhood, density, and distance [Krugman (1991); Krugman and Venebles (1995); Quah (1996); Baldwin, *et al.* (2003); van Oort (2004); Kanbur and Venebles (2005); World Development Report (2009)]. Keeping these recent developments in view, this paper identifies, measures, and models the temporal relationship between space, economic inequalities, human development, and growth for the case of Pakistan.[1] Specifically, by using data at district level from 1998 and 2005, it utilises spatial exploratory techniques to determine the effect of distance and contiguity among 98 of Pakistan's administrative districts on their human capital characteristics and inequalities.[2] This way it provides some of the first spatially explicit results for clustering of socio-economic characteristics across Pakistani districts.[3]

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[1]Economic inequalities refer to education, earnings income inequalities in particular.

[2]Examples of studies similar to this paper include: Rey and Montouri (1999) on convergence across USA, Balisacan and Fuwa (2004) for income inequality in Philipines, Dall'erba (2004) analyses productivity convergence across Spanish regions over time, Dominicis, Arbia and de Groot (2005) analyses spatial distribution of economic activities in Italy, Pose and Tselios (2007) investigates education and income inequalities in the European Union, and Celebioglu and Dall'erba (2009) analyses spatial disparities in growth and development in Turkey.

[3]The only other exception includes Burki, *et al.* (2010) that has explicitly considered spatial dependencies in its analysis. However it has analysed 56 districts.

Most of the existing research on Pakistan's socio-economy is based on a provincial level, and it neglects the role of social interactions the districts within the provinces.[4] This paper in particular investigates whether spatial clustering of income and average education levels can explain their distribution across Pakistani districts. District level research has become even more important as Pakistan has taken a major step towards fiscal decentralisation with the enactment of the 18th Constitutional Amendment. Moreover the 7th National Finance Commission Award has allowed the transfer of more funds from the federation to the provinces which now have more authority over the provision of health, educational and physical infrastructure facilities. This fundamental shift towards the division of power between the centre and the provinces bears significant implications for the country's long term policy planning, management and implementation. As education and other public and social services become the sole domain of the provinces, there is a need for increased research at the district level.

Furthermore, Pakistan is also characterised with spatial disparities between its key socio-economic characteristics such as education, health, physical infrastructure, etc. [Burki, *et al.* (2010)]. While some districts have state of the art physical and human capital infrastructure, others have made little or no progress at all. This phenomenon is in line with the findings of the World Bank's World Development Report (2009) that has demonstrated how and why the clustering or concentration of people and production usually takes place in particular favourable areas (coasts, cities, etc.) during the growth process in any country. For the case of Pakistan, the most developed districts are located in Northern and Central Punjab. It has been noted that Pakistani districts with a population density of more than 600 persons per square km are characterised by industrial clusters, superior education and health infrastructure and better sanitation facilities that serve as attractive pull factors, e.g., Karachi, Lahore, Peshawar, Charsadda, Gujranwala, Faisalabad, Sialkot, Mardan, Islamabad, Multan, Swabi, Gujrat and Rawalpindi [Khan (2003)]. On the other hand, districts with lowest population densities (or those having below 30 persons per square km) are characterised by prevalence of various push factors such as; absence of job opportunities due to lower education and health facilities, poor agricultural endowments, barren or mountainous topography, and lack of limited presence of industrial units [Khan (2003)]. Moreover, the fact that the highly (and medium) concentrated districts (except for Swat and Muzzaffargarh) are mostly clustered around metropolitan cities of Karachi and Lahore [Burki, *et al.* (2010)] demonstrates that a district's human and economic development is being shared by its neighbouring districts, confirming that economic geography matters for Pakistan.

In the light of the above mentioned issues, this study empirically investigates the spatial clustering of economic inequalities, growth and development across Pakistani districts by utilising ESDA techniques. The paper is organised as follows: Section 2 describes the data; Sections 3 and 4 provide a detailed overview of the methodology utilised; Section 5 presents the empirical results; finally Section 6 discusses the policy and methodological implications of the empirical results and concludes.

[4]Exceptions include Jamal and Khan (2003, 2003a), Jamal and Khan (2008, 2008a), Naqvi (2007), Arif, *et al.* (2010), Siddique (2008) and a few others. Except for Jamal and Khan (2003, 2003a), Jamal and Khan (2007, 2007a), most of them only study selected districts/villages from the same province e.g. Naqvi (2007) only analyses the districts/villages of Punjab.

2. DATA

For district wise average earnings income and education levels, this paper utilises micro data from the Pakistan Social and Living Standards Measurement survey (PSLM) 2004-05. It is the only socio-economic micro data that is representative at the provincial and at the district level. Moreover, the sample size of the district level data is also substantially larger than the provincial level data contained in micro data surveys such as Household Income and Expenditure Survey (HIES) of Pakistan and the Labour Force Survey (LFS) of Pakistan. This has enabled researchers to draw socioeconomic information which is representative at lower administrative levels as well. The survey for 2004-05 provides district level welfare indicators for a sample size of about 76,500 households. It provides data on districts in all four provinces of Pakistan namely; Punjab, Sindh, Khyber Pakhtunkhwa (KP), and Balochistan. The federally administered tribal areas (FATA region) along the Afghan border in the north-west and Azad Kashmir are not included in the data.

To analyse the spatial differences in district wise primary, secondary, and bachelor's education levels over time, this article has utilised the district level data from the 1998 Population Census of Pakistan. Since the data from PSLM (2004-05) is statistically comparable with the Pakistan Census Data (1998) the two data sets together provide a decent gap of 7 years to analyse the temporal changes in income and development characteristics across Pakistan.

Finally, for investigating spatio-temporal differences in district wise income, GDP growth rate, and human development levels, this paper has taken its data from the National Human Development Report (2003) and from Jamal and Khan (2008). Note that all income data from 2004-05 was deflated using the Pakistani Consumer Price Index (CPI) of 1998.

3. METHODOLOGY

Due to the abundance in data collected at a provincial or a rural/urban disaggregation, most socio-economic studies on Pakistan, are a province based analysis. Pakistani provinces however have extreme 'within' diversity in terms of their economic structures, development levels, cultures, language, natural resources and geography. Hence regional policy making requires analysing socio-economic issues at an even smaller geographical disaggregation. For this reason, the spatial unit of analysis chosen for this study is the 'districts' of Pakistan. In terms of geographical disaggregation Pakistan (excluding the Federally Administered Tribal Area (FATA) region and Azad Kashmir) has 4 levels consisting of 4 provinces (Punjab, Sindh, Khyber Pakhtunkhwa (KP), and Balochistan), 107 districts, 377 sub-districts, and 45653 villages. A lower level unit of analysis is not being used because of two main reasons. Firstly, data on regional scales below the district level in Pakistan suffers from reliability issues. The second issue is more technical. In order to give information on 45,653 villages of Pakistan instead of 107 districts, the project would need a matrix of distance with $\frac{45{,}653 \times (45{,}653+1)}{2} =$ $1{,}042{,}121{,}031$ free elements to be evaluated, hence the utilisation of district level data. Due to data constraints, this article analyses 98 out of 107 districts in Pakistan (see Table A1).

3.1. Spatial Economic Analysis and Spatial Effects

A fundamental concept in geography is that proximate locations often share more similarities than locations far apart. This idea is commonly referred to as the 'Tobler's first law of geography' [Tobler (1970)]. Classical statistical inference such as conventional regressions are inadequate for an in-depth spatial analysis since they fail to take into account spatial effects and problems of spatial data analysis such as spatial autocorrelation, identification of spatial clusters and outliers, edge effects, modifiable areal unit problem, and lack of spatial independence [Arbia, Benedetti, and Espa (1996); Beck, Gleditsch, and Beardsley (2006); Franzese and Hays (2007)].[5] Moreover, as an uneven distribution of socio-economic economic characteristics is shaping the economic geography of most countries, spatial analysis also has increasing policy relevance [World Development Report—WDR (2009)]. These reasons together necessitate the use of spatial exploratory and explanatory methods that can explicitly take spatial effects into account.

Spatial analysis investigates the presence (or absence) spatial effects which can be divided into two main kinds: spatial dependence and spatial heterogeneity. Spatial heterogeneity refers to the display of instability in the behaviour of the relationships under study. This implies that parameters and functional relationships vary across space and are not homogenous throughout data sets. Spatial dependence on the other hand, refers to the lack of independence between observations often present in cross sectional data sets. It can be considered as a functional relationship between what happens at one point in space and what happens in another. If the Euclidean sense of space is extended to include general space (consisting of policy space, inter-personal distance, social networks etc.) it shows how spatial dependence is a phenomenon with a wide range of application in social sciences. Two factors can lead to it. First, measurement errors may exist for observations in contiguous spatial units. The second reason can be the use of inappropriate functional frameworks in the presence of different spatial processes (such as diffusion, exchange and transfer, interaction and dispersal) as a result of which what happens at one location is partly determined by what happens elsewhere in the system under analysis.

3.2. Quantifying Spatial Effects

Spatial dependence puts forward the need to determine which spatial units in a system are related, how spatial dependence occurs between them, and what kind of influence do they exercise on each other. Formally these questions are answered by using the concepts of neighbourhood expressed in terms of distance or contiguity.

Boundaries of spatial units can be used to determine contiguity or adjacency which can be of several orders (e.g., first order contiguity or more). Contiguity can be defined as linear contiguity (i.e., when regions which share a border with the region of interest are immediately on its left or right), rook contiguity (i.e. regions that share a common side with the region of interest), bishop contiguity (i.e. regions share a vertex with the region of interest), double rook contiguity (i.e. two regions to the north, south, east, west of the

[5]Modifiable Areal Unit Problem: When attributes of a spatially homogenous phenomenon (e.g., people) are aggregated into districts, the resulting values (e.g., totals, rates and ratios) are influenced by the choice of the district boundaries just as much as by the underlying spatial patterns of the phenomenon.

region of interest), and queen contiguity (i.e. when regions share a common side or a vertex with the region of interest) [LeSage (1999)]. Other common conceptualisations of spatial relationships include inverse distance, travel time, fixed distance bands, and k-nearest neighbours.

The most popular way of representing a type of contiguity or adjacency is the use of the binary contiguity [Cliff and Ord (1973, 1981)] expressed in a spatial weight matrix (*W*). In spatial econometrics *W* provides the composition of the spatial relationships among different points in space. The spatial weight matrix enables us to relate a variable at one point in space to the observations for that variable in other spatial units of the system. It is used as a variable while modelling spatial effects contained in the data. Generally it is based on using either distance or contiguity between spatial units. Consider below a spatial weight matrix for three units:

$$W = \begin{bmatrix} 0 & w_{12} & w_{13} \\ w_{21} & 0 & w_{23} \\ w_{31} & w_{32} & 0 \end{bmatrix}$$

Where w_{12} or w_{ij} may be the inverse distance between two units *i* and *j* or it may be 0 and 1 if they share a border or a vertex. The *W* matrix displays the properties of a spatial system and can be used to gauge the prominence of a spatial unit within the system. The usual expectation is that values at adjacent locations will be similar.

3.3. The Spatial Weight Matrix for Pakistan

The choice of the *W* matrix representation and its conceptualisation has to be carefully based on theoretical reasoning and the historical factors underlying the concept or phenomenon under study.

This paper has employed two W matrices for Pakistan.[6] The first matrix is a simple binary contiguity W matrix (referred to as *BC matrix* from now onwards) based on the concept of Queen Contiguity i.e. if a district *i* shares a border *or* a vertex with another district *j*, they are considered as neighbours, and $w_{i,j}$ takes the value 1 and 0 otherwise. This matrix is also zero along its diagonal implying that a district cannot be a neighbour to itself. Hence it is a symmetric binary matrix with a dimension of 98x98 (98 being the total number of the districts being analysed). This matrix precisely tells us the influence of geographically adjacent neighbours on each other. A simple binary contiguity matrix is a standard starting point and its influence is often compared with other types of *W* matrices.

The second *W* matrix developed for Pakistan is one based on inverse average road distance from a district *i* to the nearest district *j* which has a '*large city*' in it (referred to as *ID matrix* from now onwards). Out of the 98 districts being studied there are only 14 that come under the category of a district with a '*large size*' city as per the classification of the coding scheme for the PSLM survey. These include Islamabad as the federal capital city; Lahore, Faisalabad, Rawalpindi, Multan, Gujranwala, Sargodha, Sialkot, and Bahawalpur as districts with a 'large size' city in Punjab; Karachi, Hyderabad and Sukkur in Sindh; Peshawar in the Khyber Pakhtunkhwa and Quetta in Balochistan. This matrix is a symmetric non-binary matrix, again with a dimension of 98x98.

[6]Usually two or more weights matrices are utilised in spatial exploratory and econometric studies as a robustness measure. It is way of demonstrating whether strength of spatial effects are robust to changing definitions of neighbourhood.

The reason for selecting road distance instead of train distance as is normally done in most studies on regional analysis is that in Pakistan, the road network is much better developed than the railway network . As a result, Pakistan's transport system is primarily dependent on road transport which makes up 90 percent of national passenger traffic and 96 percent of freight movement every year (Economic Survey of Pakistan, 2007-08). Inverse distance matrices have more explanatory power as partitions of geographic space especially when the phenomenon under study involves the exchange or transfer of information and knowledge (in our case income and education). It establishes a decay function that weighs the effect of events in geographically proximate units more heavily than those in geographically distant units. Since a country is not a plain piece of land, Euclidean distance calculations or distance as 'the crow flies' make little economic sense when we are trying to investigate the effect of distance from districts with a large city on regional human development characteristics. The effect of the density of country's infrastructure network is an important influence for which reason road distances have been utilised. For this reason this paper has utilised the inverse of the average of the maximum and the minimum roads distance between a district and its nearest district with a '*large city*'.

Finally both the matrices are row-standardised, which is a recommended procedure whenever the distribution of the variables under consideration is potentially biased due to errors in sampling design or due to an imposed aggregation scheme.

4. EXPLORATORY SPATIAL DATA ANALYSIS

Exploratory spatial analysis aims to look for "associations instead of trying to develop explanations" [Haining (2003), p. 358]. This article applies exploratory spatial data analysis (ESDA) techniques to district wise data on income, education, growth and development levels in order to detect the presence of spatial dependence. ESDA describes and visualises spatial distributions, "identifies spatial outliers, detects agglomerations and local spatial autocorrelations, and highlights the types of spatial heterogeneities" [van Oort (2004); Haining (1990); Bailey and Gatrell (1995); Anselin (1988); Le Gallo and Ertur (2003)]. The particular ESDA techniques employed in this study include the computation of Moran's *I* and Geary's *C* spatial autocorrelation statistics. They demonstrate the spatial association of data collected from points in space and measures similarities and dissimilarities in observations across space in the whole system [Anselin (1995)]. However due to the presence of uneven spatial clustering, the Local Indicators of Spatial Association which measure the contribution of individual spatial units to the global Moran's I statistic have also been utilised (*Ibid*). The results are illustrated using Moran scatter plots that have been generated to demonstrate the spatial distribution of district wage and education levels across Pakistan.

4.1. Measures of Spatial Autocorrelation

(i) *Global Spatial Autocorrelation*

Spatial autocorrelation occurs when the spatial distribution of the variable of interest exhibits a systematic pattern [Cliff and Ord (1981)]. Positive (negative) spatial autocorrelation occurs when a geographical area tends to be surrounded by neighbours with similar (dissimilar) values of the variable of interest. As previously mentioned, this

paper utilises two measures Moran's *I* and Geary's *C* statistics to detect the global spatial autocorrelation present in the data.[7] The Moran's *I* is the most widely used measure for detecting and explaining spatial clustering not only because of its interpretative simplicity but also because it can be decomposed into a local statistic along with providing graphical evidence of the presence of absence of spatial clustering.
It is defined as:

$$I = \frac{n}{S_0} \cdot \frac{\sum_i^n \sum_j^n w_{i,j}\,(y_i - \bar{y})(y_j - \bar{y})}{\sum_i^n (y_i - \bar{y})^2} \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (1)$$

Where y_i is the observation of variable in location i , $\bar{y}$ is the mean of the observations across all locations, n is the total number of geographical units or locations, $w_{i,j}$ is one of the elements of the weights matrix and it indicates the spatial relationship between location i and location j.

S_0 is a scaling factor which is equal to the sum of all the elements of the W matrix:

$$S_0 = \sum_i^n \sum_j^n w_{i,j} \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (2)$$

S_0 is equal to n for row standardised weights matrices (which is the preferred way to implement the Moran's *I* statistic), since each row then adds up to 1. The first term in Equation (1) then becomes equal to 1 and the Moran's *I* simplifies to a ratio of spatial cross products to variance.

Under the null hypothesis of no spatial autocorrelation, the theoretical mean of Moran's *I* is given by:

$$E\,(I) = -1/\,(n-1) \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (3)$$

The expected value is thus negative and will tend to zero as the sample size increases as it is only a function of n (the sample size). Moran's *I* ranges from –1 (perfect spatial dispersion) to +1 (perfect spatial correlation) while a 0 value indicates a random spatial pattern. If the Moran's *I* is larger than its expected value, then the distribution of *y* will display positive spatial autocorrelation i.e. the value of *y* at each location *i* tends to be similar to values of *y* at spatially contiguous locations. However, if *I* is smaller than its expected value, then the distribution of *y* will be characterised by negative spatial autocorrelation, implying that the value of *y* at each location *i* tends to be different from the value of y at spatially contiguous locations. Inference is based on z-values computed as:

$$z_I = \frac{I - E(I)}{sd(I)} \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (4)$$

i.e. the expected value of *I* is subtracted from *I* and divided by its standard deviation. The theoretical variance of Moran's *I* depends on the assumptions made about the data and the nature of spatial autocorrelation. This paper presents the results under the randomisation assumption i.e. each value observed could have equally occurred at all locations.[8] Under this assumption z_I asymptotically follows a normal distribution, so that its significance can be evaluated using a standard normal table [Anselin (1992a)]. A

[7]Another well-known measure of spatial autocorrelation is Getis and Ord's *G* statistic [see Anselin (1995a), p. 22–23].

[8]The other two assumptions include the assumption of normal distribution of the variables in question (normality assumption) or a randomisation approach using a reference distribution for I that is generated empirically (permutation assumption). For details and formulas of the randomisation assumption, [see Sokal, *et al*. 1998)].

positive (negative) and significant z- value for Moran's *I* accompanied by a low (high) *p*-value indicates positive (negative) spatial autocorrelation.[9]

The second measure of spatial autocorrelation that has been utilised is the Geary's C which is defined as:

$$C = \frac{(N-1)\sum_i \sum_j w_{i,j}(X_i - X_j)^2}{2W\sum_i (X_i - \bar{X})^2} \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (5)$$

where *N* is the number of spatial units (districts in our case); *X* is the variable of interest; $w_{i,j}$ represents the spatial weights matrix, where W is the sum of all $w_{i,j}$. The value of Geary's C lies between 0 and 2. Under the null hypothesis of no global spatial autocorrelation, the expected value of C is equal to 1. If C is larger (smaller) than 1, it indicates positive (negative) spatial autocorrelation. Geary's C is more sensitive to local spatial autocorrelation than Moran's I. Inference is based on z-values, computed by subtracting 1 from C and dividing the result by the standard deviation of C:

$$z_c = \frac{c-1}{sd(c)} \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (6)$$

The standard deviation of *C* is computed under the assumption of total randomness, implying that z_c is asymptotically distributed as a standard normal variate [Anselin (1992a); Pissati (2001)].

Finally, the results of the Moran's *I* and Geary's *C* are dependent on the specification of the weights matrix. Although interpretations change depending on whether the matrix was based on the use of physical distance or economic distance, a "pattern of decreasing spatial autocorrelation with increasing orders of contiguity (distance decay) is commonly witnessed in most spatial autoregressive processes regardless of the matrix specification" [van Oort (2004), p. 109].

(ii) *Local Spatial Autocorrelation*

Since the Moran's *I* and Geary's *C* are global statistics based on simultaneous measurements from many locations, they only provide broad spatial association measurements, ignore the location specific details, and do not identify which local spatial clusters (or *hot spots*) contribute the most to the global statistic. As a remedy, local statistics commonly referred to as 'Local Indicators of Spatial Association (LISA)'are used along with graphic visualisation techniques of the spatial clustering such as a Moran's Scatterplot [Fotheringham, *et al*. (2000); Haining (2003)].

The Moran scatterplot is derived from the global Moran *I* statistic. Recall that the Moran's *I* formula when we use a row standardised matrix can be written as:

$$I = \frac{\sum_i^n (y_i - \bar{y})\,(\sum_i^n w_{i,j}\,(y_j - \overline{y}))}{\sum_i^n (y_i - \bar{y})^2} \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (7)$$

This is similar to the formula for a coefficient of the linear regression *b*, with the exception of $(\sum_i^n w_{i,j}\ (y_j - \overline{y}))$, which is the so-called spatial lag of the location *i*.

Therefore *I* is formally equivalent to the regression coefficient in a regression of a location's spatial lag (*Wz*) on the location itself. This interpretation is used by the

[9]Negative spatial autocorrelation reflects lack of clustering, more than even the case of a random pattern. The checkerboard pattern is an example of perfect negative spatial autocorrelation.

Moran's scatterplot, enabling us to visualise the Moran's *I* in a scatterplot of *Wz* versus *z*, where $z = y_i - \bar{y})/(y_i)$. Moran's *I* is then the slope of the regression line contained in the scatterplot. A lack of fit in this scatterplot indicates local spatial associations (local pockets/non-stationarity). This scatterplot is centred on 0 and is divided in four quadrants that represent different types of spatial associations.

5. EMPIRICAL RESULTS

5.1. Spatial Autocorrelation Estimates for District-wise Earnings Income Inequality Levels

Our first empirical estimation involves calculating measures of spatial dependence for district income inequality (measured as Gini coefficient of average district earnings income) in the year 2004-05. Table 1 provides the results of Moran's *I* statistic and Geary's *C* statistic for district income inequality levels using the two weight matrices. In both the cases, the null hypothesis of no spatial dependence of income inequality between districts is rejected at the significance level of 1 percent as the measures demonstrate a weakly positive spatial autocorrelation amongst district inequality levels (0.21 under BC matrix specification and 0.25 under ID matrix specification). The results for Geary's C statistic have been reported in Table A2a in the Appendix. This implies that income inequality in one district is not strongly spatially associated with income inequality in its neighbouring districts in the case of Pakistan.

Table 1

Global Autocorrelation Results for Income Inequality—Moran's I (2005)

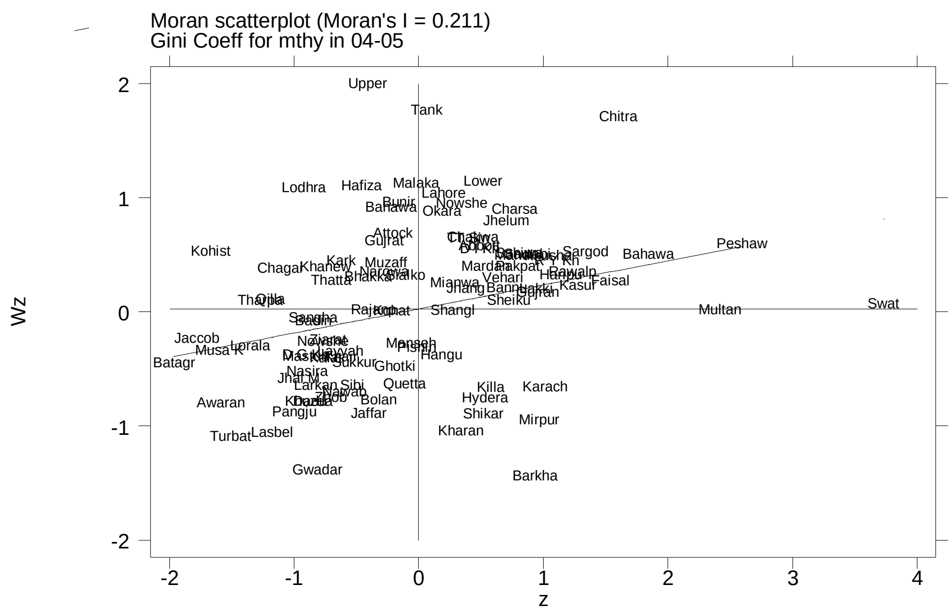
Weight Matrix	I	II
i $\neq j$	$w_{i,j} = 0 \; or \; 1$	$w_{i,j} = \frac{1}{d_{i,j}}$
$i = j$	$w_{\,i,i} = 0$	
Moran's *I*	0.211	0.257
E(I)	–0.010	–0.010
Sd(I)	0.074	0.103
Z	2.985	2.601
p-value	0.003	0.009

5.2. Local Spatial Association between District-wise Income Inequality Levels

The Moran scatterplot provides a more disaggregated view of the nature of the global autocorrelation. It not only provides us information on the presence of clusters in the data but also on the outliers contained in it (see Figure 1). This scatterplot is divided into four quadrants, each of which represents a different type of spatial association. The upper right quadrant (High-High zone) represents spatial clustering of a district with a high level of the variable under study (income inequality in our case) around neighbours that also have high values of income inequality as demonstrated by the high values of both, the *Z*-score and the *Wz* (the spatial lag). The upper left quadrant (Low *z* – High *Wz* zone) represents spatial clustering of a district with a low level of income inequality with neighbouring districts that have a high income inequality levels. The lower left quadrant (Low *z* – Low *Wz* zone) represents spatial clustering of a district with a low income level around neighbours that also have low incomes. The lower right quadrant (High *z* – Low *Wz* zone) represents spatial clustering of a high income inequality district with neighbours that have low income inequality levels.

Figure 1 illustrates the results obtained in Col I of Table 1 via a Moran scatterplot for Gini coefficient of district per capita incomes using the binary contiguity weights matrix. It shows a positive global Moran's I (z-score = 2.98), which is represented by the slope of the black line. Due to the weakly positive spatial autocorrelation, we are unable to detect any substantial clusters of high (or low) inequality districts in particular for the year 2005. Similarly, Figure A8 (see Appendix) also shows a Moran scatterplot for Gini coefficient of district per capita incomes, however it has utilised an inverse distance weights matrix instead. The overall spatial autocorrelation is although statistically significant, it still remains weak.

Fig. 1. Spatial Autocorrelation of District Income Inequality using the BC matrix



demonstrated that regions located in an economic periphery experience lower returns to skill attainment and hence have reduced incentives for human capital investments and agglomerations. However spatial externalities do not spread without limits [Darlauf and Quah (1999)] as a result of which closely related economies or regions tend to have similar kinds of human capital externalities and technology levels as compared to the more distant ones [see Quah (1996); Mion (2004)]. This section investigates the spatial disparities in education levels across Pakistan, the extent to which neighbouring districts share similar levels of education, and examines whether district human development level inequalities are spatially associated.

In order to do so, this paper uses the average district wise education attainment level (which is measured as the average number of schooling years completed in a district) as a proxy for human capital. It is expected that neighbours of districts with high education attainment should also have high educational awareness and hence similar if not equal attainment levels. Again the Moran's *I* global and local indices along with a Moran scatterplot and Geary's C statistic have been utilised.

Our results indicate that there exists a greater possibility of knowledge spillovers between districts that share a border, as compared to when they do not (see Table 2). The global Moran's I for average district education level (measured as the average education attainment of a district's citizens) is positive and statistically significant when neighbourhood is defined in terms of contiguity, however it is negative and statistically insignificant when neighbourhood is defined in terms of proximity. These results imply that for a Pakistani district, sharing a border with a district whose individuals have a high (low) education level, '*may'* result in rising (lowering) its own education levels.

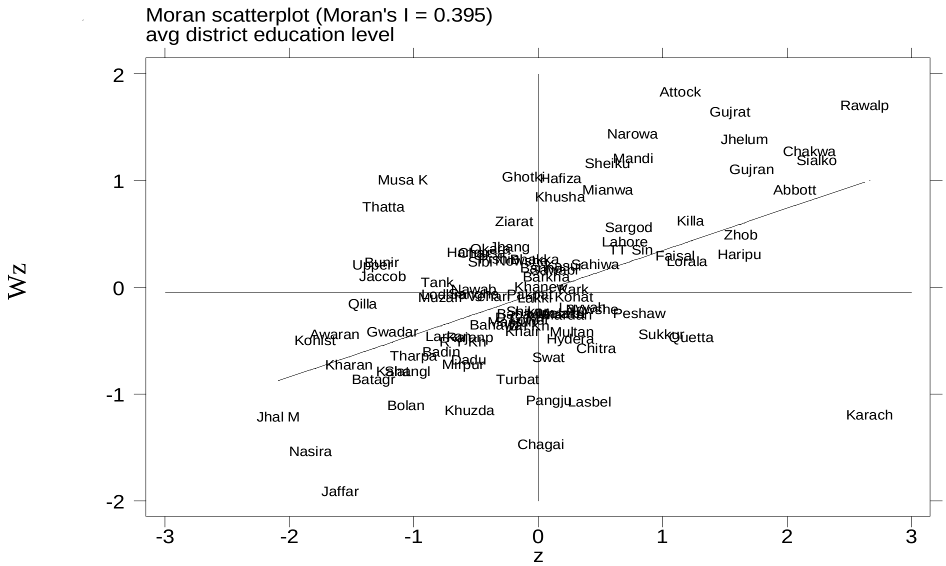
The positive pattern for spatial autocorrelation for average district education levels demonstrated by the BC matrix shows more clusters with low education levels (in the case of Balochistan) and high education levels (in the case of Punjab) as compared to outliers. Districts in northern Punjab emerge in the High-High quadrant and confirm our assumption about high human capital districts being located close to each other (Figures 2 and A5). Similar empirical findings have also been put forward in a recent study on agglomeration patterns of industries across Pakistani districts in a study by Burki and Khan (2010).

Table 2

Global Autocorrelation Results for Education Attainment—Moran's I (2005)

Weight Matrix	I	II
$i \neq j$	$w_{i,j} = 0 \text{ or } 1$	$w_{i,j} = \frac{1}{d_{i,j}}$
$i = j$	$w_{i,i} = 0$	
Moran's *I*	0.395	–0.003
E(I)	–0.010	–0.01
Sd(I)	0.075	0.103
Z	5.440	0.072
p-value	0.000	0.943

Fig. 2. Spatial Autocorrelation of District Education Levels Using the BC Matrix



The neighbouring districts of Karachi and Thatta emerge as the most significant outliers when we analyse the local Moran's I values using the BC and the ID matrices. While Karachi falls into the High-Low zone, Thatta falls in the Low-High zone. However, the fact that being a neighbour with Karachi (a district with one of the highest average education levels in Pakistan) does not translate in Thatta having improved human capital characteristics is not very surprising. Regional science and regional economics literature has demonstrated that the economic influence and knowledge spillover effects of coastal cities (such as Karachi) are quite different from the pattern of spillovers generated by landlocked regions [Glaeser, *et al.* (1992); Henderson (2003)]. The overall spatial pattern of autocorrelation is quite diffused when we use the ID matrix for analysis (see Figure A5). However under both the neighbourhood structures Rawalpindi, Abbottabad, Chakwal and Jhelum emerge as a statistically significant cluster of districts with high average education attainment levels.

5.4. The Dynamics of Spatial Association between District-wise Earnings Income Inequality and Education Levels

This section analyses the temporal change in the spatial distribution of district wise real per capita GDP growth rate, district wise per capita incomes, and district human development levels between 1998 and 2005. It also examines the spatial association between district wise primary, secondary, and bachelors education levels in 1998.

Figures A3a, A3b, A3c, and A3d in the Appendix each demonstrates a Moran scatterplot which provides a disaggregated picture of the nature of spatial autocorrelation for district per capita income in 1998 and 2005, using the BC and ID matrix respectively. The spatial lag (*Wz*) in this situation is a weighted average of the incomes of a district's neighbouring districts. The scatter plots in both the years (using both the matrices) demonstrate that the overall pattern of spatial dependence between district income levels has remained positive and statistically significant. However, the overall value of the global Moran's I statistic has reduced from being 0.81 to 0.38 between 1998 and 2005 when the results are reported using the BC matrix. Similarly, the value of global Moran's I statistic has reduced from being 0.91 to 0.51 between 1998 and 2005 under the results produced using the ID matrix.

Furthermore a spatial analysis of the growth rate between 1998 and 2005, also indicates a positive and a statistically significant spatial autocorrelation pattern when neighbourhood is defined in terms of contiguity but a statistically insignificant pattern when neighbourhood is defined in terms of proximity as measured by the ID matrix (see Table 3). This implies that districts with a high (low) real GDP growth rate may be spatially associated with their contiguous neighbouring districts which also have high (low) real GDP growth rates.

Table 3

Spatial Autocorrelation of per capita GDP Growth Rate between 1998—2005

	GDP Growth Rate (1998-2005)	
	BC Matrix	ID Matrix
Moran's I	0.430	0.140
E(I)	–0.010	–0.010
Sd(I)	0.071	0.099
Z	6.204	1.524
P-value	0.000	0.128

Source: Author's own calculations.

Moreover, since our macro-data from 1998 provides district wise statistics on individual education attainment levels (measured as the percentage of individuals having completed an education level), it has allowed us to analyse whether education levels in neighbouring districts are spatially associated or how the distance from large neighbouring cities (or provincial capitals) affects the incentives to obtain education in a district. Table 4 demonstrates that whether neighbourhood is measured in terms of geographic proximity (using ID matrix) or in terms of geographic contiguity (using BC matrix), there exists a positive and highly significant spatial autocorrelation for levels of education below high-school (i.e. primary, matric i.e., grade 10, and inter i.e., grade 12). However, for higher levels (Bachelors and above), geographic contiguity to a district with a high percentage of graduates could be more influential than the distance from the provincial capital or the nearest large city.

Finally, although spatial association between district development levels (as measured by the Human Development Index (HDI) calculated by the UNDP in NHDR, 2003) has reduced between 1998 and 2005 from 0.40 to 0.311, it still remains positive and significant (see Table 5). These results for Pakistani districts again confirm the findings of the new economic geography literature that a region's development levels, depend on the development levels prevailing in its neighbouring regions.

Table 4

Spatial Autocorrelation for Education Levels (1998)

Primary Education			Matric			Higher Education—Bachelors		
	BC	ID		BC	ID		BC	ID
Moran's I	0.494	0.559	Moran's I	0.391	0.247	Moran's I	0.327	-0.014
E(I)	–0.010	–0.010	E(I)	–0.010	-0.010	E(I)	–0.010	-0.010
Sd(I)	0.075	0.103	Sd(I)	0.074	0.102	Sd(I)	0.074	0.102
Z	6.745	5.501	Z	5.443	2.523	Z	4.582	-0.038
P-value	0.000	0.000	P-value	0.000	0.012	P-value	0.000	0.969
Geary's C	0.497	0.983	Geary's C	0.610	0.703	Geary's C	0.610	1.643
E(c)	1.000	1.000	E(c)	1.000	1.000	E(c)	1.000	1.000
Sd(c)	0.079	0.244	Sd(c)	0.085	0.379	Sd(c)	0.086	0.392
Z	–6.401	–0.069	Z	–4.573	–0.783	Z	–4.538	4.193
P-value	0.000	0.945	P-value	0.000	0.434	P-value	0.000	0.000

Source: Authors own calculations. BC: Binary Contiguity Matrix, ID: Inverse Distance Matrix.

Table 5

HDI Spatial Autocorrelation Using the Binary Contiguity Matrix

	District Human Development Index (HDI)	
	1998	2005
Moran's I	0.405	0.311
Standard Deviation (I)	0.075	0.074
Z-value	5.573	4.341
P-value	0.000	0.000

Source: Author's calculations using data from NHDR (2003).

6. CONCLUSIONS

This paper has performed an exploratory analysis of socio-economic disparities across Pakistan for the first time and has provided useful insights for the conduct of economic regional policy in Pakistan. It has investigated the spatial distribution of income inequality, income, education, growth and development levels for 98 districts between 1998 and 2005. The overall finding that emerges from this article is that the distribution of district wise income inequality, income, education attainment, growth, and development levels, exhibits a significant tendency to cluster in space (i.e. the presence of spatial autocorrelation is confirmed), thereby highlighting the importance of understanding economic geography in the context of Pakistan.

Specifically the following main findings emerge from this article. First, the province of Punjab contains the largest cluster of high per capita income districts in both 1998 and 2005. Second, district wise income inequality levels demonstrate weak spatial association. Moreover district education levels reveal high spatial association, and districts with a high (low) real GDP growth rate have been spatially associated with contiguous neighbouring districts which also have high (low) real GDP growth rates between 1998 and 2005. Third, there exists positive spatial dependence for education levels below bachelors (i.e., primary, matric i.e., grade 10, and inter i.e., grade 12). However, for higher levels (Bachelors and above), geographic contiguity to a district with a high percentage of graduates, is more influential than the distance from the provincial capital or the nearest large city. This result is corroborated by the findings from Burki and Khan (2010) which confirms that districts located away from urban centres are also the ones with lowest education levels in Pakistan. Our empirical analysis also reveals that except for Lahore, none of the other 3 provincial capitals of Pakistan (Karachi, Peshawar, Quetta) have high knowledge spillovers. While this finding is not surprising for Karachi, since coastal cities have different spillover mechanisms as compared to landlocked cities, it indicates that infrastructure and cluster development can facilitate increased knowledge spillovers at least from the centres of economic activity in Pakistan if not from all large city districts. Finally, spatial association of district wise Human Development Indicators confirms that a district's development levels may depend on the development levels prevailing in its neighbouring districts in Pakistan.

The methodological implication of the above mentioned results is that studies which utilise Ordinary Least Squares to investigate intra- Pakistan socio-economic issues could possibly be producing inaccurate statistical inferences. By assuming spatial-independence, they may produce estimates that are biased and overestimated, since our results show that observations for socio-economic district characteristics do tend to cluster in Pakistan. The main policy implication that emerges from our results is that growth and development policies need to focus on infrastructure and cluster development that can cater to large segments of the population. This is particularly because the spatial pattern of income inequality, district incomes, education levels, and development levels shows how development in Pakistan is concentrated in Punjab (in particular Northern Punjab especially in terms of human development indicators).

The presence of possible spatial spillovers as demonstrated in this paper also implies that cluster development can play an extremely important role in generating knowledge externalities, domestic commerce, and employment creation by bringing work and knowledge to people instead of them travelling to it. Pakistan already has many pseudo-clusters that have developed over time. Examples include the IT cluster 'Karachi', textile and leather cluster 'Faisalabad', automotive manufacturing cluster 'Port Qasim', furniture cluster 'Gujranwala', light engineering cluster 'Gujrat', sports and surgical cluster 'Sialkot', heavy industries cluster 'Wah' and even light weapons manufacturing cluster 'Landikotal'. An emphasis on regional and industrial regeneration policies can play a crucial role in reducing spatial disparities and enhancing the regional advantages of these districts [Pakistan (2011)]. Finally, this paper has highlighted the importance of additional research on Pakistan that takes into account spatial effects. Since it has only considered spatial changes in socio-economic phenomena in 8 years between 1998 and 2005, an immediate possibility could be to extend this spatio-temporal analysis may include extending it over a longer period of time. Another possibility may involve a spatial econometric analysis of the effect of a district's inequality, income and education levels on its growth. While the presence of spatial clustering of income and education in Pakistan (as demonstrated in this paper) could support the use of a spatial lag model to capture the spillover of inequality between districts, missing data on district incomes or omitted variables could also necessitate the use of a spatial error model (which reflects spatial autocorrelation in measurement errors) in analysing the effect of inequality on district income levels.

APPENDIX

Table A1

List of Districts

	PUNJAB		**SINDH**	67	Chitral
				68	Malakand Agency
1	Rawalpindi	35	Hyderabad	69	Shangla
2	Jhelum	36	Dadu	70	Bannu
3	Chakwal	37	Badin	71	Lakki Marwat
4	Attock	38	Thatta	72	D. I. Khan
5	Gujranwala	39	Mirpur Khas	73	Tank
6	Mandi Bahauddin	40	Sanghar	74	Bunir
7	Hafizabad	41	Tharparkar		
8	Gujrat	42	Sukkur		**BALOCHISTAN**
9	Sialkot	43	Ghotki	75	Quetta
10	Narowal	44	Khair pur	76	Sibi
11	Lahore	45	Nawab shah	77	Nasirabad
12	Kasur	46	Larkana	78	Kalat
13	Sheikuhupura	47	Jaccobabad	79	Pishin
14	Okara	48	Shikarpur	80	Qilla Abd
15	Faisalabad	49	Nowshero Feroz	81	Bolan
16	Jhang	50	Karachi	82	Pangjur
17	TT Singh			83	Barkhan
18	Sargodha		**KPK**	84	Chagai
19	Khushab	51	Peshawar	85	Jaffarabad
20	Mianwali	52	Charsadda	86	Jhal Magsi
21	Bhakkar	53	Nowshera	87	Mastung
22	Multan	54	Kohat	88	Awaran
23	Khanewal	55	Kark	89	Gwadar
24	Lodhran	56	Hangu	90	Turbat
25	Vehari	57	Mardan	91	Kharan
26	Sahiwal	58	Sawabi	92	Ziarat
27	Pakpattan	59	Abbottabad	93	Khuzdar
28	Bahawalpur	60	Haripur	94	Killa Saif
29	Bahawalnagar	61	Mansehara	95	Lasbella
30	R. Y. Khan	62	Batagram	96	Loralai
31	D. G. Khan	63	Kohistan	97	Musa Khel
32	Muzaffar grah	64	Swat	98	Zhob
33	Layyah	65	Lower Dir		
34	Rajanpur	66	Upper Dir		

Table A2a

Global Autocorrelation Results for Earnings Income Inequality—Geary's C (2005)

Weight Matrix	I	II
$i \neq j$	$w_{i,j} = 0 \ or \ 1$	$w_{i,j} = \dfrac{1}{d_{i,j}}$
$i = j$	$\boldsymbol{w_{i,i} = 0}$	
Geary's C	0.824	1.458
E(C)	1.000	1.000
Sd(C)	0.082	0.324
Z	–2.138	1.413
p-value	0.033	0.158

Source: Author's Calculations.

Table A2b

Global Autocorrelation Results for District Per Capita Earnings Income— BC Matrix

Weight Matrix	1998	2005
$i \neq j$	$w_{i,j} = 0 \ or \ 1$	$w_{i,j} = 0 \ or \ 1$
$i = j$	$w_{i,i} = 0$	
Moran's *I*	0.818	0.380
E(I)	–0.010	–0.010
Sd(I)	0.103	0.101
Z	8.048	3.856
p-value	0.000	0.000

Source: Author's Calculations.

Fig. A3a. Moran Scatterplot Real Per Capita Earnings District Income, 1998 (BC Matrix)

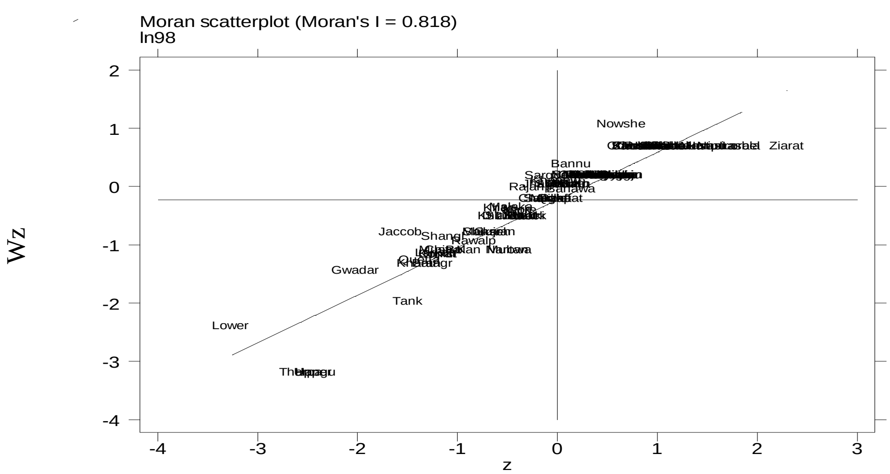


Fig. A3b. Moran Scatterplot for Real Per Capita District Earnings Income, 2005 (BC Matrix)

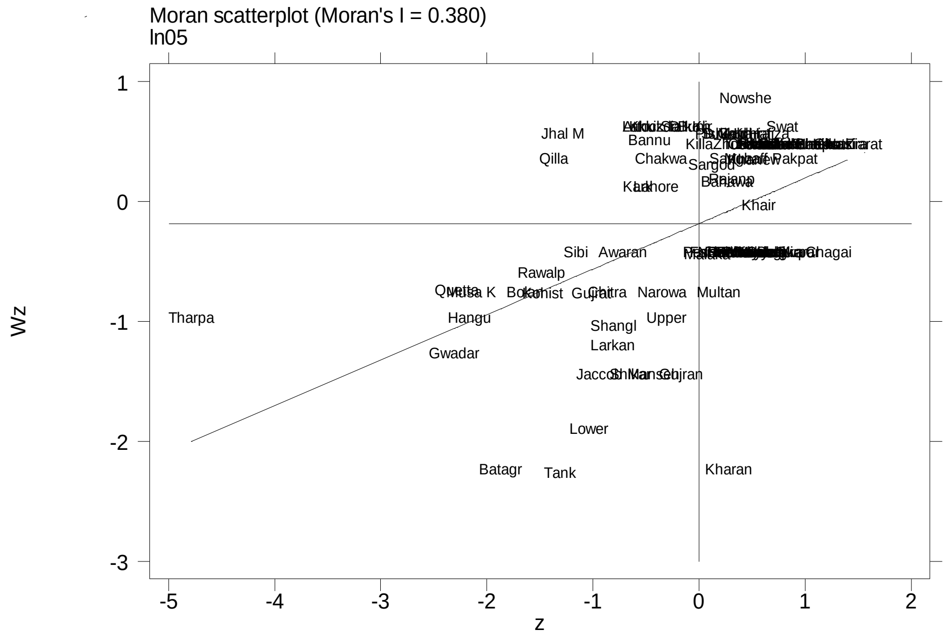


Fig. A3c. Moran Scatterplot District Real Per Capita Earnings Income, 2005 (ID matrix)

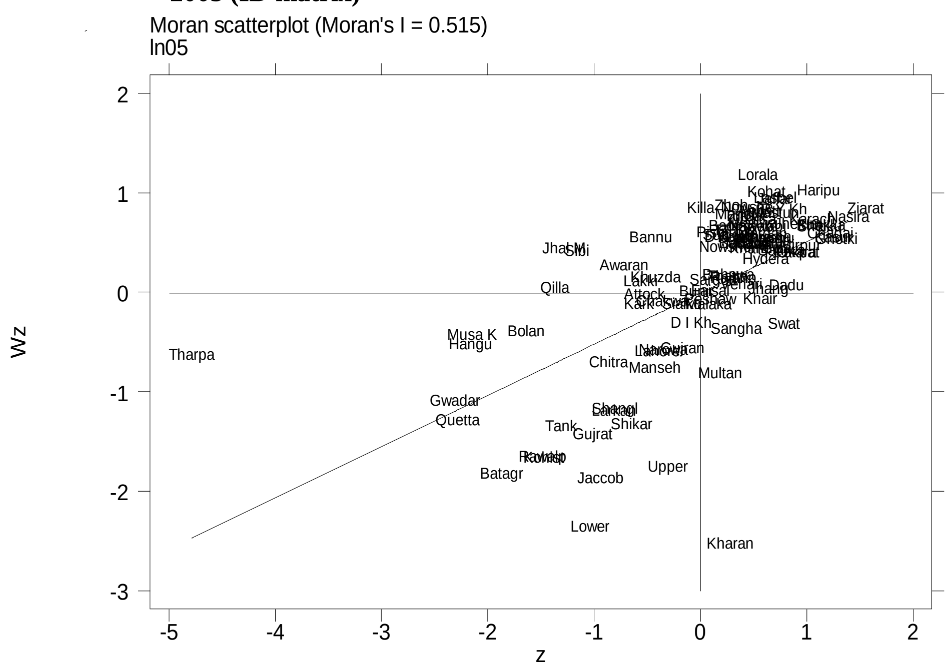


Fig. A3d. Moran Scatterplot District Real Per Capita Earnings Income, 1993 (ID Matrix)

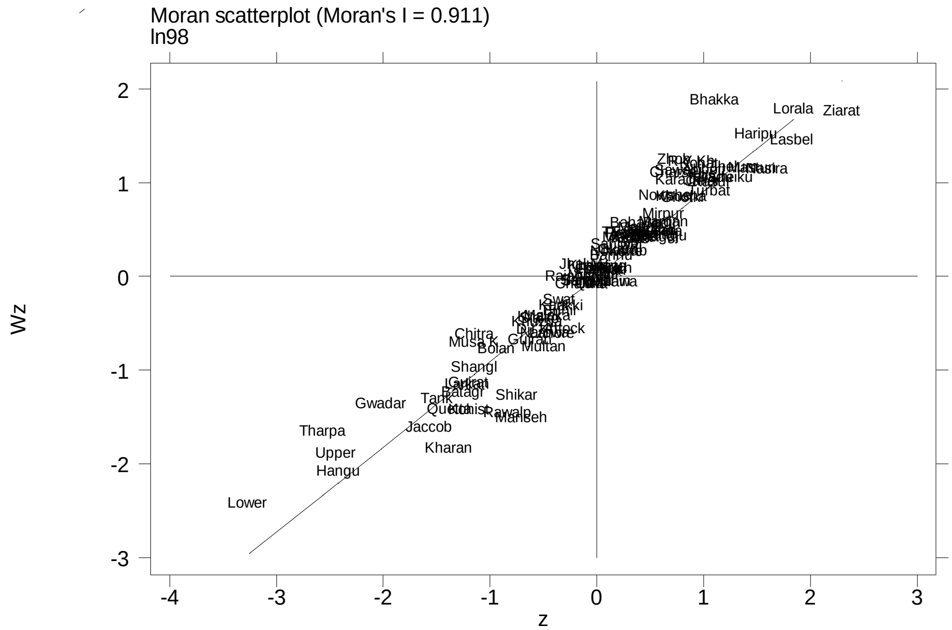


Fig. A4. Moran Scatterplot for Average District Education Level Using the ID Matrix

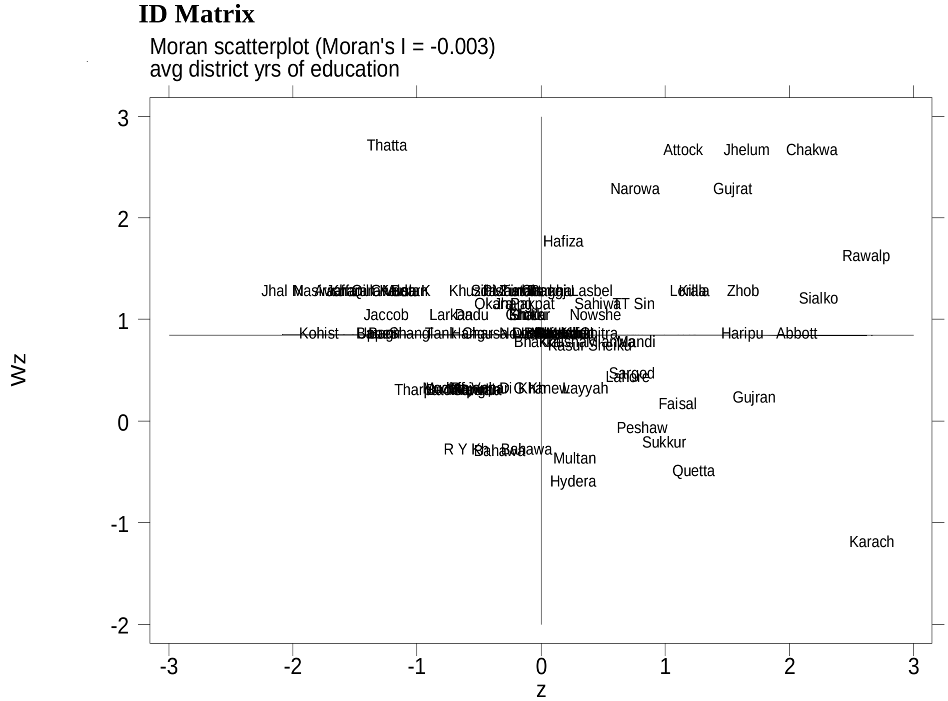


Table A5

Global Autocorrelation Results for Education Attainment—Geary's C (2005)

Weight Matrix	I	II
$i \neq j$	$w_{i,j} = 0 \; or \; 1$	$w_{i,j} = \frac{1}{d_{i,j}}$
$i = j$	$w_{i,i} = 0$	
Geary's *C*	0.584	1.092
E(*C*)	1.000	1.000
Sd(*C*)	0.080	0.275
Z	–5.230	0.336
p-value	0.000	0.737

Source: Author's Calculations.

Fig. 6a. Moran's Scatterplot for Primary Education Using the BC Matrix

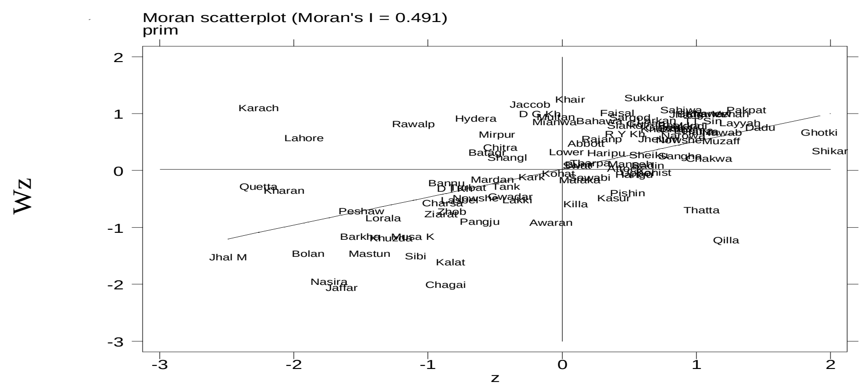


Fig. 6b. Moran's Scatterplot for Primary Education Using the ID Matrix

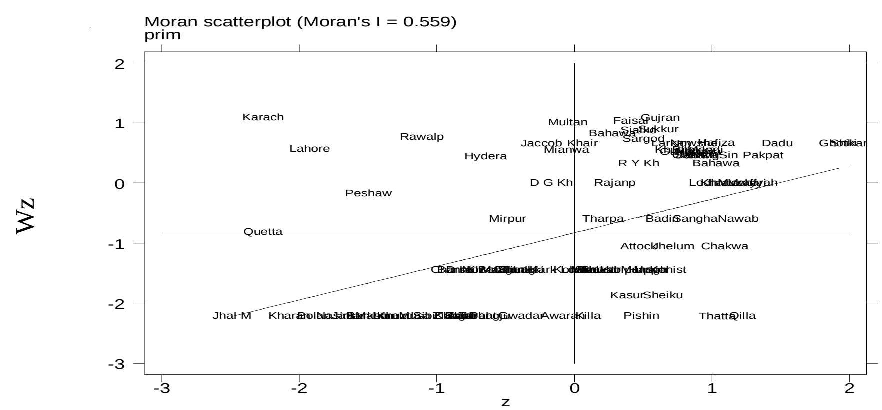


Fig. A7a. Moran's Scatterplot for Higher Education in 1998 Using the BC Matrix

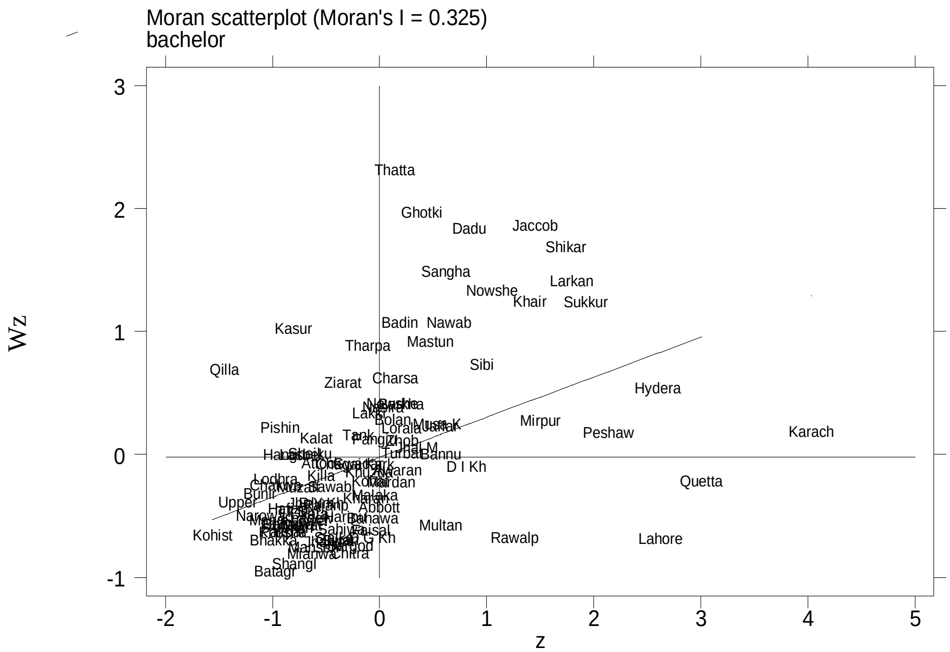


Fig. A7b. Moran's Scatterplot for Higher Education in 1998 Using the ID Matrix

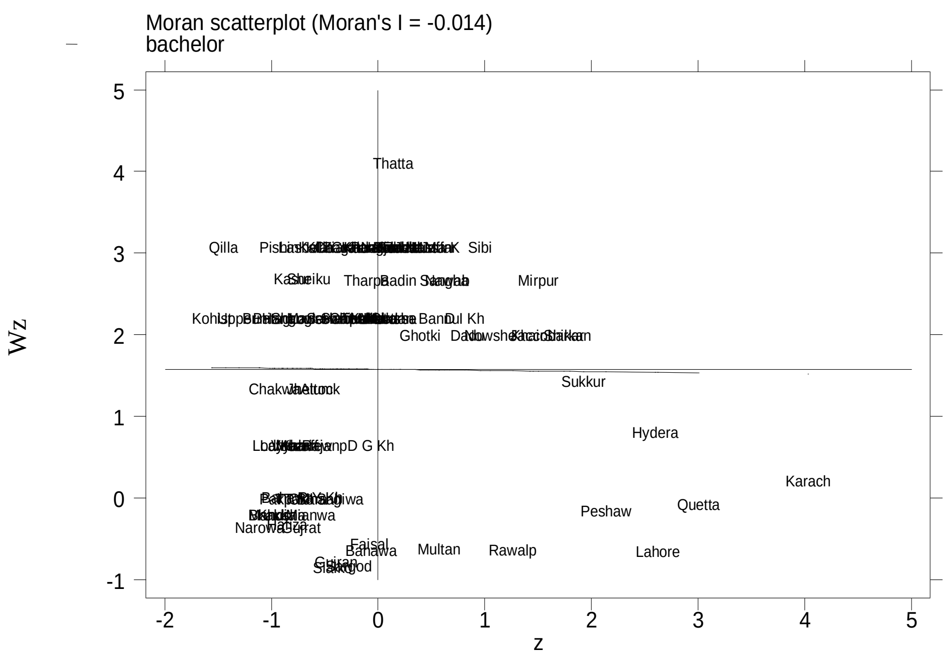
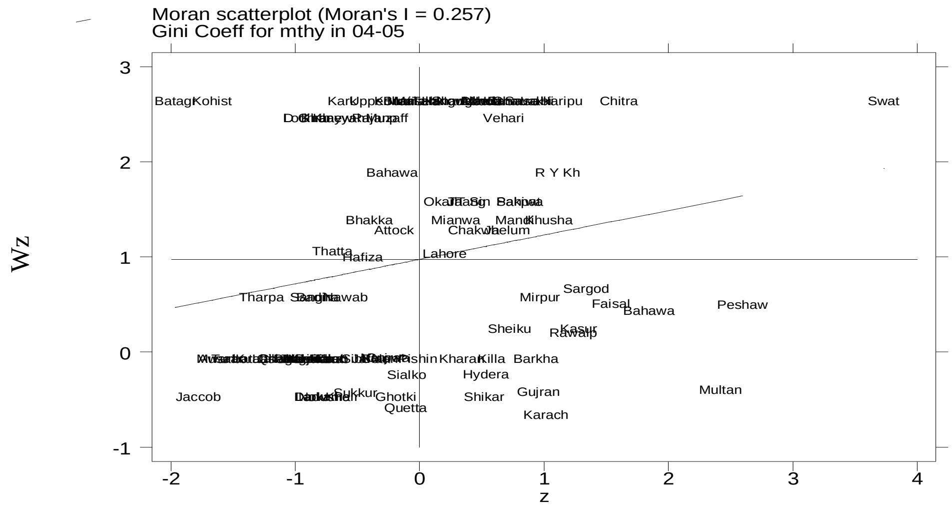


Fig. A8: Spatial Autocorrelation of District-wise Earnings Income Inequality Using the ID Matrix



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