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Remittances, Economic Growth and Poverty: A Case of African OIC Member Countries

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This paper investigates the impact of remittance inflows on economic growth and poverty reduction for seven African countries using annual data from 1992-2010. By using the depth of hunger as a proxy for poverty in a Simultaneous Equation Model (SEM), we find that remittances have statistically significant growth enhancing and poverty reducing impact. Drawing on our estimates, we conclude that financial development level significantly increases the remittances inflows and strengthens poverty alleviating impact of remittances. Results of our study further show a signficant interactive imapct of remittances and finacial develpment on economic growth, suggesting the substitutability between remittance inflows and financial development. We further find that 3 percentage point increase in credit provision to the private sector (financial development) can help eliminate the severe depth of hunger in the region. Remittances, serving an alternative source of private credit, can be effective in this regard.

Keywords: Remittance Inflow, Poverty Alleviation, Financial Development, Simultaneous Equation Model

1. INTRODUCTION

Remittances are one of the major international capital flows for underdeveloped countries. The remittance inflows primarily help poor families to mitigate the adverse effects of income shock [Yang and Choi (2007)]. [1] Direct income transfer also improves the economic status of the recipient family through a higher marginal propensity to save [Siddiqui and Kemal (2006); Adams (2002); Adams and Page (2005)]. Furthermore, the impact of remittance inflow is not limited to economic growth but also includes accumulation of physical and human capital, labour force participation and total factor productivity growth [Barajas, *et al*. (2009)]. Remittance inflows help in building the infrastructure and accumulation of human capital while at the same time reduce production process risk [Taylor (1999)], and increase access to better health care services and education [Orozco (2000)].

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[1]The direct and indirect effects of remittances including reduced output volatility, spurring development of financial sector, appreciation of real effective exchange rate (Dutch Disease), accumulation of human capital (increased spending on education and health), increased investment ratio to GDP for the recipient countries are well documented. See Barajas, *et al*, (2009); Acosta, *et al.* (2009); Bussolo (2007); Acosta and Mandelma (2007); Amuedo-Dorantes and Pozo (2004), named few.

In a broader perspective, remittance inflows through formal banking channels not only promote the financial sector development [Aggarwal, *et al.* (2011); Ruiz-Arranz, *et al.* (2005)] but also improve the foreign exchange reserves of the recipient country. Higher remittance inflows may enhance the development of domestic financial sector wherein a large number of beneficiaries/depositors may persuade the government to reform for better access to the banking and financial system.[2] Remittance inflows, in this context, are considered as a vital and stable source of funding for economic development.

On the contrary, higher remittance inflows may cause exchange rate appreciation that may adversely affect exports and thus hamper the economic growth of the recipient countries [Lartey, *et al.* (2012); Acosta, *et al.* (2009, 2008, 2007a)]. Remittance inflow may also increase households' dependence on remittances that may result in lower labour force participation[3] [Barajas, *et al.* (2008)].

In a pure economic setup, the level of foreign remittances depends on the migration rate of the home country and the economic growth rate of both the home and the host country. Countries with lower economic growth rate experience higher migration rate that may result in higher remittance inflows to the home country. However, a higher economic growth perspective in the home country as compared with the host country may also serve as motivation to remit higher amounts to the home country. This suggests that remittance inflows not only affect the economic growth (poverty reduction), but also the level of inflows can be affected by the level of economic growth, generating a bi-causal relationship. This study uses a simultaneous equation framework wherein the impact of remittances on economic growth and poverty alleviation are modelled simultaneously. The empirical estimations thus obtained are more efficient and reliable as compared to the studies, modelling the impact in a single equation framework.

We analyse the remittances-growth-poverty nexus for seven member countries of the Organisation of Islamic Cooperation (OIC) from Africa,[4] where about 50 to 80 percent of the population lives below the poverty line. One of the main reasons for the selection of OIC member countries is the structural differences among OIC member (Muslim) and non-member (non-Muslim) countries. These differences may exist due to following a social and cultural system based on religious values. For example, a Muslim may self-exclude the conventional financial system due to strict prohibition of interest in the religion of Islam.

African OIC member countries, as a group, have the lowest human capital index of 1.61 as compared to 1.92 for non-OIC member African countries[5] (see Appendix C for comparison). The difference can be attributed to the social attitude towards democracy and political set up, as well as the education system. For example gender parity in adult literacy rate in OIC member countries is 67.359 as compared to non-member countries where it is 86.289 [Malik and Qiong (2014)]. Furthermore, the Islamic social welfare system of *Zakat*[6] may also have a serious bearing on the nature and design of poverty

[2]Refer to Karikari, *et al.* (2016) for details.

[3]Known as moral hazard problem.

[4]These countries includes Egypt, Mali, Morocco, Senegal, Sierra Leone, Sudan and Tunisia.

[5]Calculations are made using data from Penn World Table 8.0 (2013) for the African region. These average are for the period 1992-2010.

[6]Islamic tithe.

reduction programmes. In this background and context, this study provides new evidence on the following questions:

- What is the impact of increasing remittances inflows on economic growth of the selected countries?
- To what extent do remittance inflows help reduce poverty in OIC member countries of the African region?
- What is the role of financial sector development in the growth enhancing and poverty-reducing impact of remittances on the region?

The findings from the study suggest that remittance inflows enhance economic growth and reduce poverty in the selected countries. Most importantly the level of financial development determines growth enhancing and the poverty-reducing impact of remittances. The rest of the paper is structured as follows: the next section reviews the relevant literature followed by the development of an analytical framework in Section 3. Section 4 discusses the estimation methodology and describes data in detail. Empirical results are reported in Section 5. Finally, Section 6 presents conclusions of the study.

2. LITERATURE REVIEW

The strand of literature examining the impact of remittances generally reports a significant positive impact on poverty alleviation. Remittance inflows can alleviate poverty through increased income and higher consumption [Jongwanich (2007)].[7] Furthermore, remittance inflows can facilitate the building of physical and human capital through a higher number of children attending schools[8] [Imai, *et al.* (2014); Javid, *et al.* (2012); Banga and Sahu (2010); Gupta, *et al.* (2009); Adams, *et al.* (2008); Adams and Page (2005)].[9]

The academic literature also depicts mixed results on the remittances-growth nexus. There is significant evidence suggesting a positive impact of remittances on economic growth.[10] Remittance inflows may influence GDP growth positively through increasing consumption expenditures, domestic savings, building human capital [Adams and Page (2008)] and increased investments [Ojapinwa and Odekunle (2013)]. Remittance inflows can also contribute to economic growth positively through improving financial intermediation [Aggarwal, *et al.* (2011); Gupta, *et al.* (2009); Giuliano and Ruiz-Arranz (2009)]. On the contrary, Jahjah, *et al.* (2003) reports a growth dissuading impact of remittances resulting from reduced labor force participation and work efforts. Furthermore, volatility of remittances can also adversely affect the growth [Imai, *et al.* (2014)].

It is also important to note that economic growth may also affect the remittance inflows. Bad economic conditions (low economic growth) in the home country encourage economic migration that may result in higher remittances to recipient families for

[7]See Bracking, and Sachikonye (2006) for an excellent survey .

[8]Kemal (2001), Gyimah-Brempong and Asiedu (2009), Ratha (2013), Enebeli-Uzor, *et al.* (2012), Shroff (2009) and Siddiqui and Kemal (2006) reports the similar findings.

[9]See Anyanwu and Erhijakpor (2010) for detail on macro, miso and micro channels of transmission of the poverty reducing effect of foreign remittances.

[10]See for example, Ratha (2005), Goldberg, *et al.* (2008), Cooray (2012), Fajnzylber and Lopez (2006). Similar results are reported by Shera and Meyer (2013), Fayissa and Nisah (2010), Imai, *et al.* (2014), Javid, *et al.* (2012), Obiechina and Emeka (2013).

altruistic purposes [Ratha (2013)]. Also, a good economic condition in the domestic economy may motivate migrants to invest more in the home country causing the remittance inflows to increase [Lucas and Stark (1985)]. This highlights the bi-causal relationship of the remittance and growth.

The literature examining the growth enhancing impact of remittances for the African countries primarily employs primary data at the household level [Adams (2006); Adams (1991)]. However, analysing the impact of remittance inflows on the economic growth, by using the data at macroeconomic scale is scant except for Fayissa and Nsiah (2010) and Nyamongo, *et al.* (2012). Both of the studies report a significant positive impact of remittances on economic growth in the region. Furthermore, the impact of remittances on poverty is widely studied in the African context.[11] Anyanwu and Erhijakpor (2010), using the data from poverty surveys for 33 African countries report a significant poverty-reducing impact of remittances, and the impact is robust to alternative measures of poverty. A look into the available literature clearly suggests that there is no study investigating the issue for OIC member countries in Africa. This study attempts to fill the void and provide evidence in this regard. We argue that the structural difference in OIC member and non-member countries of the African origin needs a careful examination as these differences may significantly affect the outcomes.

3. THE ANALYTICAL FRAMEWORK

Following Cooray (2012) and Rao and Hassan (2011), we derive growth equation by using the neo-classical production function[12] and further extended by the inclusion of remittance inflows as specified below:

$$Y_{it} = A_{i0}\, e^{\delta t}\, Z_{it}^{\emptyset i}\, K_{it}^{\alpha}\, H_{it}^{\beta} L_{it}^{1-\alpha-\beta}\, e^{\varepsilon_{it}} \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (1)$$

$0<\alpha<1$ and $0<\beta<1$

In Equation 1 above, *i* represent the country while *t* denotes time. Y_{it} is output *(GDP)*, A_{i0} is the given level of technology, and $K_{it,}$ H_{it} and L_{it} denote physical and human capital and the labour force stock respectively in country *i* at time *t*, while Z_{it} is a vector of control variables carrying conventional determinants of growth.[13]

Dividing both sides by stock of labour force (L_{it}), above equation gives

$$y_{it} = A_{i0}\, e^{\delta t}\, Z_{it}^{\emptyset i}\, k_{it}^{\alpha}\, h_{it}^{\beta}\, e^{\varepsilon_{it}} \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (2)$$

Where y_{it} is per capita *GDP*, k_{it} and h_{it} are physical and human capital per worker. This equation allows us to decompose the differences capital intensity and education attainment and return on education across different countries.[14] The above function, using a log linear specification, can be written as:

$$lny_{it} = lnA_{i0} + \delta t + \varphi i ln Z_{it} + \alpha ln k_{it} + \beta ln h_{it} + \varepsilon_{it} \quad \ldots \quad \ldots \quad (3)$$

[11]The available literature primarily deals the case studies [see Adam (1991) for Egypt, Bracking and Sachikonye (2006) for Zimbabwe, Anyanwu (2005) for Nigeria, Bhasin, and Obeng (2005) for Ghana etc.].

[12]For more details on the validity see Jones (1995) and Solow (2000).

[13]This set of conventional determinants is guided by the theory and empirical literature available on the issue.

[14]This may also explain the differences in productivity across the sample countries through contributing to output per worker.

Incorporating the variable included in Z_{it}, above equation can be written as:

$$lny_{it} = \alpha_0 + \alpha_1 lny_{it-1} + \alpha_2 PC_{it} + \alpha_3 REM_{it} + \alpha_4 HC_{it} + \alpha_5 FD_{it} + \alpha_6 GEXP_{it} + \alpha_7 OP_{it} + \alpha_8 FDI_{it} + \alpha_9 DI_{it} + \alpha_{10} RFD_{it} + \varepsilon_{it} \quad \ldots \quad \ldots \quad (4)$$

Where *lny* is the log per capita GDP growth rate; *PC* is physical capital/infrastructure; *REM* is remittance inflows;[15] *HC* is human capital; *FD* is financial development; *GEXP* is government expenditure; *OP* is openness; *FDI* and *DI* are foreign direct investment and domestic investment respectively; *RFD* is term capturing interactive impact of remittances and financial development and ε_{it} is error term. In Equation 4, y_{t_1} is included to understand dynamic relationship of the variables and to check the convergence hypothesis [Barro (1990a, 1996b); Barro and Sala-i-Martin (1995)].

The notable point in Equation 4, however, is the remittances-growth nexus. Economic growth, both in home and host countries, has emerged as an important factor in determining remittance inflows. The lower economic growth rate in the home country may cause higher migrations from the country and thus higher remittance inflow in the future. This is more pronounced when the country is passing through economic contraction phase (altruistic motive). One of the reasons for higher home remittances is to fight the negative consequence of the economic downturn.

On the contrary, higher economic growth in the home country may serve as motivation to remit higher amounts for investment purpose. This implies a bi-causal relationship between remittances and economic growth that may be counter-cyclical or pro-cyclical. Most importantly, remittance inflows could have a positive as well as negative impact on growth depending upon the transmission channel employed.[16] This simultaneous relationship is captured by incorporating simultaneity in the model.[17]

$$REM_{it} = \beta_0 + \beta_1 REM_{it-1} + \beta_2 lny_{it} + \beta_3 RER_{it} + \beta_4 Migr_{it} + \beta_5 FD_{it} + \beta_6 POV_{it} + \varepsilon_{it} \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (5)$$

Where, *RER* is real effective exchange rate[18] and *Migr* stands for number of migrants from the home country. REM_{it-1} is the lagged value of remittances used to capture the signaling impact, as the higher inflows to the host economies in the previous year may be an indication of suitable environment, encouraging remitters for higher home remittances. The rest of the variables are as explained above.

Equation (5) not only captures the simultaneity involved in growth-remittances nexus but also include the implicit poverty alleviation effect of growth through increased remittances. Remittances, unlike other international financial capital inflows, are

[15]Remittances inflows are defined as "Workers' remittances and compensation of employees comprise current transfers by migrant workers and wages and salaries earned by nonresident workers" [World Bank Group (2013)].

[16]Refer to Barajas, *et al*. (2009) for detail on transmission channels.

[17]This equation is adopted based on the literature available on the issue.

[18]Real Effective Exchange Rate= [(CPI) USA/ (CPI) local]* official exchange rate [Alfaro, *et al.* (2004)]. Studies focusing on motive to remit (and not only simple drivers of remitting) use Real Exchange Rate as movements in real exchange rate as it capture "economic conditions". For example "Real appreciation" may be an outcome of "lower inflation" or "higher interest rate" etc. which is not possible to capture using nominal exchange rate. Only through movements in "Real Exchange Rate" we can capture state of economy (boom or bust) which have implication for remittance inflows. For example, Olubiyi and Kubrat (2015) also use REER to explain movements in remittances inflows.

distributed primarily at the household level and affect the household poverty level through increased consumption of non-durables, food items and agriculture (irrigation) in African region [Nagarajan (2009)]. Poverty, as measured in this study, serves as an indicator of low economic condition at home country and may motivate migrants to remit higher amounts to meet the basic needs- the altruism. The theory of altruism proposes that increased welfare of the left-behinds (family) adds positively to the utility of migrants [Becker (1974); Stark (1991)]. Measured overall, poverty may reflect the poor economic conditions which may motivate the people to migrate and send remittances. Poverty can also serve as constraint to remittances inflows if people cannot afford the cost of migration.

Importantly, poverty derives remittances, but at the same time remittances affect poverty also. Babatunde and Martinetti (2010) report that remittances increased food security in Nigeria. Further, Nagarajan (2009), using a panel data, reports that remittance-recipient households consume a large share of the income on food and health. This implies that higher inflows of home remittances may affect poverty, through direct (increased income at the household community level, etc.) and indirect channels (resulting from increased economic growth; trickle down). Remittance inflows, therefore, improve the income of the households and help to reduce poverty. To capture the impact of remittance inflows on poverty, we extended the model and included poverty into it, as:

$$POV_{it} = \gamma_0 + \gamma_1 REM_{it} + \gamma_2 GG_{it} + \gamma_3 PCY_{it} + \gamma_4 FD_{it} + \varepsilon_{it} \quad \ldots \qquad \ldots \quad (6)$$

Where *POV* is the level of poverty and is measured by food deficit kilocalories per person per day, *GG* is the GDP growth, *PCY* is initial per capita income[19] and *FD* is financial development. Equation 6, when employing a simultaneous equation model, accounts for all the direct and indirect effects of remittances on poverty. The point worth mentioning is that in Equation 6, GDP growth (GG) is used instead of per capita GDP growth. The specification is adopted purposefully to capture the trajectory of economic growth given the initial level of income per capita. In a panel setting, it captures the poverty-eliminating trajectory of respective countries by controlling the relative poverty levels of the countries at the initial stage, which have a subsequent impact on poverty reduction efforts.

4. DATA AND ESTIMATION METHODOLOGY

4.1. Data

The sample consists of eight African OIC member countries namely Egypt, Mali, Morocco, Senegal, Sierra Leone, Sudan and Tunisia for the period from 1992 to 2010. The final selection of the countries and the time period is guided by the availability of data on major variables. All the variables are extracted from the 2013 online version of the World Development Indicators (WDI), International Financial Statistics (2012) and Penn World Table (2013). All the data are in constant US dollars ($) 2005. The variables are converted into a percentage of GDP except the indices.

[19]Average per person income in 1992 in our case.

Given the non-availability, data on the real effective exchange rate for Egypt, Mali, Senegal, and Sudan were constructed, using Alfaro, *et al.* (2004) wherein REER real effective exchange rate= [(CPI) USA/ (CPI)]* local official exchange rate. Credit provided to the private sector (% of GDP) is used as a proxy for financial development (FD). Human Capital Index calculation, based on years of schooling [Barro and Lee (2013)] and the returns on education [Psacharopoulos (1994)], serves as the proxy for human capital [PWT (2013)], while telephones per 100 persons are used as physical capital/infrastructure/infrastructure (PC). Trade openness (OP) is the sum of exports and imports of goods and services as a ratio to GDP. To avoid the double counting bias, domestic investment (DI) is calculated by subtracting FDI from the gross fixed capital formation. Since the migration data were available at four years' interval so we interpolated the migration data to convert it yearly.

The definition of poverty has a special relevance for the region under consideration. Hunger persists widely in the majority of the population residing in African countries, while Sub-Saharan Africa ranks highest in hunger/malnourishment [FAO (2013)].[20] The measure of poverty used in this study essentially captures the food (in)security element.[21] The measure of poverty becomes highly relevant, given the estimates that 239 million people were hungry or undernourished in sub-Saharan Africa in 2010.[22] To capture the impact of poverty, this paper, uses the depth of hunger as a proxy for poverty and is measured in the food deficit kilocalories per person per day.[23] A higher number shows a deeper level of hunger.

The descriptive statistics highlight some differences in variables across the sample countries as reflected by the range and standard deviations (see Appendix A). Per capita GDP growth rate represents an average growth rate of 2 percent, indicating a low growth environment during the sample period. Remittances represent a major capital inflow at 4.57 percent of the GDP as compared with FDI of 2.43 percent of GDP. This suggests that remittances constitute major capital inflow during the sample period for these countries and could have a major impact on poverty levels and economic growth. It is also evident that sample countries use the domestic investment for financing their economic growth. In terms of poverty, the sample countries are found food deficient on average (119.83) ranging from severely food deficit Sierra Leone (333.00) to almost non-deficit Tunisia (3.00); similarly very lower level of openness is evident in the region. In summary, the descriptive statistics provide the motivation for further investigation.

4.2. Estimation Methodology

In the presence of simultaneous feedback of the dependent variables, estimating a single equation model would have been erroneous [Carkovic and Levine (2005a)]. A

[20]http://www.fao.org/docrep/018/i3434e/i3434e.pdf

[21]Also the data on poverty head count ratio based on $ 1.25 and 2 per day and poverty gap were either not available for the panel of countries or a good number of values were missing.

[22]http://www.worldhunger.org/articles/Learn/africa_hunger_facts.htm

[23]"Depth of hunger or the intensity of food deprivation indicates how much food-deprived people fall short of minimum food needs in terms of dietary energy. The food deficit, in kilocalories per person per day, is measured by comparing the average amount of dietary energy that undernourished people get from the foods they eat with the minimum amount of dietary energy they need to maintain body weight and undertake light activity. The depth of hunger is low when it is less than 200 kilocalories per person per day, and high when it is higher than 300 kilocalories per person per day" (World Bank).

simultaneous equation model consisting of three equations with per capita GDP growth, remittance inflows (% GDP) and depth of poverty as dependent variables is estimated. Given the fact, that lagged values of the dependent variable may correlate with the combined error terms, leaves OLS redundant amid violation of orthogonality assumption. Generalised Method of Moments (GMM) is used to estimate a dynamic panel model to account for the endogeneity problem. We used "internal" instruments, as strictly exogenous instruments are hard to come by particularly in the context of sample countries. Sargent J stat [Sargan (1958); Sargan and Desai (1988)] tests the validity of instruments with null hypothesis that "instruments are valid".

5. RESULTS AND DISCUSSION

Since the basic hypothesis of the study is that higher the remittance inflow lower will be the poverty, and that strong and well established financial capital strengthens the impact. Also, we argue that financial development persuades remittance inflows. These hypotheses are tested in two ways (1) descriptive analysis (including correlation and graphical presentation of data) and (2) regression analysis.

5.1. Descriptive Analysis

The linear association between major variables is given in Table 1 below. The correlation coefficient between financial development and remittances is positive (0.27), suggesting that an increase in financial development increases remittances. Similarly, the data exhibits that financial development reduces poverty. The correlation coefficient between financial development and poverty is very high (–0.87) and negative, showing a very strong interrelation. Most importantly however, remittances are strongly (coefficient of association is –0.50) and negatively correlated with poverty, which support our very basic hypothesis that an increased inflow of remittances has strong poverty reduction effect.

Table 1

Correlation Matrix Panel Data [1992-2010, N=133]

Correlation	REM	FD	LNY	POV
REM	1.00			
FD	0.27	1.00		
LNY	0.37	0.90	1.00	
POV	–0.50	–0.87	–0.82	1.00

For the ease of the reader, we also present a country level graphical analysis of relationship/association between major variables of study. The relationship between financial development and poverty is inverse for the entire set of countries except Senegal [see part (i) Appendix B]. Part (ii) of Appendix B portrays the relationship between financial development and remittances. Remittances are supposed to be positively associated with strong and well established financial system. The data did not support this relationship in case of Egypt, Morocco and Tunisia while in the remaining countries the association holds. Lastly, in part (iii) inflow of remittances play significant role in reduction of poverty in all countries except Egypt and Senegal. Overall, the descriptive analysis provides evidence for major hypothesis of study.

5.2. Regression Analysis

All the three Equations (4, 5 and 6 above) are estimated simultaneously, and the results are reported in Tables 2, 3 and 4. 1st column of Tables 2, 3 and 4 reports the results of specification (1) while the second column of all three tables carry the results of specification (2) and so on. The sensitivity of the direction and magnitude of the impact of the respective variables is gauged by introducing an alternative set of alternative control variables (M1-M5). Last Column of all the three tables (M5) report the results of final specification and forms the bases of analysis and conclusions. To set the baseline comparison, we begin our discussions on results with M1 and then the impact of set of control variables is discussed in the light of findings from final model (M5).

Table 2

GMM Estimates for Determinant of Economic Growth [1992-2010]
[Dependent Variable= GDP Per Capita Growth (y)]

IND VAR.	M 1	M 2	M 3	M 4	M 5
y_1	–0.44***	–0.42***	–0.43***	–0.24***	–0.13***
	(0.08)	(0.08)	(0.08)	(0.07)	(0.04)
PC	0.12***	0.18***	0.22***	0.24***	0.30***
	(0.03)	(0.06)	(0.05)	(0.04)	(0.07)
REM	0.69*	1.09***	1.22***	0.83***	1.26***
	(0.48)	(0.38)	(0.39)	(0.34)	(0.45)
HC		–2.12*	–2.58***	–2.33***	–2.85*
		(1.29)	(1.21)	(0.91)	(1.65)
FD			–0.29	–0.77***	–0.54**
			(0.25)	(0.19)	(0.27)
GEXP			0.17	0.59	1.26*
			(0.59)	(0.49)	(0.80)
OP				–0.39	–0.91**
				(0.31)	(0.41)
FDI				0.39***	0.37***
				(0.06)	(0.08)
DI				1.40***	1.42***
				(0.17)	(0.19)
RFD					–0.01*
					(0.00)
Constant	2.50***	2.84***	3.13***	–0.91	–3.76*
	(0.57)	(0.72)	(1.32)	(1.36)	(2.55)
J-Stat	0.19	0.20	0.19	0.20	0.20
P-Value (J-stat)	0.91	0.90	0.98	0.99	0.99
No. of Obs.	**105**	**105**	**105**	**105**	**105**

In parentheses are Heteroskedasticity-Autocorrelation (HAC) corrected Newey-West standard errors. *, **, ****indicate* 10 percent, 5 percent and 1 percent level of significance respectively.

Table 3

GMM Estimates for Determinants of Remittance Inflows [1992-2010]
[Dependent Variable= Remittance as % of GDP (REM)]

IND VAR.	M 1	M 2	M 3	M 4	M 5
REM_1	0.93***	0.89***	0.84***	0.79***	1.05***
	(0.04)	(0.04)	(0.05)	(0.04)	(0.03)
Y	0.13***	0.12***	0.11***	0.09***	1.10***
	(0.02)	(0.02)	(0.02)	(0.01)	(0.02)
RER	0.03***	0.03***	0.03**	0.03***	0.09***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)
Migr			0.04	0.01	0.13*
			(0.03)	(0.03)	(0.08)
FD			0.08**	0.06**	0.17*
			(0.04)	(0.03)	(0.11)
POV					-0.24***
					(0.08)
Constant	–0.36***	–0.29***	–0.41***	–0.25**	0.75*
	(0.10)	(0.10)	(0.09)	(0.10)	(0.46)
J-Stat	0.19	0.20	0.19	0.20	0.20
P-Value (J-Stat)	0.91	0.90	0.98	0.99	0.99
No. of Obs.	105	105	105	105	105

In parentheses are Heteroskedasticity-Autocorrelation (HAC) corrected Newey-West standard errors. *, **, *indicate 10 percent, 5 percent and 1 percent level of significance respectively.

Table 4

GMM Estimates for Determinants of Poverty [1992-2010]
[Dependent Variable= Depth of Hunger (Deficit Kilocalories per Day per Person]

IND VAR.	M 1	M 2	M 3	M 4	M 5
REM	6.03	4.64	–3.86	–9.36***	–8.33***
	(6.59)	(6.23)	(5.89)	(3.82)	(3.36)
GG	1.68*	0.58	0.63	–0.48	–1.17*
	(0.88)	(0.82)	(0.82)	(0.67)	(0.75)
PCY	–25.09***	–24.46***	–25.29***	–24.54***	–22.86***
	(9.08)	(9.18)	(6.65)	(4.19)	(4.88)
FD	–72.14***	–72.48***	–69.60***	–67.34***	–68.06***
	(7.57)	(7.65)	(5.82)	(3.59)	(3.34)
Constant	484.08***	484.55***	495.63***	493.99***	484.76***
	(45.18)	(45.30)	(33.91)	(21.37)	(25.03)
J-Stat	0.19	0.20	0.19	0.20	0.20
P-Value (J-Stat)	0.91	0.90	0.98	0.99	0.99
No. of Obs.	105	105	105	105	105

In parentheses are Heteroskedasticity Autocorrelation (HAC) corrected Newey-West standard errors. *, **, ***indicate 10 percent, 5 percent and 1 percent level of significance respectively.

The estimation results of growth equation are presented in Table 2. The coefficient of the remittance inflows (REM) is positive and statistically significant, implying that higher inward remittances boost the economic growth in the home country. These results are in concurrence with Cooray (2012), Ratha (2013). Also, Fajnzylber and Lopez (2006); Fayissa and Nisah (2010); Imai, *et al.* (2014) and Javid, *et al.* (2012); reported a positive association between the inward remittances and growth. The significant and negative lagged dependent variable confirms the convergence hypothesis of Solow. The idea behind convergence hypothesis, also known as catch-up effect, is that poor countries grow faster as compared to rich countries and, in the long run, growth rate of rich and poor countries will converge to each other.[24] Physical capital/infrastructure (PC) enters with a statistically significant positive sign, implying that infrastructure development boosts economic growth [World Bank Staff (1994)].

Among other control variables, Column 1 of Table 3 reports the estimation results for Equation (5) [determinants of remittances]. The coefficient of per capita GDP growth is positive and statistically significant, suggesting that better economic conditions at home country lead to higher remittances back to home.[25] The lag of the dependent variable is positive and statistically significant suggesting the persistence. There may be two alternative explanations for this persistence. The first one, which is more plausible, is that due to inflation, a higher level of income is required to maintain the current standard of living and thus results in higher home remittance. Alternatively, higher remittances can be attributed to better investment opportunities in the home country. Real effective exchange rate (RER) (Table 3) shows a significant and positive impact on remittance inflows, suggesting that appreciation of home country's currency will lead to more inflow of remittances [Dakila and Claveria (2007)].[26]

Returning to the impact of remittances on poverty alleviation, remittances *(REM)* register a positive sign but is statistically insignificant, implying that higher remittances are not effective in mitigating poverty, as measured by food deficit (1st column of Table 4), even though they have been found significantly affecting growth positively. Also, it may be due to the uneven distribution of remittances themselves. Initial per capita income (PCY) has a significant and negative impact on poverty, confirming the argument that relative economic position of the countries measured in terms of per capita income is a significant determinant of poverty reduction.

Similarly, GDP growth (GG) enters with a statistically significant positive sign, suggesting plausibly, that initially with increased level of growth, in the presence of inequality, will increase the poverty.[27] It is stated that poverty is more sensitive to income inequality than to income level, and the country-specific threshold level of income inequality determine the extent to which the growth can reduce poverty [Fosu (2009)]. Financial development (FD) enters significantly with negative sign designating that financial development may be helpful in alleviating poverty. Remittances, serving as an alternative source of finance in the presence of credit constraints, provide more

[24]Barro R. and X. Sala-i-Martin (1995) provides excellent discussion on the issue.

[25]It is assumed here that a part of inflows is used for investment.

[26]It is however asserted that appreciation in the currency is not necessarily guaranteed to be positive for the overall growth of the economy and that the argument drawn here must be evaluated only in the context of remittance-exchange rate nexus.

[27]Similar argument was forwarded by Ravallion (2007).

opportunities for investment to small entrepreneurs. Thus, more economic activity occurs which, in turn, through expanding employment opportunities, may reduce poverty [Ordóñez (2012); Jeanneney and Kpodar (2008)].

Interestingly, human capital enters into growth equation with negative sign. Initially, it may sound counter intuitive but it is not the case here. Human capital can carry negative sign in developing countries [Nyatepe-Coo (1998)]. Poor quality of education, higher costs involved in education, coupling with lower return and less job opportunities, a common case for the region understudy, can be probable candidates underlying this outcome [Pritchett (2001)]. Also, the gains from human capital depend on its interaction with other forms of capital available in country, say physical capital. These gains may not be realised if any of the two is below threshold level, a case in countries understudy.[28]

It is reiterated that even though we undertake a sensitivity analysis to observe the changes in the basic set of variable (specification 1), by including a set of control variables alternatively. But, for brevity, and to avoid any omitting variable bias, the results of the final model (model 5) are discussed in detail. Model-1 was discussed to set the base scenario in order to draw a meaningful comparison and implication of the introduction of the alternative set of variables. The discussion that follows is based on final specification (M-5 in respective Tables 2, 3 and 4).

In growth equation (Table 2), lagged growth (y_{t_1}) confirms the significant convergence across the sample countries and the relation is robust, but the rate of convergence is the lowest when the full set of control variables is introduced (M-5). Remittances inflows (REM), the variable of interest in the study at hand, contribute to the growth positively and the impact is robust across the alternative specification and retains statistical significance. Importantly however the impact magnitude is highest when the full set of controls is included in the model. Interestingly, however, irrespective of the set of controls, human capital (HC) retains the negative sign. The plausible reason for negative sign of HC might be the poor quality of education, higher cost of education with lower returns, especially at initial levels of human capital development and fewer job opportunities [Pritchett (2001)]. The point of caution, however, is interpreting this negative sign. It does not imply that human capital accumulation is bad for growth per say, rather it reflects the environment failing to exploit the human capital to maximise the gains.

Financial development (FD), measured as credit provided to the private sector, carries a statistically significant robust negative sign in growth equation (M-5, Table 2).[29] Financial liberalisation may generate uncertainty in the financial sector at the initial stages and hampering the growth consequently. Uncertainty in financial markets also means poor information which, through reduced investments, may cause financial underdevelopment harms growth. Further to add, a nonlinear monotonic relationship between financial sector development and economic growth may render negative impact in countries with lower levels of per capita income [Méon and Weill (2010); Rioja and

[28]Studies reporting negative signs on human capital in growth equation include, but not limited to, Benhabib and Spiegel (1994); Kyriacou (1991); Lau, *et al.* (1991); Bashir (1999); and Pritchett (2001).

[29]The results are in concurrence with Loayza and Ranciere (2005) and De Gregorio and Guidotti (1995).

Valev (2004); Deidda and Fattouh (2002); Lee (1996)]. The estimates are not surprising, given the lower level of financial market development in sample countries, coupled with lower per capita income.

Government expenditures (GEXP) enter statistically significant and positive in growth equation (M-5, Table 2). Openness is found hampering the economic growth for the region while FDI and Domestic Investment (DI) persuade the growth in the region. A negative sign for openness implies that trade hurts the economies under investigation. This may partly be a reflection of the fact that the countries with specialisation in traditional goods, exporting raw material or primary goods and face lower levels of human capital. Consequently, a trade deficit may experience negative impacts of trade openness.

FDI inflows to the poor countries generate externalities through increasing business competence and easing technology transfers [Alfaro (2003) and Carkovic and Levine (2002b)]. FDI is also associated with the transfer of new knowledge in the form of acquisition of new skills, introducing modern management practices, etc. FDI can also accelerate growth in line with the development of domestic financial sector [Alfaro, *et al.* (2004); Hermes and Lensink (2003); Levine (1991)]. Additionally, this growth enhancing the impact of FDI has strengthened a crowd in domestic investment. We find the evidence of the complementary relationship as a domestic investment (DI), carries coefficient larger than that of FDI [Agosin and Mayer (2000)].

Lastly, we turn to the interactive impact remittance and financial development (RFD) on economic growth (model of Table 2). The argument is that effectiveness of remittance inflows, in promoting economic growth is conditional on financial sector conditions in the home country. Remittance inflows serve an alternative source and increase the supply of funds to domestic banking system facing resource constraints. Also, remittance inflows stimulate financial development by reducing intermediation costs. A negative sign on interaction term means that remittance inflows act as a substitute when there are credit constraints (i.e. low level of financial development). Looking at column 5 (M-5) of Table 2, we find a statistically significant negative sign of interaction term RFD confirming the substitutability between remittance inflows and financial development [Ruiz-Arranz and Giuliano (2005)]. Lastly, but most importantly, the constant term in the growth equation (Table 1) shows a significant decline in the growth over the time, registering negative growth rates on average for the region.

In the remittance inflows equation (Table 3, M-5), financial development (FD) enters with statistically significant positive, suggesting that a well-functioning financial market attracts more remittances as it provides an easy and efficient way for remitting. The findings are suggestive that for the countries under investigation, financial development increased the inflows of remittances over the period under study. Economic growth in the recipient country and real effective exchange rate appreciation attract a significant amount of remittances, and the relation is robust to the alternative set of control variables.[30]

Finally, we turn to the central concern of this study: the poverty-reducing impact of remittances. As is evident from the last column of Table 4, remittance inflows (REM)

[30]A very detailed discussion of determinants of remittances is avoided intentionally as it does not fall in the primary scope of this study.

reduce poverty (consequently reducing hunger depth). Remittance inflows increase the income of households, resulting in higher levels of consumption of both durable and non-durable goods and increased saving ratios of families back home. Thus through an increase in consumption, this money flow result in increased demand for local products; and hence, stimulate the production of local goods and build small scale entrepreneurship [Woodruff and Zenteno (2001)]. The increased flows of remittances also act as a private welfare system that enhance the purchasing power of poor, smooth out consumption patterns, build infrastructure, human capital and reduce poverty [Adams, *et al.* (2008); Hildebrandt, *et al.* (2005); Fajnzylber and Lopez (2006)]. The findings are also suggesting that the positive impact of remittances is conditional on the level of financial development of recipient economies.

The study provides striking evidence on the severe depth of hunger irrespective of the control variables, as the deficit per day is greater than 485 kilocalories on average which is more than double of the target set for lower hunger i.e. 200 kilocalories per person per day. Looking at Table 3, it is evident that, along with per capita income (PCY), the contribution financial development (FD) is highest and a one percent increase in the provision of credit to private sector results in a drop in the mean depth of hunger by, as high as, 72 kilocalories per person per day. Intuitively, given the food deficit, hovering around 485 kilocalories per person per day, *citrus paribus*, credit provision to the private sector increased by 3 percent can eliminate/diminish the severe depth of hunger. Remittances, serving an alternative source of private credit as is evident from the above discussion, can be hugely effective in this context. Finally, Sargan J statistic of over-identifying restrictions is applied and the results, validating the instruments being exogenous, are reported in a 2nd bottom row of Tables 2, 3 and 4 respectively.

6. CONCLUSION

This study, using simultaneous equation model, assessed the impact of remittance inflows on economic growth and poverty for seven OIC member countries of African origin. Measured as the depth of hunger, we find that severe poverty prevails in the region. Importantly, however, remittance inflows appear productive for economic growth and help households get out of poverty. Some important findings emerge from the assessment. First and the foremost, international remittances exert a statistically significant poverty reducing impact through direct and indirect channels. Second, remittances contribute to the economic growth of the region significantly. Third, the contributions of remittances to growth are conditional on level of financial development. Fourth, financial market development and the initial level of per capita income exert a strong impact on alleviation of poverty. Increased provision of credit to private sector can help eliminate sever hunger. Fifth, private investors face credit constraints, and remittances may serve as an alternative source. Finally, the evidence submits that FDI,[31] physical capital/infrastructure, trade openness and government expenditures are significant determinants of economic growth.

These findings highlight some key policy implications. First, the countries need to design policies to promote export of labour in order to generate remittances. Second, financial market development is the key to growth enhancing and poverty reducing

[31]Most importantly FDI crowd-in domestic investment in the region.

impact of remittances. The introduction of advanced technology in the banking sector may encourage the remitters to remit more through formal financial institutions at lower transaction cost which, in turn, could be better channelised to growth enhancing sectors of the economy to combat poverty. Also, there is an urgent need to bring serious financial reforms which could provide easy access to credit, while reducing credit constraints to reap gains from investing into small and medium enterprise projects. Government expenditures are found to be counterproductive for economic growth and thus need to be utilised so as to contribute positively to economic growth and to provide benefits to the poor. Finally, the governments of the respective countries should pay special attention to increasing the quality of the workforce through vocational and technical education, in line with the demands of national and international labour markets. This will not only generate more remittances through exporting skilled labour force to work in high paid sectors of foreign countries but will also enable the countries to reap benefits of other transnational investments and financial capital inflows.

Appendices

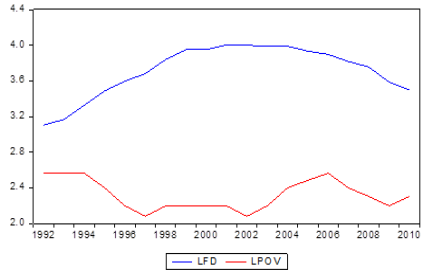
Appendix A

Descriptive Statistics [1992-2010]

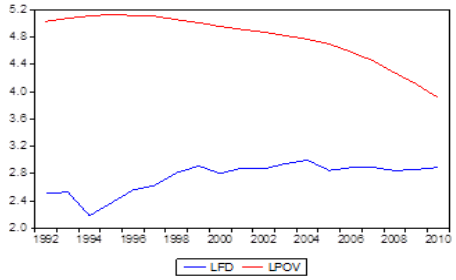
Variable Name (Notation)	Mean	Max	Min	Std. Dev.
Financial Development (FD)	27.97	69.11	1.62	21.70
GDP per Capita Growth (y)	2.15	20.72	–18.58	4.01
Foreign Direct Investment (FDI)	2.43	9.42	–0.97	2.25
Government Expenditure (GEXP)	13.10	19.35	4.84	3.50
Human Capital (HC)	1.69	2.38	1.14	0.32
Domestic Investment (I)	17.21	30.25	–5.04	6.60
Number of Migrants (MIGR)	1.44	4.45	0.16	1.15
Openness (OP)	0.59	1.03	0.15	0.21
Remittances (REM)	4.57	14.58	0.01	2.60
Physical Capital/Infrastructure /Infrastructure (PC)	4.03	15.70	0.15	4.45
Initial per Capita Income (1992) (PCY) [US$]	1126.23	3861.51	304.25	899.02
Poverty (POV)	119.83	333.00	3.00	105.36

Appendix B (i)
Relationship between Financial Development and Poverty

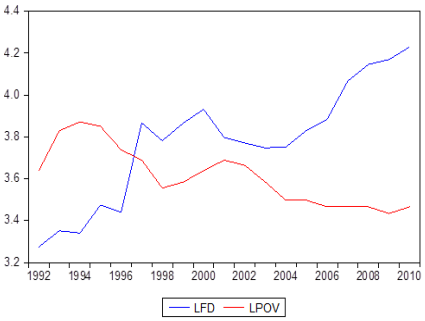
Egypt



Mali



Morrocco



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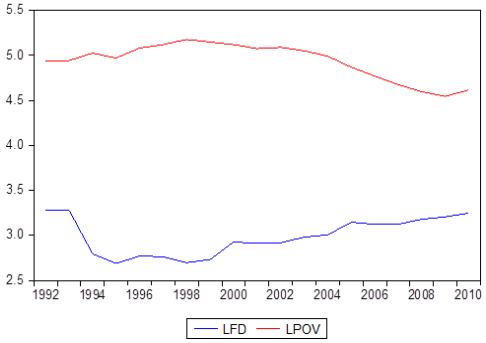
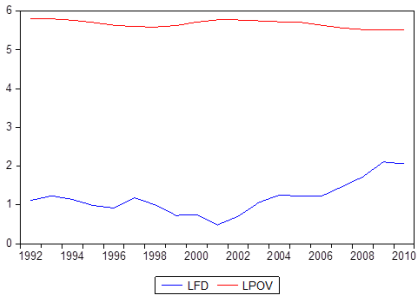
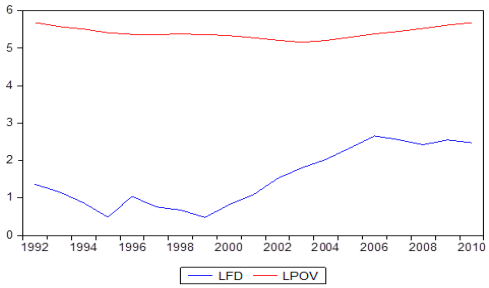


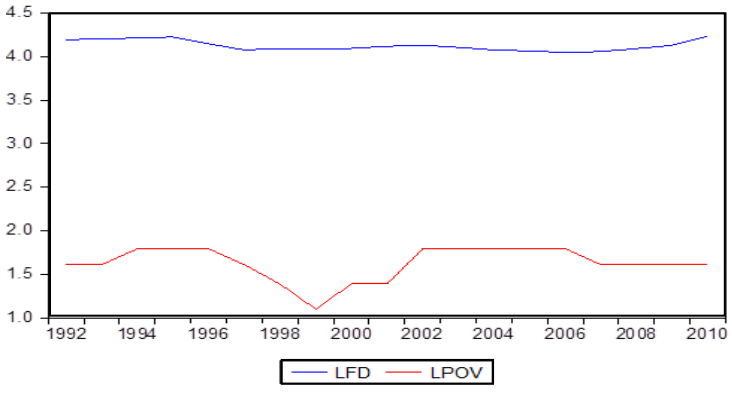
Sierra Leone



Sudan

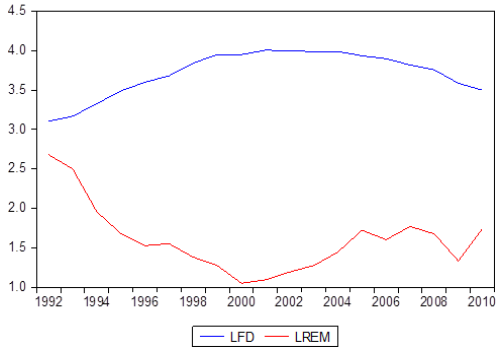


Tunisia

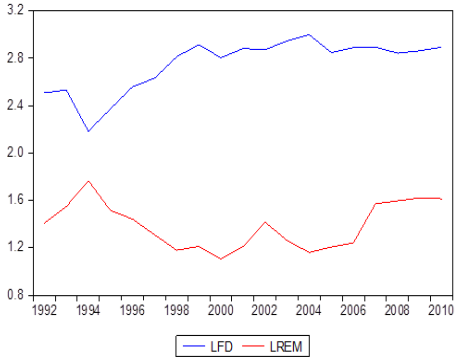


(ii) Relationship between Financial Development and Remittances

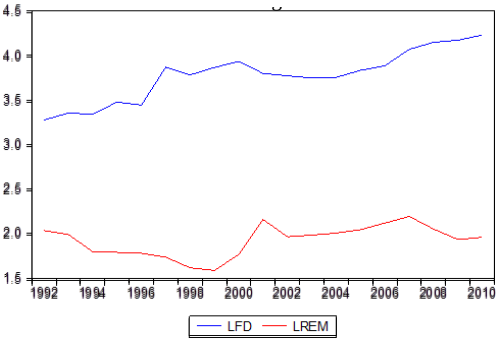
Egypt



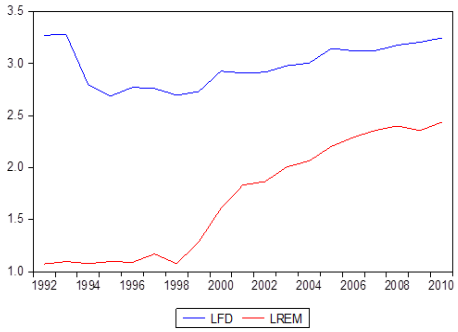
Mali



Morocco



Senegal



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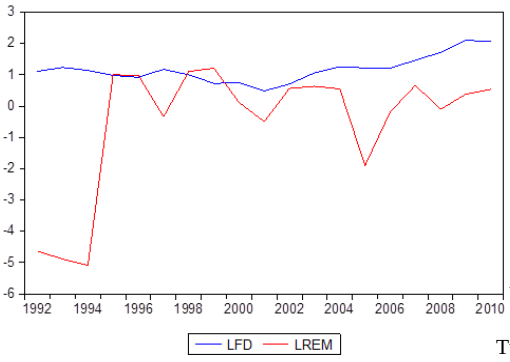
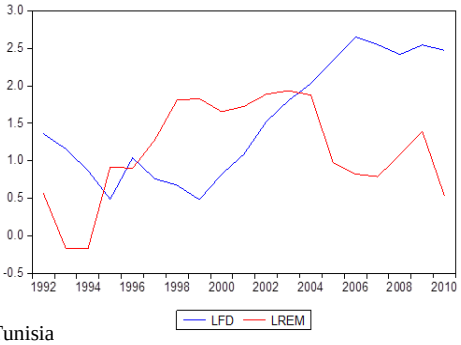
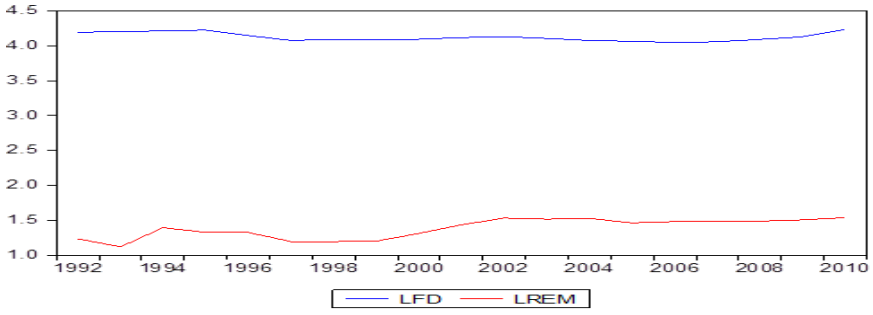


Sudan

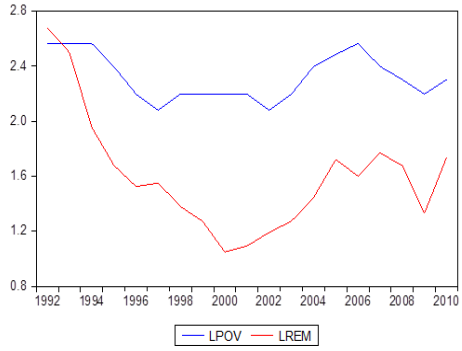


Tunisia

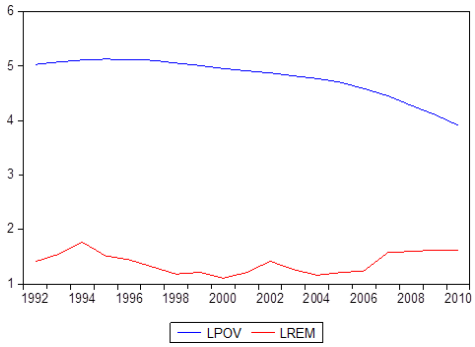


(iii) Relationship between Poverty and Remittances

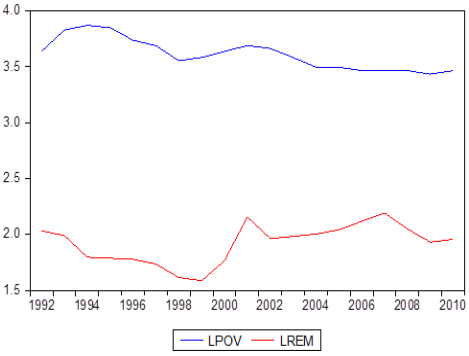
Egypt



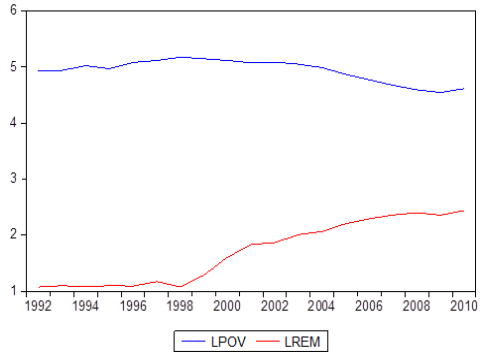
Mali



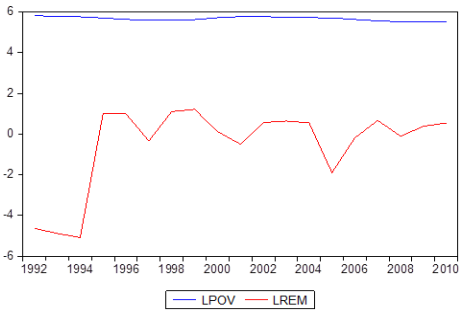
Morocco



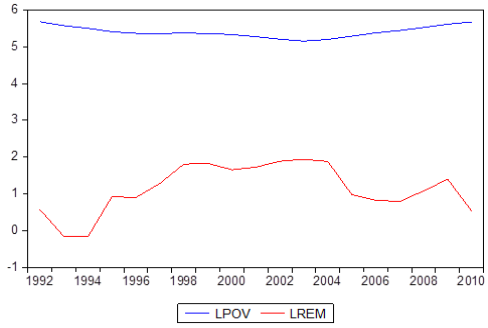
Senegal



Sierra Leone



Sudan



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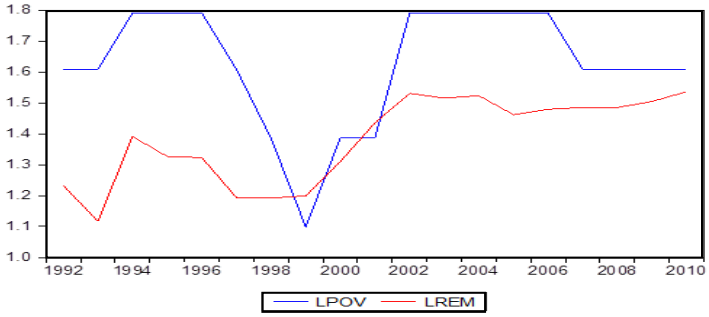

Appendix C

Average Human Capital Index by Region [1992-2010]

Classifications (Region)	Human Capital Index (Average)	Classifications (Region)	Human Capital Index (Average)
Africa	1.83	East Africa	1.71
African Muslim Countries	1.61	West Africa	1.74
African Non-Muslim Countries	1.92	North Africa	1.79
Central Africa	1.99	Southern Africa	2.11

Note: Calculations are made using data from Penn World Table 8.0 (2013) for the African region. The data on Human capital index for the countries (Algeria, Comoros, Djibouti, Eritrea, Ethiopia, Guinea-Bissau, Libya, Nigeria, Somalia, Angola, Burkina, Chad, Madagascar, Malawi, Sao Tome and Principe, Seychelles and Togo are not available so, these countries are not included in the calculation.

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Impact of Project and Programme Aid on Economic Growth: A Cross Country Analysis

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This study examines the impact of foreign aid instruments, namely Project Aid and Programme Aid, on economic growth of 27 aid-receiving countries. The study constructs a system of three equations, i.e. growth, investment and human capital. Using the Generalised Method of Moment estimation technique, the study concludes that while Project Aid has a positive and significant impact on economic growth, Programme Aid has an insignificant impact on economic growth. Additionally, the study finds that economic policies do enhance effectiveness of aid at aggregate level. Therefore, the capacity of aid-recipient countries to effectively use their resources for economic development needs due consideration.

Keywords: Project Aid, Programme Aid, Economic Growth, Conditionality, Procurement Reform, System Equation Method, Generalised Method of Moment (GMM), Principal Component Analysis

1. INTRODUCTION

The role of foreign aid in economic growth of developing countries has been a controversial issue. Since 2000, several high level international forums on 'Aid Effectiveness' were held. These forums formulated principles of how to increase the amount of foreign aid more effectively. The central principle was that the greater ownership of the recipient country in the development process, with special regard to aid utilisation, is a prerequisite for the desired developmental effects. The formulation of new aid effectiveness principles resulted in decrease in the share of Project Aid, while a share of Programme Aid has increased since 1980s. The basic rationale of this shift was the recognition of the ineffective nature of the Project Aid and acceptance of Programme Aid as an effective modality [Wilkes (2001); Camara (2004); Van de Walle (2005)].

Traditionally, foreign aid was delivered through Project Aid. In Project Aid, funds are given for well-defined activities and are implemented through a parallel management system with a very limited integration of national ministerial agencies. This instrument challenges local ownership of the

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development process and the generation of local institutional capacity. Contrary to Project Aid, funds through Programme Aid are given to finance overall development strategy and are delivered through recipient government budgets and accounting system.

The opponents of project aid argued that the project approach leads to the emergence of a parallel system which hampers planning, alignment, coordination and predictable budgeting. Project Aid through its fragmented implementation also leads to huge transaction cost. Contrary to Project Aid, the programme based approach leads to improved ownership, planning, coordination and predictable budgeting because of its less fragmented nature. Programme Aid also reduces transaction cost of foreign aid utilisation [Camara (2004)].

Contrary to the popular view of accepting Programme Aid as an effective aid modality, there are some concerns associated with Programme Aid. While Programme Aid is considered as vulnerable to corruption, Project Aid is generally considered to be more transparent. Moreover, greater ownership in utilisation of funds may induce politicians to shift more financial resources to their election constituencies, rather than considering economic needs of the whole country [Camara (2004)]. Therefore, according to Koeberle and Stavreski (2006), Project Aid is preferable in the presence of weak financial management system, weak policy environment and lack of consensus between donors and recipient government on priorities.

Programme Aid is not a new modality. Its history goes back to the Marshall Plan which comprised mainly of Programme Aid. Major part of US aid programme, especially to South Asia comprised of food programme aid. But decline in the food aid led to a reduction in the importance of this sort of aid. IMF lending in all comprises of Programme Aid. The amount of IMF programme lending, increased dramatically as a result of oil crises in 1970s and the debt crises since 1980s. The upsurge in this sort of lending subsided in the early 1980s, but rose again in late 1980s, in the shape of new instrument known as structural adjustment facility (SAF). This instrument was progressively used in crises years; 1995 in Mexico, 1997 in East Asia and 1998 in Russia [White and Dijkstra (2003)]. Structural adjustment facility (SAF) was basically Programme Aid attached with some conditions of policy reforms. Following the IMF initiative, the World Bank formally started lending conditional Programme Aid in the name of structural adjustment loans (SALs) in 1980. This shift from Project Aid to Programme Aid was the result of changing views about the need for Project Aid and changing international environment [Mosley, Harrigan, and Toye (1991)]. Since the 1980s various changes have been recorded in the framework of conditionality associated with Programme Aid. In the 1980s, the conditionality was mainly focused on the requirement to pursue economic reforms while the conditionality in the 1990s was more political in nature and demonstrated a clear commitment to poverty-reduction strategy. In the 2000s, the language of conditionality recorded another change that emphasised effective aid utilisation and greater ownership of foreign aid by recipient country. The fundamental principle under this framework of conditionality was

that the recipient government will prepare national development strategy, focused on poverty reduction and development which the donor may agree to finance. The conditionality was associated with the selectivity, according to which the recipients are judged according to their past performance rather than future promises. With the rise of this new condition of recipient ownership, Programme Aid or budget support became an important aid modality. But the concern remains that giving aid through budget support is risky in countries where the government system is corrupt and inefficient. This concern became the main motivation for donors to engage in the recipient countries procurement systems and hence new conditions of efficient and transparent procurement systems were introduced [McDonald (2008)]. These developments have significant implications for economic growth process in foreign aid recipient countries.

Foreign aid has been questioned for its effectiveness in bringing sustainable economic growth in aid receiving countries. It is argued that billions of dollars spent in the name of economic growth and development in aid receiving countries are not purely used for it. The hidden commercial and political agenda of the donor agencies are the main impediments to effective aid utilisation [Anwar and Michaelowa (2006); Bokhari (2011)]. However, international funds have been increasingly shifted from Project Aid to Programme Aid. This shift raised several questions: What is the rationale behind this shift in aid disbursement strategy? Is Programme Aid more effective than Project Aid in generating economic growth? Does foreign aid work better in a better policy environment?

This study aims to assess the effectiveness of both Project Aid and Programme Aid in accelerating growth in aid recipient countries. The study specifically addresses the question, whether Programme Aid is more effective than Project Aid in generating growth! Further, the political and economic debate on the rationale for shift in the aid delivery instrument will be explored. The study will also give policy recommendations for effective utilisation of aid instruments.

Previous studies addressed the issue of foreign aid with respect to its effectiveness for saving, investment, economic growth and other development variables, such as education, health and poverty [Ali (2008)]. The empirical literature showed that using aggregate foreign aid variable for analysis did not give the desired results [e.g. White (1992); Ouattara and Strobl (2006); Camara (2004)]. Therefore, various other studies were conducted, using disaggregated aid variables [e.g. Ishfaq and Ahmad (2004); Khan and Ahmed (2007); Feeny (2005)]. However, there are various loopholes and weaknesses in these studies. The main weakness of these studies is that, instead of applying system equation method, they have used a single equation method for analysing foreign aid and growth relationship. There are few studies that used system equation method but they have used aggregate aid variable for analysis [e.g. Ali and Isse (2007); Quazi (2000)]. This study addresses the impact of foreign aid on overall economic growth, by using system equation method consisting of three equations for growth, physical capital and human capital. The study uses

disaggregated variables, namely Project Aid and Programme Aid. The study will help the development community know, whether and how new aid disbursement strategy is working in generating economic growth.

2. PROJECT AID VERSUS PROGRAMME AID

Project Aid is a traditional method of delivering aid to developing countries. Under this instrument assistance is provided for a set of activities, having specified time duration and well defined objectives. Project Aid is usually provided for building infrastructure, for example roads, harbors, dams, irrigation projects and telecommunication projects. In addition, funds under project aid can be directed towards large and small scale industrial and agricultural projects, rural development projects, education and health projects, population projects and projects for women etc. Project Aid is utilised through project management units that are set up in parallel with local government system [Szirmai (2004)]. Contrary to the Project Aid, Programme Aid is not linked to a specific activity; rather it is given for general development purposes. The key characteristic of Programme Aid is its direct channeling to recipient countries through their local accounting system [Camara (2004)], which is given for debt relief, import support and budget support [White and Dijkstra (2003)].

Since the 1980s the development agencies have shifted funds from Project Aid to Programme Aid and the reasons for the shift are summarised below:

Table 1

Comparison of Project and Programme Aid

Features	Project Aid	Programme Aid	References
Nature of the Aid Instruments	Powerless in making environment conducive for economic growth	Powerful in influencing environment conducive for economic growth	Chakravarti (2005)
Ownership	Great involvement of donor in project	Great ownership of recipient	Anwar and Michaelowa (2006), Bokhari (2011), Koeberle and Stavreski (2006)
Coordination	Coordination gap due to multiple projects	Less fragmentation and more coordination	Van de Walle (2005), Lorentzon (2011)
Transaction Cost	Significant transaction cost	Reduced transaction cost	Van de Walle (2005), Koeberle and Stavreski (2006); Acharya, *et al.* (2003)
Predictability	Bypass local system making the funding process unpredictable	Utilised through local budgetary system making the funding process predictable.	Van de Walle (2005)
Fungibility	Recipient can adjust their own spending which may offset donor preferences	Approves overall expenditure plan, hence less fungibility	Camara (2004)
Institutional Effects	Deprives the recipient of government capacity	Promotes the recipient of government capacity	Wilkes (2001), Camara (2004), Van de Walle (2005)

Despite the fact that Programme Aid has many advantages over traditional Project Aid, following are concerns associated with programme aid:

Table 2

Risks of Programme Aid

Risk	Description	Reason of the Risk	References
Fiduciary Risk	Funds may not be used for intended purposes	Weak financial and economic management and official corruption	Camara (2004), Shand (2006), Koeberle and Stavreski (2006)
Policy Risk	Funds can be used for prohibited sectors e.g. War, Weapon of mass destruction, drugs etc.	Greater discretionary powers in using funds	Wilkes (2001), Radelet (2006)
Developmental Risk	The intervention may have unsatisfactory outcome	Lack of political will or technical ability of the recipient in economic management, implementation of reforms and effective poverty reduction strategy	Wilkes (2001)
Conditionality Risk	Conditionality diverts resources and challenges ownership of the recipient	IFI's prescribe same kind of reforms for different countries with different ground realities.	Hussain (2003)

The motivation for imposing conditionality was to increase effectiveness of aid. But conditionality has been widely regarded as ineffective. The prevailing conditions have taken various forms over time. They have expanded from macroeconomic reforms to good governance; demand for democracy and efficiency; transparency in public financial management and procurement system; reduction of poverty and economic growth [Hayman (2010)]. Although the donors agreed to withdraw aid conditions from the policy documents of recipient government, but in large part, the actual content of that policy is determined by external actors.

The current structure of policy-based lending and economic reforms programmes are counter-productive for developing countries as they favor creditors only. According to Chossudovsky (2003), the purpose of the reforms in the name of policy-based lending is to maintain developing countries into straightjacket, which prevent them from formulating an independent economic

policy. The policy based-lending did not favor the real economy, as no money was directed towards investment under these lending. Further, the economic reforms have diverted resources from domestic economy to imports from rich countries.

The policy-based lending enables the donors to pursue liberalisation of procurement systems in the aid receiving countries. Globally government procurement system constitutes a big business. It is estimated that government annually spend more than US $2,000 billion on tradable goods and services through public procurement system. The procurement system, a potential trade sector, was excluded from multilateral process. In developed countries public procurement system creates demand for locally produced goods and effectively contributes into growth process. The new procurement reforms focus on efficiency of recipient procurement system but the terms 'efficiency' is conservatively defined in terms of monetary value, i.e. the best quality at the lowest cost. The best quality can only be achieved through open competition. So the procurement reforms encourage more liberal system which increases chances of foreign firms to win the contracts because of economies of scale [McDonald (2008)].

World Bank and OECD prefer benefiting foreign firms from the recipient government procurement system. The public investment programme (PIP), which has been established under technical support of World Bank, allocates all public works project in aid recipient countries to international firms. Local firms are excluded from the tendering process. Only those firms are given separate subcontracts, which can provide local labour having very low cost. The loan money for infrastructure is recycled towards multinational contractors through these settings [Chossudovsky (2003)].

3. LITERATURE REVIEW

After the Second World War, the European reconstruction influenced early economic growth models, which stressed on the role of capital and capital formation for development [Mercieca (2010)]. It was believed that for any country to grow, it needed real resources like industrial plant, machinery and social overhead. But to achieve these prerequisites of growth, the underdeveloped countries were considered to be capital deficient. Hence, for economic growth and development of the underdeveloped countries, it was required to overcome this main constraint. This idea of growth was basically given by John Maynard Keynes in 1930s, arguing that by financing investment, governments could stimulate development and growth [Meier and Stiglitz (2001)]. Based on Keynes' idea of economic growth, a new breed of development economists argued that investment in developing countries could be stimulated by injecting cash from overseas. The logic for this new development theory was that investment in a country depends on saving which is determined by per capita income. Since poor countries have low level of income and saving, they are caught in vicious circle of poverty. It was argued

that foreign aid would dissolve this vicious circle by financing investment, and that donors can stimulate growth in developing countries by financing saving-investment gap of developing countries [Mercieca (2010)]. Another model which reflected gap theory was the Harrod-Domar growth model [Harrod (1948); Domar (1947)]. This model argued that in the developing countries labouris abundantly available but the availability and productivity of capital is the only constraint for the growth of developing countries. Since saving capacity of developing countries is too low to achieve the target growth rate, they require foreign aid to overcome saving constraint for the enhancement of investment to have higher economic growth [Mercieca (2010)]. Chenery and Strout (1966) claimed that developing countries face foreign exchange gap besides saving or resource gap. They highlighted that developing countries have limited capacity to generate enough export earning needed to import capital for investment. The authors claimed that foreign aid can help the developing countries in overcoming this constraint. Bacha (1990) and Taylor (1990) identified a third gap known as fiscal gap. They claimed that some developing countries have very low revenue raising capacity to cover the desired level of investment. If foreign aid is provided directly to the government, it could relax fiscal gap of recipient countries. Hence, it can be concluded that foreign aid can supplement domestic saving, foreign exchange and revenues. By filling these aforementioned gaps foreign aid stimulates investment in recipient country which leads to a higher economic growth.

Based on the gap theories mentioned above, empirical research on the macroeconomic impact of foreign aid has been divided into four generations. The first generation researchers worked on the impact of foreign aid on saving. The second generation used investment as independent variable for analysis. The third generation interpreted aid with growth and the fourth used development variables as yardstick to check the effectiveness of foreign aid [Ali (2008)].

Hansen and Tarp (2000) conducted a survey of the first and the second generation research and concluded that the researchers mostly used cross sectional data. Here, the single equation method to test regression for total sample and sub-samples, based on geographical locations was used. Based on their survey, the results of the three generation regressions are given below:

Table 3

Impact of Foreign Aid on Saving, Investment and Economic Growth

Impact of Foreign Aid	First Generation (Saving)	Second Generation (Investment)	Third Generation (Growth)
Positive Impact	2 %	94 %	55 %
Negative Impact	61 %	0 %	1 %
No Impact	36 %	6 %	43 %

Source: Adapted from Moreira (2005).

The empirical research of growth generation contributed more in policy formulation of the donors by late 1990s. Up to that time, the researchers could

not reach consensus on the impact of foreign aid on economic growth. Earlier, empirical research in 1960s and 1970s produced controversies regarding impact of foreign aid. Empirical research at macro level in the late 1990s played a very important role in shaping the donor policies. The World Bank (1998) through the empirical research concluded that aid works productively in a better policy environment. This conclusion has played a very important role in stimulating recent increase in foreign economic assistance which had been stagnated in the early 1990s [Mercieca (2010)]. These findings were further justified by the empirical research of Burnside and Dollar (2000), who concluded that aid works better in countries having good fiscal, trade and monetary policies. Contrarily, a number of studies concluded that aid works in developing countries, irrespective of the differences in quality of policy regimes [e.g. Amavilah (1998); Hansen and Tarp (2000, 2001); Dalgaard and Hansen (2001); Lensink and Morrissey (2000); Lensink and White (2001); Hudson and Mosley (2001); Lloyd, *et al.* (2001); Chauvet and Guillamont (2002); Gounder (2001, 2002); Mavrotas (2002); Ram (2003); Feeny (2005); Outtara and Strobl (2004); Heady, *et al.* (2004); Roodman (2003) and Clemens, *et al.* (2004)]. The empirical research also ascertained that as aid is given through different modalities, therefore application of aggregate aid variable does not give meaningful results [Mavrotas (2003); Feeny (2005)].

Ouattara and Strobl (2004) used data of 72 countries for the period from 1973 to 1997 and concluded that Project Aid is more effective than Programme Aid. Similarly, Ishfaq and Ahmad (2004) divided aid into 'Programme Aid, Technical Assistance and Food Aid'. They concluded that technical assistance is more effective in promoting growth in Pakistan. Major deficiency in the study of Ishfaq and Ahmad (2004) is that they have not used Project Aid for analysis. They have used OLS method and data set is up to 2000. By incorporating Project Aid into analysis with suitable econometric technique, the study can be extended up to 2009 using panel data. Similarly, dividing aid into 'Project Aid and Non-Project Aid', Khan and Ahmed (2007) used ARDL model and concluded that Project Aid is more effective than Non-Project Aid in defining growth in Pakistan. Deficiency in this study is that the authors have not used investment in their model and according to Feeny (2005), removing investment from regression of aid and growth will result into serious model misspecification. Moreover, they have used Non-Project Aid which included not only Programme Aid but also Technical Assistance and Food Aid. Feeny (2005) has analysed the times series data from 1965 to 1999 to see the impact of foreign aid on economic growth in Papua New Guinea. Using ECM version of ARDL model he concluded that aggregate aid has no impact on long run economic growth. By dividing aid into Project Aid and Budget Support (i.e. Programme Aid), he concluded that Project Aid is more effective than Budget Support in promoting economic growth in Papua New Guinea.

The main deficiency in the above mentioned studies is that they have used single equation models to assess the impact of aid on economic growth. Aid and growth relationship is complicated. Foreign Aid impacts growth

through different channels. Therefore, single equation modelling is not an appropriate method to explore this relationship [White (1992)]. Few researchers have gone beyond single equation modelling and have used structural equation modelling to explore this relationship. For example, Ali and Isse (2007) used a system of three equations, i.e. growth, trade and aid. They tested data of 150 countries for the period from 1975 to 2000. Using 3SLS method they concluded that aid is a strong determinant of growth. Similarly, Quazi (2000) used a system of two equations, i.e. saving and growth, to explore the impact of aid on economic growth for Bangladesh from 1973 to 1996. Using 2SLS method, he concluded that aid has a positive impact on economic growth in Bangladesh. The above mentioned studies are comprehensive in terms of methodology. However, they have assessed the impact of foreign aid on economic growth using aggregate aid variable only.

Literature shows that foreign aid impacts growth by contributing into physical capital and human capital investment [White (1992)]. In this connection, it is important to mention a few studies that explored the impact of foreign aid on human capital through single equation method. For example, Ali (2008) used data of Pakistan from 1975 to 2006. Applying ARDL bound test, he concluded that the aid has positive impact on human capital in Pakistan. Masud and Yontcheva (2005) explored effectiveness of foreign aid provided by Non-Government Organisation (NGO) and bilateral aid in promoting health and education. They tested data for an unbalanced sample of 51 countries from 1990 to 2001. Using GMM technique, the authors concluded that NGO aid and bilateral aid both have insignificant impact on human capital.

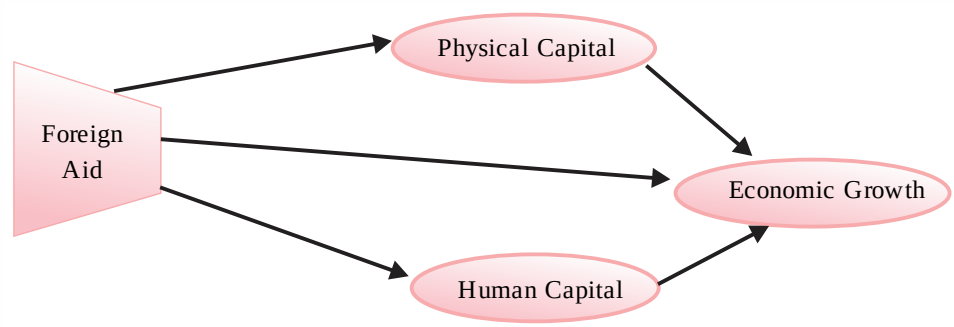
To sum up, there are three main conclusions of the empirical research. First, aid and economic growth relationship is significant in the countries having sound fiscal, monetary and fiscal policies. Second, disaggregate aid variables give more meaningful result than aggregate aid variables. Third, aid contributes in economic growth through different channels. Hence, using single equation method to find relationship between aid and economic growth is not appropriate. We may conclude that system equation method is more suitable to know the nature of aid and growth relationship. However, currently no research is available on aid and economic growth relationship, using disaggregated aid variables by incorporating system equation method.

4. THE CONCEPTUAL FRAMEWORK

Most of the research papers written on aid and growth relationship are based on single equation modelling. However, according to White (1992), single equation method is not a suitable methodology, if any of the regressors form part of a simultaneous system with dependent variable. He further elaborated that finding aid-growth relationship is undoubtedly the case of simultaneous system. He argued that Harrod-Domar model is not a perfect characterisation of the economic growth process. For finding meaningful aid and growth relationship, he suggested that econometric literature on aid and growth relationship should move beyond single equation method. White (1992) claimed that effective

labour force contributes significantly in economic growth. Increase in the effective labour force is explained by improvement in human capital. The author concluded that impact of aid on growth is not as simple as explained in Harrod-Dommar model. Aid affects growth through other channels as well, such as human capital, etc. Therefore, we need to take help from system equation method to explore impact of aid on economic growth. The above discussion also clarifies that foreign aid affects economic growth through formation and accumulation of physical and human capital.

Fig. 1. Path Diagram of Foreign Aid Impact on Economic Growth



Growth Equation

Various factors of production and technology determine output of an economy. Following Loening (2002) and Babatunde, *et al.* (2005), who considered human capital as independent factor of production beside labour and capital; our production function will look as following:

$$Y = f(A, L, K, H) \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (1)$$

Where Y is the percent change in real GDP. K represents physical capital and L is labour, A shows total factor productivity and H represents human capital. As we are going to investigate the impact of foreign aid on growth, we assume that total factor productivity is function of foreign aid besides other factors. Total factor productivity basically provides measure of economic efficiency, in producing maximum quantity of output with given quantity of input. It is basically reflection of economic policies, political situation and institutional changes in addition to technological progress [Hussain (2010)]. Bjurek and Durevall (2000) concluded that foreign aid has strong positive relationship with productivity growth. Similarly, Hansen and Tarp (2000) stated that "aid works through the channels which impact the total factor productivity". Based on the above discussion we can write following functional equation:

A = f (Aid, Trade policy, Monetary policy, Fiscal policy, Institutional quality)

By substituting these factors into Equation (1) we obtain:

Y= f (L, K, H, Foreign aid, Trade openness, Monetary policy,
Fiscal policy, Institutional quality) … … … … (2)

The percentage change in real GDP is used as output (dependent) variable. As input factors, labour force variable (People between 15 and 64 years of age as percentage of total population) is used for input 'L'. Investment variable (Gross capital formation as percent of GDP) is considered for input 'K'. The input 'A' (foreign aid) is divided into two components, i.e. project aid and programme aid. Policy variables of budget deficit to GDP ratio and inflation rate are used as proxies for fiscal and monetary policy, respectively. For trade policy trade openness variable (Trade as percentage of GDP) is used. Freedom house index is used to represent institutional quality. For human capital 'H', we considered data on educational attainment from Barro and Lee (2010). After substituting all these proxy variables in function (2), we obtained following equation:

$$Yti = a + b1Proj.Ati + b2Prog.Ati + b3Lti + b4Iti + b5BDti + b6TOIti + b7INFti + b8PFIti + b9Hti+U \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (3)$$

Where we expect

$$b1 > 0, b2 > 0, b3 > 0, b4 > 0, b5 < 0, b6 > 0, b7 < 0, b8 > 0, b9 < 0, b10 > 0$$

In the above Equation (3)

Y= Real GDP growth, Proj. A= Project aid, Prog. A= Programme aid, L= Labour force, I= Investment (Gross Capital Formation as percent of GDP), BD = Budget deficit as percent of GDP, TOI= Trade Openness Index, INF= Percent change in consumer price index (CPI), PFI= Political freedom index, H= Human capital (Average years of schooling).

Where t represents time and i represents country in a balanced panel of 150 countries for the period from 1995 to 2009.

We have included three policy variables, namely fiscal policy (budget deficit), monetary policy (inflation) and trade policy (trade openness) variables in the aid and growth equation. These variables have been frequently used in literature after the study of Burnside and Dollar (2000). Inflation and budget deficit are expected to have negative impact on growth, while trade openness is expected to have positive impact on economic growth [Javid and Qayyum (2011)].

For political freedom we have used freedom house index. Isham, *et al.* (1997) concluded that rates of return on projects, financed by the World Bank in various developing countries over the period 1974-93, were higher in nations with greater civil liberties. Scully (1988) used the freedom house index as measure of nations' institutional quality. Unlike other indicators of the governance, the data of freedom house is available for a long period covering more countries. Groslambert, *et al.* (2006) have used this index as a proxy for overall institutional quality of the country. Due to the importance of institutions in growth process, the political freedom index is also used in this study as proxy variable for institutional quality.

Physical Capital Equation

As evident from literature, aid affects growth mainly through investment. A major part of the aid goes into investment. Therefore, separate equation for investment is given below:

Physical capital (Investment) = f (Foreign aid, GDP growth, Government consumption expenditure, Domestic credit offered by banks, FDI, Policies, Governance) … … … … … … (4)

Hence, physical capital (investment) equation is given below:

$$Iti = a + b1Proj.Ati + b2Prog.Ati + b3Yti + b4Gti + b5DCti + b6FDIti + b7INFti + b8BDti + b9TOIti + b10PFIti + U \quad \ldots \quad \ldots \quad \ldots \quad (5)$$

Where we expect that

$$b1 > 0,\ b2 > 0,\ b3 > 0,\ b4 > 0,\ b5 > 0,\ b6 > 0,\ b7 < 0,\ b8 > 0,\ b9 > 0,\ b10 > 0,\ b11 < 0$$

In Equation (5):

I= Investment as ratio to GDP, Y = GDP growth, G = Government consumption expenditures, DC = Domestic credits offered by banks, FDI = Foreign Direct Investment, INF = Inflation (proxy for monetary policy), BD = Budget deficit as a ratio to GDP (proxy for fiscal policy), TOI=Trade Openness Index, i.e. trade as percentage of GDP (proxy for trade policy), PFI= Political Freedom Index (Measure of institutional quality or governance in country).

The above mentioned determinants of the investment were used by Feeny (2005) and Hecht, *et al*. (2004). The government economic policies, namely the monetary policy (inflation), the fiscal policy (budget deficit) and the trade policy (trade openness index) reflect control of government over macroeconomic environment. Good policy environment provides an incentive for the investors to invest.

Similarly, the government consumption policies may either crowd out or crowd in investment in a country. According to neoclassical investment theory, the growth in real output is an important determinant of investment in a country. This is because the growth in real output indicates changes in the aggregate demand which investors seek to meet [Can and Ozturk (2011)].

According to Keynesian view "state of credit" is an important determinant of the investment. Similarly, many authors linked investment with the size of financial intermediation in national economy [Gurley and Shaw (1955); McKinnon (1973); Shaw (1973); Greenwood and Smith (1997)].

Human Capital Equation

Human capital accumulation through educational attainment has strong link with the economic growth. Thus, following Barro and Lee (2010), the data set for the educational attainment (average years of schooling) is taken as proxy

for human capital. Literature survey shows that educational attainment in a country depends on the following inputs.

Educational Attainment = f (Foreign aid, Public education expenditures, Teacher pupil ratio, Urbanisation, Per capita income, Poverty) … … … (6)

Based on the above determinants, our equation for human capital is given below:

$$Hti = a + b1Proj.Ati + b2Prog.Ati + b3EEti + B4Urbti + b5PCYti + b6PHCti + b7PTRti + U \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (7)$$

Where we expect that

$$b1 > 0, b2 > 0, b3 > 0, b4 > 0, b5 > 0, b6 < 0, b7 < 0$$

In Equation (7):

H = Human capital, EE = Public education expenditures, Urb = Urbanisation, PCY = Per capita GDP, PHC = Poverty head counts, PTR = Pupil teacher ratio.

The determinants used in the above equation were used by Chaudhry and Aman (2010) and Masud and Yontcheva (2005). The rationale for using urbanisation (urban population as percentage of total) as determinant of educational attainment is that educational services are readily available in cities as compared to villages. University and colleges are also established in urban areas. Millennium Development Goals (MGDs) reports stated that low income and poverty issues were major reasons for high school drop-out ratios in developing countries. This justifies incorporation of per capita income and poverty head counts variables in our model. Masud and Yontcheva (2005) compared 10 countries having highest illiteracy rate with 10 countries having lowest illiteracy rate and concluded that "higher illiteracy rates appear to be associated positively with higher poverty levels and negatively with the level of urbanisation…Bilateral aid, on the other hand, is lower than average in countries with high illiteracy rates and higher in countries with low levels of illiteracy. The government effort (measured by education expenditure per capita) appears to be far lower than average in countries with the highest levels of illiteracy and much higher than average in countries with high levels of illiteracy."

Data and Sources

Initially, we considered data for 150 aid recipient countries from 1995 to 2009. But due to problems of missing data for certain variables, the number of countries were reduced to 27. The problem of missing values of the data in these countries was solved through interpolation method.

Three different types of data set were available for Project and Programme Aid. First, OECD–CRS Project Aid and Programme Aid commitment data was available from 1974 to 2009. This commitment data was

used by Cordella and Dell'Ariccia (2003). Problem in commitment data was that aid commitment does not reflect the actual amount of aid delivered to aid receiving countries. To overcome this problem, Project Aid and Programme Aid commitment data was converted into disbursement data.[1] This method of converting the commitment data into disbursement data was followed by other researchers, such as Ouattara and Strobl (2004) and Camara (2004). This is what we categorised as second type of data. Initially, it was aimed to use the second type of data for analysis but after calculation of the data, we got very strange foreign aid figures for few countries. In some cases, the calculated disbursement was higher than the commitment figure and in other cases the former was quite lower than the latter figure. Even for some countries, negative aid disbursement figures were received which had no meaning. Third type of data was available in the actual disbursement form in OECD-CRS data base. But the data covered a period from 2002 to 2009. Thus, we used actual aid disbursement data for 2002-2007 from OECD-CRS database. The purpose of reducing the upper bound of sample period from 2009 to 2007 was to eliminate impact of financial crises in 2008 on results.

The data on political freedom was taken from Freedom House, based on two categories, namely the political rights and the civil liberties. The political rights permit people to take part in political process actively through the use of votes, struggle for public office and election of representatives for policy-making. The civil liberties allow civilians in the freedoms of expression and belief, assembly, educational, associational and organisational rights, rule of law and personal self-sufficiency without interference from the state. Every country is placed on a scale of 1 to 7 where 1 represents the highest level of freedom and 7 the lowest level.

The data on human capital was taken from Barro and Lee (2010) online database whereas the data on the remaining variables was retrieved from World Development Indicators.

Estimation Methods

The Equations 3, 5 and 7 clearly show the presence of simultaneity and endogeneity problem in our model. In such cases the usage of ordinary least square method (OLS) gives inconsistent results. Presently, the generalised method of moment (GMM) is considered to be the most efficient method to estimate a model with panel data, containing endogeneity and simultaneity problem [Amin (2012)]. We can see that GDP growth, investment and human capital determine each other simultaneously. It means our model has problem of endogeniety.

Haavelmo (1943), who introduced simultaneous equation method, claimed that if variables are operating in simultaneous framework, they should be estimated

[1] At first stage, the commitment data on Project Aid and Program Aid was added to have total figure. At second stage, percentage share of Project Aid and Programme Aid in total commitment was calculated. At third stage, these percentages were applied to the net ODA disbursement data available in OECD-DAC database minus food aid and technical assistance [Mavrotas (2002)].

through system method and not through single equation method, because the in latter case each equation violates restrictions imposed by other equations. In that case, a single equation method may generate misleading results. Moreover, the efficiency of results depends on developing model, which successfully define and capture stochastic properties of the variables generating simultaneity in the system. A model with limited information, i.e. by estimating separate equation one by one, does not capture simultaneous information of other equation in the system [Amin (2012)].

GMM is more efficient for simultaneous equations system with large number of cross-section (N) and short time period (T). Hence, we opted for "GMM time series HAC" for estimation in E-Views 5. This estimation technique has additional advantage of producing hetroskedasticity and auto-correlation consistent standard errors. GMM addresses heterogeneity problem arising from unobserved country specific problems, enables dynamic estimation of relationship and resolves endogeneity problem [Amin (2012)].

Although GMM produces efficient and consistent results in the presence of hetroskedasticity, but the efficiency of GMM depends on the instrumentation of endogenous variables in the system. A valid instrument has two features: Firstly, it is strictly correlated with endogenous variables. Secondly, it is orthogonal to error term. It is hard to find strictly exogenous instruments which are outside the model. Hence, an internal instrumentation of exogenous variables was followed. Following Amin (2012), lagged values of endogenous variables and level values of strictly exogenous variables were used as an instrument.

Using data of 27 countries[2] from 2002 to 2007, Equations 3, 5 and 7 were tested in the first stage, using GMM (HAC). Majority of the results were insignificant. The point of concern was that some core variables were insignificant having opposite signs.[3] The second stage was to reduce the number of control variables. For this purpose, separate equation for growth, investment and human capital were tested using OLS method. All the insignificant and less relevant variables were removed. After removing the insignificant variables, the system of growth, investment and human capital was tested using GMM, as mentioned in the following equations:

Growth Equation:

$$Yti = a + b1PJDti + b2PGDti + b3Iti + b4HCBti \quad \ldots \quad \ldots \quad \ldots \quad (8)$$

Where we expect that B1>0, b2>0, b3>0, b4>0.

In the above Equation (8) PJD = Project Aid Disbursement, PGD = Programme Aid Disbursement, I= Investment and HCB = Human Capital [Barro and Lee (2010)].

Investment Equation:

$$Iti = a + b5PJDti + b6PGDti + b7Yti + b8Gti + b8DC \quad \ldots \quad \ldots \quad \ldots \quad (9)$$

Where we expect that B5>0, b6>0, b7>0, b8>0.

[2]See list of countries in Appendix 1.

[3]See results given in Appendix 2.

In Equation (9) G = Government consumption expenditures, DC = Domestic Credit Offered by Banks.

Human Capital Equation:

$$HCBti = a + b9PJDti + b10PGDti + b11EEti + b12PHCti + b13PTPti \quad \ldots \quad (10)$$

Where we expect that B9>0, b10>0, b11>0, b12<0, b13<0.

In Equation (10) EE = Education Expenditure, PHC = Poverty Head Counts, PTP = Pupil Teacher Ratio.

5. ESTIMATIONS AND RESULTS

Nexus of Foreign Aid and Economic Growth

The system of economic growth, the investment and human capital equations, given as Equations 8, 9 and 10 in the previous section, was estimated using data of 27countries (see Appendix 2) for the period 2002 to 2007. Using GMM (HAC) estimation method following results were obtained:

Table 4

Estimation Results for Nexus of Aid and Growth

Growth Equation			
Variable	Coefficients	T- value	P-value
Constant	1.363782	1.094081	0.2745
Project Aid	0.002955	2.338387	0.0198
Programme Aid	0.001658	1.441241	0.1502
Investment	0.108388	2.473021	0.0138
Human Capital	0.092233	0.912122	0.3622
List of Instruments: GDP Growth (–1), Investment (–1), Human Capital (–1) Project Aid, Programme Aid			
Investment Equation			
Constant	–19.16181	–1.681636	0.0933
Project Aid	–0.013059	–1.473313	0.1413
Programme Aid	–0.009380	–1.342810	0.1800
GDP Growth	7.449391	4.522604	0.0000
Government Expenditure	0.485401	2.177678	0.0299
Domestic Credit Offered by Banks	0.026706	0.582100	0.5608
List of Instruments: Investment (–1), GDP Growth (–1), Project Aid, Programme Aid, Government Consumption Expenditure, Domestic Credit Offered by Banks			
Human Capital Equation			
Constant	9.108654	15.74144	0.0000
Project Aid	–0.000103	–0.098800	0.9213
Programme Aid	0.002004	2.440468	0.0150
Education Expenditures	0.288742	4.802003	0.0000
Poverty Head Counts	–0.057696	–5.475817	0.0000
Pupil Teacher Ratio	–0.070938	–3.083754	0.0022
List of Instruments: Human Capital (–1), Project Aid, Programme Aid, Education Expenditure, Poverty Head Counts, Pupil Teacher Ratio			

The above table reveals that Project Aid has significant positive impact on economic growth at 5 percent significance level. One percent increase in Project Aid causes 0.002 percent increase in economic growth. This result matches the findings of other researchers [Ouattara and Strobl (2004); Ishfaq and Ahmad (2004); Khan and Ahmed (2007); Feeny (2005)], who found that Project Aid has significant impact on the economic growth. Programme Aid, however, has insignificant impact on the economic growth. This result matches Ouattara and Strobl (2004), Ishfaq and Ahmad (2004), who concluded that project aid is more effective in generating economic growth as compared to programme aid. It was also found that Project Aid has insignificant impact on investment and human capital. Our results are also supported by Hansen and Tarp (2000) survey findings, mentioned in Table 3 under section two. These results partially match with the findings of Boone (1994); Durbarry, *et al*. (1998); and Mosley, *et al*. (1987), who found that overall aid has insignificant impact on the economic growth. The results are supported by the discussion in section two, wherein we found substantial empirical evidence to support the fact that Project Aid is superior to Programme Aid in generating economic growth.

The investment equation section in the table reveals that both project and programme Aid has insignificant impact on investment. This result matches the literature survey results, conducted by Hansen and Tarp (2000) that 6 percent of literature found no relation between foreign aid and investment.

According to the results in Table 4, Programme Aid has positive and significant impact on human capital and at 5 percent significance level, one-percent increase in Programme Aid increases human capital by 0.002 percent. Although no study is available about impact of aid on human capital, using disaggregate variables but our finding is partially supported by the finding of Chaudhry and Aman (2010). They analysed the impact of aggregate foreign aid on human capital and found that foreign aid has significant positive impact on human capital. This finding is supported by the fact that World Bank in 2001 started poverty reduction support credit (PRSCs) as one of the main components of International Development Association (IDA), to support low-income countries. PRSCs come under programmatic approach to policy based lending, wherein a major part of the lending was allocated to education and health sector [Factora (2006)]. Moreover, the author also claimed that health and education are the most suitable sector for Programme Aid.

Results show that Project Aid has significant impact on economic growth, but insignificant impact on investment and human capital. Similarly, Programme Aid has insignificant impact on economic growth and investment but positive impact on human capital. The reason for positive impact of project aid on growth could be the fact that project aid works on economic growth through other channels, like total factor productivity, not included in our system of equations. Reason for positive impact of programme aid on human capital could be the fact that this modality is best suited to social sector development.

All economic variables have correct sings and are statistically significant except the human capital. Table 4 reveals that human capital has insignificant

impact on growth and this finding, however, contradicts the endogenous growth theory. Several possible explanations have been given in this regard. Krueger and Lindhal (2001) argued that measurement error is possible explanation for negative and insignificant result. Some researchers [e.g. Fuente and Domenech (2002); Cohen and Soto (2007)] argued that poor data may be responsible for the conflicting results. Some other researchers [e.g. Bassanini and Scarpetta (2001); Freire-Seren (2002)] claimed that poor estimation methodology might be responsible for poor results. Despite the fact that we used advanced data for human capital and proper estimation technique, our results still contradict the theoretical foundation. Perhaps, the conclusion of Haque and Hussain (2013) supports our findings, by concluding that improvement in human capital may increase non-productive efficiencies, namely 'bureaucratic stealing'. The net effect of human capital depends on the behavior of human resource in the country. Moreover, the net impact of improvement in human capital may be negative or insignificant, if the nonproductive behaviour dominates the productive behaviour.

Investment has significant and positive impact on GDP growth at 5 percent level of significance and one percent increase in investment leads to 0.11 percent increase in GDP growth. This result is supported by theory, i.e. Harrod-Domar model, and empirical findings [e.g. Ucan and Ozturk (2011)]. According to our results, the GDP growth appears to have positive and significant impact on investment and one percent increase in GDP boosts investment by 7.4 percent. This finding is compatible with neoclassical investment theory which claims that growth in real output is an important determinant of investment. This is because the growth in real output indicates changes in aggregate demand which investors seek to meet. The finding is also supported by empirical evidences [e.g. Ucan and Ozturk (2011)]. Our results show that government consumption expenditure has positive and significant impact on investment. One percent increase in the government consumption expenditure increases investment by 0.48 percent. The finding is supported by Ucan and Ozturk (2011), who claimed that government consumption policies may either crowd out or crowd in investment. The results show that domestic credit has insignificant impact on investment. This result contradicts with Keynesian view that 'state of credit' in a country is important factor in determining investment in a country. Although the results are consistent with empirical research findings of Hailu (2015), who found that domestic credit has insignificant and negative impact on investment.

The education expenditure has a positive and surely significant impact on human capital accumulation. One percent increase in education expenditure enhances human capital by 0.28 percent. This is compatible with the fact that the government education expenditure is the main input for provision of education infrastructure and services. The finding is also supported by empirical evidences [e.g. Chaudhry and Aman (2010)]. Poverty head counts have negatively significant impact on human capital accumulation. The results show that one percent increase in poverty head counts decreases human capital by 0.06 percent. This is compatible

with evidences from developing countries that poverty is the main reason for high dropout ratio from schools [Dieltiens and Meny-Gibert (2008)]. Pupil teacher ratio has negative and significant impact on human capital. One percent increase in pupil teacher ratio causes decline in human capital by 0.07 percent. This result is supported by the fact that small pupil teacher ratio improves the education system both by quality and quantity [Chaudhry and Aman (2010)].

Nexus of Foreign Aid, Economic Policies and Economic Growth

The purpose of this section is to test the conclusion of World Bank (1998) and Burnside and Dollar (2000), who claimed that aid works better in countries having better policies.

In order to study the policy nexus of foreign aid and economic growth, a policy index of Burnside and Dollars (2000) variables, namely inflation, budget deficit and trade openness, using principal component analysis (PCA) was constructed. We found weights for the variables separately for each country through PCA in Eviews-7. The first vector of components was used as weights, as they represent high degree of correlation. Weights were first normalised and then, following Javid and Qayyum (2011), the index was created using following equation:

$$\text{Policy Index} = a_1 * \text{Trade openness} - a_2 * \text{Inflation} - a_3 * \text{Budget deficit} \quad \ldots \quad (11)$$

To assess the nexus between the foreign aid, economic policies and economic growth, in first stage, interaction term (aid*policy) besides the policy index was added into Equation 8, wherein aid was sum of Project Aid and Programme Aid and policy was the policy index created through Equation 11.[4] The estimation results showed that the interaction term (aid*policy) is significant. It means that effectiveness of aid depends on the quality of policy regime. This result contradicts with the results of Outtara and Strobl (2004), Heady, *et al.* (2004), Roodman (2003) and Clemens, *et al.* (2004). However, the result matches with discussion in earlier section of paper that aid works better in better policy regimes. The result also matches with empirical finding of World Bank (1998) and Burnside and Dollar (2000).

In the second stage, we added two interaction terms, i.e. Project Aid*policy and Programme Aid*policy, besides policy index into Equation 8 and ascertained that both the interaction terms were insignificant.[5] It suggested that economic policies have no role into enhancing effectiveness at segregated level. These results are consistent with the findings of Outtara and Strobl (2004), who found that interaction terms of both project and programme aid with policy index were insignificant.

We found that the nexus of policies and economic growth is established at aggregate level. This result matches with the well-understood phenomenon that sound economic policy is a reflection of good economic management, which most probably enhances effectiveness of foreign aid for economic growth.

[4]See results in Appendix 3.
[5]See results in Appendix 4.

6. CONCLUSIONS AND RECOMMENDATIONS

During the previous decade, the OECD organised several high level international forums on foreign aid effectiveness. In these forums, a series of agreements were reached. The central agreement was to deliver foreign aid in a way that increases local ownership of aid utilisation. In this regard the traditional aid instrument, namely Project Aid, was criticised for its fragmented implementation and huge transaction cost. Thus, in principle, delivery of foreign aid through Programme Aid, wherein funds are transferred through local systems, was supported and agreed in high level forums. In response to these agreements, share of Programme Aid increased during the past decade. This paradigm shift in aid delivery instruments triggered debate and research on foreign aid modalities, i.e. Project and Programme Aid.

In Programme Aid it is difficult to track down the end use of the fund being utilised. Thus, at recipient end, Programme Aid is associated with fiduciary risk with the components of weak country public financial management and procurement system as well as official corruption. To avoid the risk associated with Programme Aid, the instrument has been attached with strict conditions. Apparently, these conditions were imposed to avoid the slippage of funds. The conditions have expanded from macroeconomic reforms to good governance, demand for democracy and efficiency and transparency in public financial management and procurement system. Since 2000, donors started awarding recipient countries with economic assistance on the basis of past performance rather than future promises. It has been argued that economic reforms programmes are counter-productive for developing countries and they are designed to serve the commercial interest of donors.

The new procurement reforms associated with Programme Aid in the name of efficiency has been criticised by many analysts. Efficiency in the context of cost and price as well as in quality through open competition supports more liberal procurement system. This increases chances for big foreign firms and multinational concerns to win contracts due to economies of scale. The involvement of donors in procurement system has undermined the ability of a recipient country to link its procurement system with its own development priorities.

Several empirical studies have been conducted to evaluate the impact of Project and Programme Aid on economic growth. Some of them concluded that Project Aid has positive impact and Programme Aid has negative impact on the economic growth. The major weakness of these studies is that they have applied single equation method to see the impact of aid variables on economic growth. As foreign aid contributes into economic growth through different channels, therefore a method of system equations is more appropriate to estimate the impact of foreign aid on economic growth.

To fill the gap in literature, this study used three equations system, i.e. growth, investment and human capital, to see the impact of Project and Programme Aid on GDP growth. The system by incorporating data of 27 countries for the period from 2002 to 2007 was estimated. With application of

Generalised Method of Moment, we found that Project Aid has significant impact on economic growth but insignificant impact on investment and human capital. Programme Aid has insignificant impact on economic growth, insignificantly negative impact on investment and significantly positive impact on human capital. All the other macroeconomic variables were correctly signed and statistically significant. Only human capital has insignificant impact on economic growth which contradicts theory, but supports empirical evidence from developing countries. It was also found that in these countries economic policies play a role in enhancing effectiveness at aggregate level but at segregated level the nexus of foreign aid and policies is insignificant for both types of aid instruments.

A discussion on these findings concluded that Project Aid is still a dominant modality of aid and is contributing more to economic growth as compared to programme aid. The reason for less effectiveness of programme aid could be linked to the fact that programme aid works better in a sound institutional set up, strong political will and transparent governing system. The risk associated with programme aid in the shape of fiduciary risk, corruption, lack of political will and weak economic and financial management system are harsh realities across all developing countries, which may be playing role in hampering its effectiveness in generating economic growth in aid receiving countries. Programme aid is associated with tough conditionality's, which challenges ownership and hampers the process of capital formation. The stated reasons may be responsible for little contribution of programme aid in promoting economic growth and investment in aid receiving countries.

Programme Aid of the World Bank aimed at poverty reduction has mainly supported education and health sectors which were considered to be the most suitable sectors for programme financing. Our empirical finding supports the evidence that Programme Aid has positive and significant impact on human capital. Good economic policies reflect good economic management which should enhance effectiveness of foreign aid for economic growth. This is reflected in our empirical findings which show that complementarity between foreign aid and sound economic policies for enhancing economic growth exists at macro level.

It can be concluded that Project Aid is still superior to Programme Aid in generating economic growth, but in the context of social development, programme aid is more effective due to the nature of this modality. The reason for overall non effective role of programme aid is that this modality is associated with tough conditionalities, which leave little space for the recipient countries to pursue their development objectives according to their own priorities. For better aid effectiveness, the recipient government should have the necessary space to pursue its own development objectives. The current monopoly of the donor agencies in prescribing policies and economic ideas, combined with weak bargaining position of developing countries, are the main hurdles in the development of sustainable and mutually beneficial relationship. Unless serious attempts are made on both

sides to come out of the incentive structures available for both donor and recipient, the objective of effective aid utilisation cannot be achieved. Utilisation of aid through collective planning can bring the desirable outcome of development in the recipient countries.

Lastly, it is believed that a true development outcome can surely be realised, if foreign aid is not used as a tool for business promotion of donor countries, but for the improvement of infrastructure and living standards of the people in the aid recipient countries.

Appendix 1

List of Countries

No.	Country	No.	Country
1	Brazil	18	Mauritania
2	Costa Rica	19	Mexico
3	Croatia	20	Moldova
4	Egypt, Arab Rep.	21	Morocco
5	El Salvador	22	Mozambique
6	Gambia, The	23	Namibia
7	Ghana	24	Nepal
8	Guatemala	25	Nicaragua
9	Indonesia	26	Niger
10	Iran, Islamic Rep.	27	Pakistan
11	Kazakhstan		
12	Kenya		
13	Kyrgyz Republic		
14	Lao PDR		
15	Lesotho		
16	Malaysia		
17	Mali		

Appendix 2

Estimation Results of Equations 3, 5 and 7

Variable	Coefficients	T value	P value
Growth Equation			
Constant	–0.893523	–0.299276	0.7648
Project Aid	0.000966	1.511996	0.1310
Programme Aid	0.000934	0.729208	0.4662
Investment	–0.167482	–3.213846	0.0014
Human Capital	–0.515271	–2.481933	0.0133
Labour	0.174993	2.361264	0.0185
Institutional Quality	–0.600618	–1.969733	0.0493
Trade Openness	0.020842	3.014685	0.0027
Inflation	0.166187	3.411033	0.0007
Budget Deficit	0.087889		
List of Instruments: GDP Growth(–1), Investment (–1), Human Capital (–1) Project Aid, Programme Aid, Labour, Institutional Quality, Trade Openness, Inflation			
Investment Equation			
Constant	49.41231	2.570394	0.0104
Project Aid	0.014036	2.549838	0.0110
Programme Aid	0.002653	0.358065	0.7204
Government Consumption Expenditure	–0.643782	–1.403227	0.1611
FDI	0.878323	2.495309	0.0128
Domestic Credit	–0.032245	–0.426333	0.6700
GDP Growth	–6.908002	–2.507185	0.0124
Inflation	0.965794	3.248268	0.0012
Trade Openness	0.112273	1.791511	0.0737
Budget Deficit	0.829636	2.490389	0.0130
Institutional Quality	–2.859065	–1.130053	0.2589
List of Instruments: Investment (–1), GDP Growth (–1), Project Aid, Programme Aid, Government Consumption Expenditure, FDI, Domestic Credit, Inflation, Trade Openness, Institutional Quality			
Human Capital Equation			
Constant	8.174302	2.240060	0.0254
Project Aid	0.000112	0.067811	0.9460
Programme Aid	0.000697	0.372317	0.7098
Education Expenditures	0.346330	2.062378	0.0396
Poverty Head Counts	–0.059746	–1.348099	0.1781
Urbanisation	–0.018347	–0.433814	0.6646
Pupil Teacher Ratio Primary	–0.077231	–1.123415	0.2617
Pupil Teacher Secondary	0.070546	0.968607	0.3331
Per Capita Income	9.95E-05	0.312401	0.7548
List of Instruments: Human Capital (–1), Project Aid, Programme Aid, Education Expenditure, Poverty Head Counts, Pupil Teacher Ratio Primary, Pupil Teacher Ratio Secondary, Per Capita Income, Urbanisation			

Appendix 3

Estimation Results for Nexus of Aid, Policies and Growth

Variable	Coefficients	T value	P value
Growth Equation (Dependent Variable: GDP Growth)			
Constant	1.505424	1.189044	0.2350
Project Aid	–0.001366	–0.635504	0.5254
Programme Aid	–3.21E–06	–0.002453	0.9980
Investment	0.110541	2.631179	0.0088
Human Capital	0.095823	0.862886	0.3886
Policy Index	–0.009683	–0.461266	0.6448
Aid*Policy	0.000183	1.919606	0.0555
List of Instruments: GDP Growth(–1), Investment (–1), Human Capital (–1) Project Aid, Programme Aid, Policy Index, Aid*Policy			
Investment Equation (Dependent Variable :Investment)			
Constant	–16.94765	–1.476682	0.1404
Project Aid	–0.011788	–1.369952	0.1714
Programme Aid	–0.008855	–1.284432	0.1996
GDP Growth	6.841512	4.103360	0.0000
Government Consumption Expenditures	0.498278	2.260032	0.0243
Domestic Credit Offered by Banks	0.032932	0.693561	0.4883
List of Instruments: Investment (–1), GDP Growth (–1), Project Aid, Programme Aid, Government Consumption Expenditure			
Human Capital Equation (Dependent Variable: Human Capital)			
Constant	9.210659	16.37553	0
Project Aid	–0.00015	–0.14264	0.8866
Programme Aid	0.001995	2.431992	0.0154
Education expenditures	0.275823	4.832627	0.0000
Poverty Head Counts	–0.05802	–5.50599	0.0000
Pupil Teacher Ratio	–0.07115	–3.09519	0.0021
List of Instruments: Human Capital (–1), Project Aid, Programme Aid, Education Expenditure, Poverty Head Counts, Pupil Teacher Ratio			

Appendix 4

Estimation Results for Nexus of Disaggregate Aid, Economic Policies and Growth

Variable	Coefficient	T value	P value
Growth Equation (Dependent Variable: GDP Growth)			
Constant	1.384486	1.106840	0.2689
Project Aid	0.000416	0.136115	0.8918
Programme Aid	–0.001820	–0.662103	0.5082
Investment	0.111405	2.668779	0.0079
Human Capital	0.102794	0.909300	0.3637
Policy Index	–0.006498	–0.314808	0.7530
Project Aid*Policy	8.29E-05	0.543124	0.5873
Programme Aid*Policy	0.000310	1.597259	0.1109
List of Instruments: GDP Growth(–1), Investment (–1), Human Capital (–1) Project Aid, Programme Aid, policy Index, Project Aid*Policy, Programme Aid*Policy			
Investment Equation (Dependent Variable: Investment)			
Constant	–17.03564	–1.480942	0.1393
Project Aid	–0.011841	–1.376048	0.1695
Programme Aid	–0.008877	–1.287986	0.1984
GDP growth	6.864473	4.102815	0.0000
Government Consumption Expenditures	0.497883	2.261010	0.0242
Domestic Credit Offered by Banks	0.032768	0.690522	0.4902
List of Instruments: Investment (–1), GDP Growth (–1), Project Aid, Programme Aid, Government Consumption Expenditure			
Human Capital Equation (Dependent Variable: Human Capital)			
Constant	9.206867	16.39151	0.0000
Project Aid	–0.000148	–0.141157	0.8878
Programme Aid	0.001996	2.432839	0.0154
Education Expenditures	0.276362	4.835676	0.0000
Poverty Head Counts	–0.058010	–5.505066	0.0000
Pupil Teacher Ratio	–0.071145	–3.095277	0.0021
List of Instruments: Human Capital (–1), Project Aid, Programme Aid, Education Expenditure, Poverty Head Counts, Pupil Teacher Ratio			

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Does Pak-Rupee Exchange Rate Respond to Monetary Fundamentals? A Structural Analysis

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This study empirically examines the contribution of monetary fundamentals in explaining nominal exchange rate movements in the case of Pak-rupee *vis-à-vis* US-dollar over the period 1982Q2 to 2014Q2. The empirical results support the existence of cointegration relationship between nominal exchange rate and monetary fundamentals. The results reveal that relative money stocks and real income are the key drivers of exchange rate determination in Pakistan in the long-run. For dynamic interaction, the Structural Vector Autoregressive (SVAR) method is applied. Results from the SVAR show that the responses of exchange rate to shocks, originated from money supply, income, interest rate and inflation differentials, are consistent with the predictions of the flexible-price variant of the monetary model of exchange rate in the short-run. More specifically, the results indicate that inflation and interest rate differential explain maximum variations in exchange rate in the short-run. In essence, results suggest that monetary fundamentals are the key drivers of exchange rate fluctuations in Pakistan, especially in the short-run.

JEL Classification: F31, F33, C32, F41
Keywords: Monetary Model, Exchange Rate, SVAR, Pakistan

1. INTRODUCTION

The exchange rate being a vital pillar of macroeconomic stability has received an extensive consideration by the analysts, policy-makers and researchers, especially after the Asian contagion in 1997 and global financial crisis (GFC) in 2008. However, economic policies in developing countries like Pakistan are undermined by deficiencies in the exchange rate policies. Inept exchange rate policies have contributed to debt crisis and worsened external balances which have subsequently led to an overall economic slowdown. Pakistan replaced fixed exchange rate regime in 1982 with managed floating exchange rate, which subsequently changed into floating exchange rate in 2000.[1] With a shift in exchange rate regime from managed to floating, exchange rate stabilisation has remained a matter of concern for policy-makers in Pakistan [Khan and Qayyum (2008)]. In addition, Pakistan has introduced reforms in trade and financial sectors over the last two and half decades. These reforms have introduced variations in the foreign exchange market with significant implications for macroeconomic stability and economic growth.

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[1]An analysis of exchange rate regimes is beyond the scope of this study. However, analysis of Pakistan's exchange rate regime can be seen in Rizvi, *et al.* (2014).

Pakistan has faced a decline in foreign capital inflows, exports, equity flows and a substantial depreciation of exchange rates after the GFC [Amjad and Din (2010)].[2] Exchange rate depreciation has increased external debt burden and made external borrowing more expansive, which has severe implications for corporate sector that relies heavily on external capital flows.[3] It is argued that disequilibrium in exchange rate, especially in the long-run, may cause substantial welfare loss. Edwards (1988) argued that a stable exchange rate is a key element in successful outward-oriented and export-based development strategies, while poorly aligned exchange rate with economic fundamentals, such as money supply and real income, interest rates, can lead to widespread macroeconomic and financial instability in developing countries [Dumrongrittikul and Anderson (2016)]. Being an important transmission channel of monetary policy strategy, the exchange rate is also used as an important instrument for measuring the currency over and/or under valuation. Therefore, a proper understanding of exchange rate dynamics is required for macroeconomic stability, economic growth and implementation of efficient monetary policy strategy in Pakistan.

The literature has shown that macroeconomic consequences of exchange rate variation can be analysed using the traditional monetary models of exchange rate [Groen (2000**)**; Rapach and Wohar (2002)]. These models show that depreciation in exchange rate is a monetary phenomenon and monetary fundamentals, such as money supply, income, inflation and interest rate are the key drivers to explain exchange rate dynamics. However, Kim, *et al.* (2010) and Meese and Rogoff (1983) show that traditional exchange rate models have failed to predict exchange rate behaviour, especially the short-run dynamics, despite the significant contribution of monetary fundamentals in the long-run macroeconomic policy discourse. These studies show that inflation, interest rates and economic growth are important determinants of Dollar/Euro exchange rate movements. Similarly, Junttila and Korhonen (2011) conclude that traditional economic factors are important determinants of short-run dynamics of exchange rates. Despite a vital role of monetary fundamentals in exchange rate determination, short-run contemporaneous relationship between exchange rate and monetary factors has remained unexplored. Hence, it is pertinent to investigate the dynamics of exchange rate and monetary variables in the short-run as well as in the long-run in Pakistan.

The empirical literature that has investigated the relationship between exchange rate and monetary fundamentals in developing countries, like Pakistan has been scant. The reason could be that majority of these countries have opted floating exchange rate regime until recently. Restrictions on capital mobility and on domestic financial transactions in these countries have created a different macroeconomic environment for exchange rate dynamics, particularly for testing the monetary model of exchange rate determination. An empirical test for such models in countries with binding constraints on capital flows and under developed domestic financial sectors can help to understand the

[2]Pakistan rupee was depreciated as much as 69 percent from 62.72 per US dollar in 2008Q1 to 106.00 per US dollar in 2013Q3. Thereafter, the rupee was appreciated by about 7.78 percent from 106 rupee per US dollar in 2013Q3 to 98.81 per US dollar in 2014Q2.

[3]Pakistan's exports growth reduced from 12.23 percent in 2008 to –7.16 percent in 2009. Net portfolio equity inflows decreased from $451 million to $272 million. Similarly, foreign direct investment was decreased from $5492 to $2338 from 2007 to 2009. During the GFC, exchange rate depreciated from 62.5/$ to 78.0/$, registering 20 percent depreciation against US dollar. Foreign exchange reserves declined from $14.2 billion in 2007 to $3.4 billion in 2008. Pakistan's economic growth also reduced from 6.3 percent in 2007 to 1.2 percent in 2009.

role of monetary and exchange rate policies in developing countries [Kletzer and Kohli (2000)].

The empirical literature associated with the monetary approach to exchange rate determination is sparse in Pakistan and does not cover recent exchange rate fluctuations and its interaction with monetary fundamentals. The available literature mainly considered the role of external factors, like terms of trade and remittances in studying the exchange rate behaviour [Haque and Montiel (1992); Chisti and Hasan (1993); Afridi (1995); Siddiqui, *et al.* (1996); Bhatti (1996**)**; Zakaria, *et al.* (2007); among others]. Few studies have examined the behaviour of nominal exchange rate, by considering the PPP hypothesis or variant of monetary and Keynesian models of exchange rate determination [Hina and Qayyum (2015**)**; Khan and Qayyum (2011**)**; Zakaria and Ahmad (2009); among others]. However, majority of these studies do not analyse dynamic interaction between exchange rate and monetary fundamentals, which give important policy implications about the reaction of exchange rate with regard to the monetary factors.

Pakistan followed a fixed-peg exchange rate regime up to the early 1980s. The State Bank of Pakistan (SBP) decided to replace pegged exchange rate regime when it started working on comprehensive financial sector reforms in the late 1980s. As a consequence of this initiative, the de jure exchange rate regime shifted to a managed float till 2000 and thereafter to a free float, after a two year transition period of multiple exchange rates.[4] Changes in the exchange rate regime are expected to eliminate deviation from parity conditions [Khan and Qayyum (2008)]. Besides, trade and financial sector liberalisation and loosening of restrictions on capital flows over the past two decades have reduced many distortions. The floating exchange rate regime provides motivation to study the role of monetary fundamentals in the determinations of exchange rate process in Pakistan.

Against the above backdrop, the present study contributes to the existing literature, by analysing the long-run and short-run relationships between exchange rate and monetary fundamentals in Pakistan, using quarterly data over the period 1982-2014. Second, this study uses the cointegration and Structural Vector Autoregressive (SVAR) approaches for empirical analysis. These approaches are useful as they allow estimating the short-run contemporaneous correlations among monetary fundamentals and nominal exchange rate, while considering the existence of cointegration between exchange rate and monetary factors [Loria, *et al.* 2010)]. Third, we consider Impulse Response Functions (IRFs) and Forecast Error Variance Decomposition (FEVD) analysis to trace out how nominal exchange rate has responded to changes in monetary fundamentals. Particularly, this study analyses the dynamic reaction of exchange rate to monetary policy shocks. Fourth, this paper imposes sign restrictions and a zero restriction on IRFs, based on economic theory to trace out meaningful policy shocks. Fifth, the present study takes care of structural break in the data by employing Lumsdaine and Papell (1997) test.[5] As

[4]Following nuclear tests in 1998, the SBP introduced a number of measures to rescue the economy from crisis. The authorities adopted a two-tier exchange rate system. For example, exports proceeds, home remittances, invisible flows and non-essential imports can be traded at the floating inter-bank rate (FIBR), the official rate fixed by SBP while FIBR was determined in the inter-bank market. However, this arrangement was transitory and therefore, replaced with unified floating exchange rate system with effect from May 19, 1999 [Khan (2008)].

[5]The structural breaks associated with nuclear tests in 1998, Asian financial crisis in 1997, global financial crisis in 2007-08, financial liberalisation and changes in exchange rate regimes from fixed to managed and free float.

Gregory, *et al.* (1994) points out that conventional cointegration tests are biased towards accepting the null hypothesis of no cointegration in the presence of structural breaks.

The rest of the paper is structured as follows: Section 2 reviews the literature review on monetary model of exchange rate determination. Section 3 describes methodology and the data sources. Section 4 reports and discusses empirical results, while Section 5 concludes along with some policy implications.

2. LITERATURE REVIEW

The exchange rate is considered as an important component of transmission mechanism of monetary policy because movements in exchange rate have significant impacts on the overall economy **[**Demir (2014)]. The exchange rate may influence macroeconomic fundamentals through three main channels. First, the exchange rate appreciation may decrease economic growth, by switching expenditures and slow adjustment of prices of imported goods owing to low inflation [Taylor (2001)]. Second, changes in the exchange rate induce wealth effects that subsequently effect consumption and investment which are important ingredients of overall economic development. Since, households are assumed to have inter-temporal smoothing behaviour; a direct decrease in net wealth may lead to a drop in consumption. Third, the exchange rate depreciation may increase the value of collateral, which may reduce external financing constraints and therefore final spending [Demir (2014)]. Taylor (2001) highlighted that exchange rate determines terms of trade and hence influences the overall imports and exports of the country. The exchange rate may also be used for predicting currency crisis [Ahmad and Pentecost (2009**)**; Astley and Garratt (2000)]. This discussion indicates that exchange rate contributes to economic development, enhances external competitiveness and improves social welfare [Chin, *et al.* (2009)]. On the other hand, excessive volatility in exchange rate hampers external capital flows, worsens the trade balance, and impedes economic growth [Effiong (2014)].

To contextualise the role of monetary factors, in determining the behaviour of nominal exchange rate, various theoretical models have been proposed in the literature.[6] The monetary model of exchange rate and its extended versions are considered as an attractive theoretical tool in understanding the dynamics of exchange rate across the globe [MacDonald (2007**)**; Neely and Sarno (2002**)**; Schroder and Dornau (2002)]. These models show that variations in nominal exchange rate are ascertained by inflation, money supply and interest rate between two trading economies. While real factors, including real income, budget deficit and government consumption do have impact on exchange rate variations but indirectly through money markets. Literature also shows that forecasting of exchange rate may be based on its current values but again it is a largely monetary induced phenomenon [Bhatti (2001**)**; Wilson (2009)]. According to the monetary models, economies that adopted relatively expansionary monetary policy, normally observe depreciation in currencies and vice versa. Therefore, the monetary model predicts a proportional relation between exchange rate and money supply of the trading economies in the long-run. Owing to this, monetary models are considered best to

[6]These models are Purchasing Power Parity (PPP), Covered Interest Rate Parity (CIP), Uncovered Interest Parity (UIP), Sticky Price Variants of the Monetary Model and Real Interest Rate Differential Monetary Model.

explain exchange rate behaviour [Dabrowski, *et al.* (2014)]. These models also give a long-run benchmark for exchange rate between two currencies and set the criteria for determining whether currency is undervalued or overvalued [Rapach and Wohar (2002)].

Despite numerous studies, the outcome remains inconclusive and the empirical validity of the monetary model of exchange rate determination is elusive [Khan and Qayyum (2008**)**; Moosa (1994)]. Majority of empirical studies have examined long-run association between exchange rate and monetary fundamentals, using the Johansen's (1988) cointegration test, while ignoring the short-run dynamics. However, high degree of volatility in exchange rate calls for a short-run analysis. Over the last four decades, extensive surveys were conducted on empirical validity of the monetary model of exchange rate.[7] These surveys provide conflicting evidence on the long-run validity of the monetary model of exchange rate [MacDonald (1995**)**; MacDonald and Taylor (1992)]. Empirical literature can be divided into six main groups. First, a number of studies concerning the interwar and the flexible exchange rate periods, during the 1970s have found supportive results for the validity of the monetary models [Frenkel (1976**)**; Putnam and Woodbury (1979); among others]. Second, studies covering post Breton Woods period have failed to support monetary exchange rate models, owing to its poor performance [Backus (1984**)**; Meese and Rogoff (1983**)**; Rasulo and Wilford (1980)]. Third, studies during the 1990s favour the long-run validity of the monetary exchange rate models along with their forecasting performance [Chinn and Meese (1995**)**; MacDonald and Marsh (1997)]. Fourth, studies carried out beyond the period of 2000 show significant forecasting ability of the monetary fundamentals, in projecting future exchange rates [Chen, *et al.* (2011**)**; Chin, *et al*. (2009**)**; Islam and Hasan (2006)]. Fifth, studies dealing with the issue of transaction costs and non-linear adjustments in exchange rate analysis, supporting the existence of non-linearity [Beckmann, *et al.* (2015**)**; Chen and MacDonald (2015**)**; Junttila and Korhonen (2011**)**; Kim, *et al.* (2010)]. Sixth, studies based on the SVAR methodology show that monetary exchange rate models are powerful tools to study the long-run as well as the short-run dynamics of the exchange rate [Effiong (2014**)**; Heinlein and Krolzig (2012**)**; Loria, *et al.* (2010)].

For example, Loría, *et al.* (2010) found short-run as well as long-run relationships between monetary factors and the exchange rate for Mexican economy using SVAR method. This study concluded that monetary model is very useful for understanding of Mexican exchange rate process. Effiong (2014)**,** used the same methodology and found the evidence of cointegration between exchange rate and monetary factors for Nigerian economy, based on flexible price of variant monetary model. Katusiime, *et al.* (2015) analyses the relation between Uganda Shilling/US$ and monetary fundamentals and finds that hybrid model provides support to analyse the Uganda Shilling/US$ exchange rates behaviors. Similarly, Bahmani-Oskooee, *et al.* (2015) investigated the link between exchange rate and monetary factors for six countries, using the Autoregressive Distributed Lag (ARDL). This study found supportive evidence for the validity of monetary exchange rate model.[8]

[7]The comprehensive survey of empirical studies carried out in the 1970s, 1980s and early 1990s can be found in Levich (1985), Frenkel and Mussa (1985), Isard (1988), MacDonald and Taylor (1992), MacDonald (1995), Odedokun (1997) and Khan (2008).

[8]Countries included are: Canada, France, Germany, Italy, Japan and UK.

Another strand of empirical literature concerning the sign restrictions on IRFs is based on economic theories. Sign restriction has become popular in recent years because it avoids the use of wrong identifying assumptions [Dumrongrittikul and Anderson (2016)]. Studies, inter alia by Farrant and Peersman (2006), Scholl and Uhlig (2008), Bhornland and Halvorsen (2014) and Fisher and Huh (2016) used sign restrictions to examine the monetary policy shocks.

The empirical literature in developing countries with regard to the validity of the monetary exchange rate model is relatively scarce because most of the existing monetary exchange rate models have focused on the industrialised countries. The application of the monetary model of exchange rate for the developing countries include, among others, Afghanistan [Fry (1976)], Peru [Lyons (1992); Edwards (1983)], Sub-Saharan Africa [Odedokun (1997)], East Asian countries [Chin (1998); Chin, *et al.* (2009)]; Asian countries [Husted and MacDonald (1999); Chinn and Azali (2012)], India [Kletzer and Kohli (2000)], South Asian countries [Yunus (2001)], the Philippines [Chin, *et al.* (2007)], Korea [Kim, *et al.* (2010)], Pakistan [Bhatti (2001); Khan (2008); Khan and Qayyum (2011); Bhatti (2013)] and Sri Lanka [Maitra (2010)]. Majority of these studies concluded that money supply, real income, inflation rate, interest rates, trade and budget deficits are the prime determinants of exchange rate dynamics.

3. MODEL, METHODOLOGY AND DATA

3.1. Model and Methodology

The monetary model of exchange rates is an extension of the quantity theory of money [Diamandis, *et al.* (2000)]. It holds that exchange rate is determined by the demand for and supply of domestic and foreign currencies. The basic contention of the monetary exchange rate model is that the national monetary policy is the key driver of the exchange rate. The central feature of the monetary exchange rate model is that it combines the purchasing power parity (PPP) theory with the quantity theory of money. Theoretical literature suggests that the exchange rate is determined by the relative money supply, relative real income, interest rate and inflation differentials. The model assumes that domestic and foreign countries have identical stable money demand functions, such that the money market equilibrium conditions at home and abroad are given. It further assumes that prices, nominal interest rates and exchange rates adjust instantaneously to clear goods, money and foreign exchange markets. It is assumed that aggregate price level is determined according to the quantity theory of money and that PPP holds continuously in the long-run [Chen, *et al.* (2011); Bhatti (2013)]. The monetary exchange rate model further assumes that domestic and foreign capitals are perfect substitutes and the Fisher parity condition holds at home and abroad. Furthermore, real interest rates across countries are assumed to be constant in the long-run. Following Heinlein and Krolzig (2012), the monetary exchange rate model is expressed as follows:[9]

$$s_t = \underset{+}{f}(\underset{+}{m_t^d}, \underset{-}{y_t^d}, \underset{\pm}{I_t^d}, \underset{+}{\pi_t^d}) \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (1)$$

[9]Details can be seen in Pilbeam (2013, Ch. 7). Moreover, details of variable construction can be seen in Khan (2008) and Khan and Qayyum (2011).

Where s_t represents the long-run equilibrium exchange rate (positive value indicate depreciation and vice versa), $m_t^d = m_t - m_t^*$ denotes money supply differential, $y_t^d = y_t - y_t^*$ is the real income differential, $I_t^d = I_t - I_t^*$ shows the short-term interest rate spread, while $\pi_t^d = \pi_t - \pi_t^*$ is the inflation rate differential.

Differences are calculated with reference to the United States (indicated by *). The model presented by Equation (1) shows that an increase in the relative money supply causes depreciation in the exchange rate, while increase in relative real income causes appreciation in the exchange rate [Hallwood and MacDonald (2000**)**; Hunter and Ali (2014**)**; Katusiime, *et al.* (2015)]. The model also indicates that increase in relative short-term interest rate and relative inflation rate causes depreciation of exchange rate.

Empirical analysis starts by examining the long-run relationship between all the variables, using Johansen (1995) reduced rank cointegration test. However, to examine the dynamic interaction between exchange rate and monetary fundamentals, we use the SVAR modelling framework. The main advantage of the SVAR modelling is that it allows identification of structural shocks with respect to economic theory [Khan and Ahmed (2014)]. It provides an opportunity to identify the net effect of unanticipated changes in variables in the system. Unlike Dynamic Stochastic General Equilibrium (DSGE) model, SVAR framework is more data driven, because it is restricted only by the number of variables, lags and prior restrictions used to identify the structural shocks of interest [Bhornland and Halvorsen (2014)]. Fisher and Huh (2016) reported that SVAR can allow for simultaneous interaction between monetary policy and the exchange rate. It is worth mentioning here that specification of SVAR, in terms of relative variables allows the economic activity of a country or region to influence the economic activity of its major trading partner. The SVAR model is equally useful for small open economies, where it is generally perceived to have no significant impact on its trade partners [Fisher and Huh (2016)]. Following Blanchard and Perotti (2002), the impact of monetary fundamentals shocks is estimated from the Vector Autoregressive (VAR) model. The dynamics of the variables $z_t = (s_t, m_t^d, y_t^d, I_t^d, \pi_t^d)'$ are modelled by the following $p-$ dimensional VAR**:**[10]

$$A_0 z_t = A_1 z_{t-1} + \ldots\ldots\ldots A_i z_{t-i} + \Phi D_t + B\varepsilon_t \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (2)$$

Where A_0 indicates contemporaneous relationships in the model, $z_t = [z_{t-1}, \ldots\ldots\ldots z_{t-l}]'$ is the vector of lagged variables, i is the number of lags, $A_j's$ is (5×5) matrix of autoregressive coefficients, B is (5×5) matrix of non-singular structural coefficients, D_t is vector of deterministic components and $\varepsilon_t = [\varepsilon_{m_t^d}, \varepsilon_{y_t^d}, \varepsilon_{I_t^d}, \varepsilon_{\pi_t^d}]'$ is vector of structural shocks with $E[\varepsilon_t] = 0, E[\varepsilon_t \varepsilon_t'] = \Sigma, E[\varepsilon_t \varepsilon_s'] = 0 \; \forall s \neq t.$ The reduced form of the SVAR is given as:

$$z_t = \delta_1 z_{t-1} + \ldots\ldots\ldots \delta_k z_{t-i} + \alpha D_t + u_t \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (3)$$

[10]The money supply differential (m_t^d) captures money supply shocks, while real income differential (y_t^d) captures the demand shock. Monetary policy instrument (I_t^d) and monetary target variables (π_t^d) are included to captures the effect of monetary policy shocks on exchange rate.

Where $\delta_j = A_0^{-1}A_j$ $(j = 1,\ldots\ldots i)$ and $\alpha = A_0^{-1}\Phi$. Moreover, $u_t = A^{-1}B\varepsilon_t$ are the reduced form residuals. In the SVAR modelling approach, the reduce-form residuals $u_t = [u_{m_t^d}, u_{y_t^d}, u_{I_t^d}, u_{\pi_t^d}]'$ are assumed to be linearly correlated with the underlying structural shocks $\varepsilon_t = [\varepsilon_{m_t^d}, \varepsilon_{y_t^d}, \varepsilon_{I_t^d}, \varepsilon_{\pi_t^d}]'$. The estimates α, δ and $E[\varepsilon_t\varepsilon_t']$ can be obtained by using the Ordinary Least Squares (OLS) method, but B and ε_t are not identified. Enders (2015) and Amisano and Giannini (1997) combine the restrictions for matrices A and B such that $Au_t = B\varepsilon_t$.

To identify structural coefficients, it is essential to define identification restrictions on A and B which is 5^2. For identification of the full system $5^2 - [(5^2 + 5)/2] = (5^2 - 5)/2 = 10$ restriction is required. Following Christiano, *et al.* (2007), we impose only short-run restriction as SVAR performs well, based on short-run restrictions. Following Alom, *et al.* (2013) and Kim and Roubini (2000), we define restrictions on the contemporaneous structural parameters, based on theoretical underpinning of the variant of the monetary exchange rate model which are given as follow:

$$\begin{bmatrix} 1 & a_{12} & a_{13} & a_{14} & a_{15} \\ 0 & 1 & a_{23} & a_{24} & 0 \\ 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & a_{45} \\ 0 & a_{52} & a_{53} & 0 & 1 \end{bmatrix} \begin{bmatrix} u_{s_t} \\ u_{m_t^d} \\ u_{y_t^d} \\ u_{I_t^d} \\ u_{\pi_t^d} \end{bmatrix} = \begin{bmatrix} b_{11} & 0 & 0 & 0 & 0 \\ 0 & b_{22} & 0 & 0 & 0 \\ 0 & 0 & b_{33} & 0 & 0 \\ 0 & 0 & 0 & b_{44} & 0 \\ 0 & 0 & 0 & 0 & b_{55} \end{bmatrix} \begin{bmatrix} \varepsilon_{s_t} \\ \varepsilon_{m_t^d} \\ \varepsilon_{y_t^d} \\ \varepsilon_{I_t^d} \\ \varepsilon_{\pi_t^d} \end{bmatrix} \quad \ldots \quad \ldots \quad (4)$$

Where $\varepsilon_{s_t}, \varepsilon_{m_t^d}, \varepsilon_{y_t^d}, \varepsilon_{I_t^d}$ and $\varepsilon_{\pi_t^d}$ are structural innovations and $u_{s_t}, u_{m_t^d}, u_{y_t^d}, u_{I_t^d}$ and $u_{\pi_t^d}$ are residual generated from reduced form VAR. First two rows represent variants of monetary exchange rate model and relative money demand function; third row indicated exogenous shocks from domestic income, relative to foreign income and fourth row shows monetary reaction function in terms of the Fisher hypothesis.[11] Fifth row gives domestic price setting behaviour. The short-run form of monetary model of exchange rate is given as:

$$u_{s_t} = a_{12}u_{m_t^d} + a_{13}u_{y_t^d} + a_{14}u_{I_t^d} + a_{15}u_{\pi_t^d} \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (5)$$

Where $a_{12}, a_{15} > 0, a_{13} < 0$ and $a_{14} \gtrless 0$. The model is uniquely indentified and the shocks are orthogonalised. These restrictions allow contemporaneous interactions

[11]The Fisher hypothesis states that the nominal interest rate (I_t) equals the real interest rate R_t plus inflationary expectations (π_{t+1}^e). That is $I_t = R_t + \pi_{t+1}^e$. The Fisher hypothesis motivates real interest rate parity condition which hypothesises that real interest rate at home and abroad should equalise in the long-run, that is; $R_t - R_t^* = (I - \pi_t^e) - (I_t^* - \pi_t^{e*})$ where * indicate foreign country. According to the Uncovered Parity Condition or Fisher Parity Condition $I_t - I_t^* = E_t(s_t - s_{t-1}) = (\pi_t^e - \pi_t^{e*})$. The short-run form of the Fisher hypothesis can be written as $u_{I_t^d} = a_{45}u_{\pi_t^d}$.

between exchange rate and monetary fundamentals. The short-run dynamics of exchange rate can be examined using IRFs, based on the structural identification and FEVD.

3.2. Data

To achieve the aforesaid objectives, quarterly time series data has been used over the period 1982Q2-2014Q2. The data on money supply is defined as M2 (currency plus demand deposits plus time deposits plus other deposits), Six-month Treasury bill rate and Consumer Price Index (2000=100) are taken from the International Financial Statistics (IFS), published by International Monetary Fund (IMF). The quarterly data on GDP is not available for Pakistan. To construct quarterly series of GDP, we have used Goldstein and Khan (1976) methodology. Relative income is calculated, by taking the difference of Pakistan and the US real incomes, while relative money supply is calculated by taking the difference of Pakistan and the US money stocks. Similarly, interest rate differential is calculated by considering the difference between six-month Treasury bill rate of Pakistan and the US Treasury bill rate. The four quarter inflation rate (π_t) is calculated as $\pi_t = (\ln P_t - \ln P_{t-4}) \times 100$, where P_t is the consumer price index. All the data is expressed in logarithmic form except for the interest rate. An increase in exchange rate represents a nominal depreciation.

4. EMPIRICAL RESULTS AND DISCUSSION

4.1. Unit Root Analysis

To examine the stationarity of the data, the Augmented Dickey Fuller (ADF) test is used with seasonal dummies. The results are reported in Table 1. The results show that all series are stationary at first difference, that is the variables are integrated of order one. The results remain same even when seasonal dummies are included in the unit root test.

Table 1

Unit Root Analysis

	With Constant and Seasonal Dummies		With Constant only	
Series	Log-level	Log-difference	Log-level	Log-difference
s_t	–1.296 (1)	–9.229 (0)***	–1.270 (1)	–9.465 (0)***
m_t^d	–1.390 (2)	–5.269 (1)***	–1.491 (4)	–4.853 (4)***
y_t^d	–1.737 (2)	–3.243 (2)***	–1.765 (2)	–3.280 (1)***
I_t^d	–2.105 (3)	–5.551 (2)***	–2.100 (3)	–5.685 (2)***
π_t^d	–1.656 (4)	–5.788 (4)***	–1.680 (4)	–5.868 (4)***

Note: *** and ** indicates significance at the 1 percent and 5 percent level. Numbers in brackets show lag length. Critical values are –2.88 at 5 percent and –3.48 at 1 percent.

It is worth mentioning here that data sample is subject to several economic shocks, including Asian financial crisis of 1997, nuclear tests of 1998, changes in exchange rate regime in 2000, 9/11 event, global financial crisis of 2007-08, along with

business cycle. These events may produce structural breaks in the data. Given the possibility of structural breaks, we apply unit root test with structural breaks, proposed by Lumsdaine and Papell (1997), called LP test which allows two endogenous breaks. The results of LP test are reported in Table 2. The results show that all the variables are stationary at first difference, in the presence of two endogenous structural breaks. In essence, the results of the ADF and LP tests confirm that all the series are integrated of order one. Hence, cointegration analysis is suitable.

Table 2

Unit Root Test with Two Structural Breaks

Variables	Test Statistic	TB1	TB2
s_t	–2.06 (16)	2001Q3	2007Q4
m_t^d	–2.24 (17)	2001Q3	2007Q4
y_t^d	–2.48 (18)	2001Q3	2008Q4
I_t^d	–4.71 (22)	2003Q3	2008Q4
π_t^d	–2.80 (16)	2003Q3	2008Q4

Note: Critical values for LP Test are –7.19 at 1 percent and –6.75 at 5 percent and are taken from Ben-David, *et al*. (2003, Table 3).

4.2. Cointegration Analysis

Reduced rank maximum likelihood technique proposed by Johansen (1995) is used for cointegration analysis. The vector of five endogenous variables including $z_t = (s_t, m_t^d, y_t^d, I_t^d, \pi_t^d)'$, seasonal dummies and unrestricted constant are included in the Vector Error Correction Model (VECM). To control the impact of structural breaks, three impulse dummies (D_{98Q2}, D_{00Q2}, D_{07Q3}), covering the events of nuclear test (1998), flexible exchange rate regime (2000) and GFC (2007)[12] are incorporated. The lag length for VAR is set to be 6 quarters.[13]

To determine the number of stable long-run cointegrating relationships, trace statistic for the cointegration rank is reported in Table 3.[14] The result confirms the existence of a single cointegration relationship between the exchange rate and the monetary fundamentals for Pakistan. The existence of unique cointegrating relationship indicates that the relationship is tied up in a single direction.

[12]Though LP test does not support the presence of structural break, we have incorporated the impulse dummies (D_{98Q2}, D_{00Q2}, D_{07Q3}) due to their significant impacts in the VAR model. We exclude seasonal dummies, owing to no effect on cointegration rank.

[13]Lag length of order 6 quarters is supported by the LM test of serial correlation and Hannan-Quinn Criterion (HQC).

[14]On the basis of the diagnostic results, reported in Appendix Table 1, it can be inferred that the estimated VAR model does not suffer from error autocorrelation. The heteroscedasticity test also confirms that residuals are homoscedastic. Hansen and Rahbek (1999) argued that cointegration estimates are not very much sensitive to the heteroscedasticity. Normality test reject the null hypothesis that residuals are non-normal. Gonzalo (1994) shows that the performance of Johansen test is little effected by non-normal residuals. MacDonald and Marsh (1997), report that trace test is found to be more robust in the presence of non-normal residuals.

Table 3

Johansen Coingtegration Test of $H_0 : rank < r$

r	Eigenvalue	Trace Test	p-value
0	0.2401	67.79*	0.070
1	0.1332	34.84	0.463
2	0.1001	17.68	0.598
3	0.0253	5.03	0.806
4	0.0161	1.95	0.163

Note: * Indicate significance at the 10 percent level.

For the normalised coefficients of nominal exchange rate, based on the reduced rank, maximum likelihood estimation is presented in Equation (6). Equation (6) shows that inflation rate differential is not significant in determining exchange rate in the long-run; hence zero restriction is imposed on the coefficient of inflation rate differential, which cannot be ignored.

$$\begin{matrix} s_t = 0.78 m_t^d - 1.01 y_t^d + 0.06 I_t^d - 0.01 \pi_t^d \\ (2.60)^{***} \ (-5.32)^{***} \ (3.00)^{***} \ (0.50) \end{matrix} \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (6)$$

The restricted monetary exchange rate model is presented in Equation (7). The results indicate that coefficients are broadly aligned with the Bilson-type flexible-price exchange rate model.

$$\begin{matrix} s_t = 0.69 m_t^{\,d} - 1.06 y_t^{\,d} + 0.06 I_t^{\,d} \\ (2.76)^{***} \ (-6.63)^{***} \ (3.00)^{***} \end{matrix} \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (7)$$

The patterns of dynamic adjustment are presented in Equation (8). The adjustment of coefficients of all variables, except real income differential has significant feedback effect to restore equilibrium in the long-run. The feedback coefficient of Δs_t possesses expected negative sign, indicating that long-run relationship between exchange rate and monetary fundamentals pushes exchange rate towards equilibrium. The coefficient of coefficient is –0.04, implies that changes in nominal exchange rate are correct around 4 percent of the deviations in each quarter in the long-run. This implies weaker response of exchange rate. The feedback coefficient of Δy_t^d is insignificant, which suggests that real income differential is weakly exogenous and plays no role in the adjustment process in the short-run.[15]

[15]The long-run weak exogeneity test shows that Δy_t^d is weakly exogenous, implying that Δy_t^d acts as a unique common stochastic trend in the system (see appendix Table 2a)

$$\begin{array}{lll} \Delta s_t = -0.04 & \Delta m_t^d = 0.06 & \Delta y_t^d = 0.04 \\ \quad (-2.31)^{**} & \quad (2.96)^{***} & \quad (1.08) \\ \Delta I_t^d = 2.45 & \Delta \pi_t^d = 1.54 & \\ \quad (2.66)^{***} & \quad (2.03)^{**} & \end{array} \quad \ldots \quad \ldots \quad \ldots \quad (8)$$

The long-run weak exogeneity test (Table 5 appendix) also confirms that real income differential is the only variable that is weakly exogenous in the system. Thus, real income differential acts as unique common stochastic trend in the system.

To examine the validity of Johansen (1995) cointegration test, Autoregressive Distributed Lag (ARDL) cointergation test proposed by Pesaran, *et al.* (2001) is used.[16] Dreger and Wolters (2015) have demonstrated that estimates based on cointegrated VAR model are useful only to explore stability of the system. Belke and Czudaj (2010) argue that estimates based on the single-equation approach are more reliable and close to economic theory, as single-equation estimates save degrees of freedom and assume a unique cointegration vector. Thus, we utilise the bounds testing approach to cointegration, which begins with the estimation of following conditional vector-error correction model [Hassler and Wolters (2006)].

$$\Delta y_t = c + \gamma y_{t-1} + \theta x_{t-1} + \sum_{i=1}^{n-1} \alpha_i \Delta y_{t-i} + \sum_{i=0}^{p-1} \phi_i \Delta x_{t-i} + \delta D_t + v_t \quad \ldots \quad \ldots \quad (9)$$

Where $y_t = [s_t, x_t]'$, $x_t = [m_t^d, y_t^d, I_t^d, \pi_t^d]'$, D is vector of impulse dummies and v_t is error term. We estimated Equation (9) and tested for the presence of cointegration between the exchange rate and monetary fundamentals, by setting the coefficients of the lag-level variables equal to zero.

The estimated results of the bounds cointegration test are reported in Table 4. Based on Lagrange Multiplier (LM) test of serial correlation and HQC, 6 lags were chosen. The results (Table 4) show that there exists a cointegration relationship between exchange rate and monetary fundamentals when s_t, y_t^d and I_t^d are used as dependent variables. The presence of cointegration confirms the findings, deduced from the Johansen's (1995) reduced rank cointegration test. We, on the other hand, do not find cointegration relationship when m_t^d and π_t^d are used as dependent variables, indicating weak exogenous nature of these variables. It is worth mentioning here that unlike Johansen's cointegration test, we obtained three cointegrating relationships: exchange rate equation, relative real income equation and equation for interest rate differential. The presence of multiple relationships implies that exchange rate and monetary fundamentals are tied up in more than one direction and the system is relatively more stable in multiple directions.

[16]The ARDL model is considered to be superior over Johansen's (1995) cointegration test. The Johansen's test selected same lag order for all the variables, while ARDL can take different lags for different variables [Bahmani-Oskooee, *et al*. (2015)]. This approach is directly applicable, irrespective of whether the variables are I(0), I(1) or mutually integrated. However, in Johansen cointegration test I(0) variables are excluded from the estimation, under the assumption that I(0) variables belong to cointegrating space. In finite sample models, ARDL is superior to other cointegration methods, including Johansen's method because other approaches suffer from truncation bias [Panopoulou and Pittis (2004)]. Furthermore, unlike Johansen approach estimates based on the ARDL approach can be tested for structural stability, directly in terms of Cumulative Sum of Squares Residuals (CUSUM) and CUSUM Squares of Residuals.

Table 4

Bounds-Cointegration Tests

Model	Lags	F-statistic	Outcome
$F(s_t \mid m_t^d, y_t^d, I_t^d, \pi_t^d, D)$	6	33.68^{***}	Cointegration
$F(m_t^d \mid s_t, y_t^d, I_t^d, \pi_t^d, D)$	6	1.54	No cointegration
$F(y_t^d \mid s_t, m_t^d, I_t^d, \pi_t^d, D)$	6	8.70^{***}	Cointegration
$F(I_t^d \mid s_t, m_t^d, y_t^d, \pi_t^d, D)$	6	4.27^{**}	Cointegration
$F(\pi_t^d \mid s_t, m_t^d, y_t^d, I_t^d, D)$	6	1.64	No cointegration

Note: D is vector of impulse dummies.

4.2.1. Monetary Exchange Model: Short-run and Long-run Estimates

Given the presence of cointegration between exchange rate and monetary fundamentals, we have obtained the short-run and long-run estimates of monetary exchange model using the ARDL method. The long-run estimates of the monetary exchange rate model are given by Equation (10).

$$\underset{\quad (4.43)^{***}}{s_t = 0.63m_t^d} \underset{\quad (8.09)^{***}}{-1.62y_t^d} \underset{\quad (1.17)}{-0.05I_t^d} \underset{\quad (1.56)}{+0.08\pi_t^d} \underset{\quad (-2.58)^{**}}{-0.74D_{98Q2}} \underset{\quad (1.93)^{**}}{+2.10D_{00Q3}} \underset{\quad (-1.70)^{***}}{-0.69D_{07Q3}} \quad \ldots (10)$$

Equation (10) reveals that m_t^d and y_t^d are the core drivers of exchange rate in the long-run. The positive sign of m_t^d indicates that an increase in domestic money stock relative to foreign money stock causes depreciation in the Pak-rupee exchange rate in the long-run. This suggests that increase in domestic money supply induces an increase in domestic price level, which in turn reduces competitiveness of domestic goods and hence deteriorates trade balance. The result is in line with previous studies [Kletzer and Kohli (2000); Khan (2008); Khan and Qayyum (2011)]. The estimated elasticity of money supply differential is 0.63, which indicates that a 1 percent increase in domestic money relative to foreign money results in a depreciation of Pak-rupee exchange rate by 0.63 percent in the long-run. The reason could be that over the past two decades an excessive money growth due to fiscal deficit exerted depreciation pressure on the Pak-rupee exchange rate. The estimated coefficient of y_t^d, which is significant and negative (–1.62), is consistent with the prediction of monetary exchange rate model. This suggests that increase in the relative real income increases demand for real money balances, which leads to an appreciation of Pak-rupee exchange rate in the long-run. Bilson (1978) noted that an appreciation of exchange rate, following increase in real income will only hold in the case of export-led growth. However, our finding is consistent with the Monetarist view that an increase in domestic output increases exports which would improve the trade balance. The estimated elasticity of y_t^d is greater than the estimated elasticity of m_t^d, which is consistent with the Blassa-Samuelson (BS) effect.[17] The estimated

[17]Large income elasticity could be the result of the productivity differential across countries.

coefficient of y_t^d is quite consistent with the earlier findings of Kletzer and Kohli (2000), Khan and Qayyum (2011) and Bhatti (2013) in case of Pakistan. The long-run semi-elasticity of exchange rate with respect to I_t^d is negative and insignificant; demonstrating that a rise in domestic interest rate, relative to foreign interest rate may not induce changes in exchange rate, which may be owing to lack of integration of Pakistan's financial market with the rest of the world. Various studies support these findings [for example, Katusiime, *et al.* (2015); Chen, *et al.* (2011); among others]. The coefficient of I_t^d is insignificant, indicating no impact of inflation differential on the exchange rate. The coefficient of D_{98Q2} is negative and significant, indicating that after nuclear tests in 1998 Pak-rupee exchange rate significantly appreciated in the long-run. The reason of this appreciation could be that after nuclear tests world community imposed sanctions on Pakistan. However, due to financial support of the Arab and other Muslim countries, Pakistan's economy recovered successfully.[18] The regime dummy D_{00Q3} has a positive and significant coefficient, implying that over the period of flexible exchange rate regime, Pak-rupee exchange rate depreciated significantly. The coefficient of D_{07Q3} is negative and significant. One reason of this result could be that it is due to large inflows of worker's remittances.[19] The other reason could be the global oil price uncertainty since 2008.[20]

To examine the dynamic interaction between exchange rate and monetary fundamental, an error-correction model based on the ARDL (1, 2, 2, 1) long-run estimates is estimated. Equation (11) presents the results:

$$\begin{aligned}\Delta s_t = {} & -0.19\,\Delta m_t^d - 0.11\Delta m_{t-1}^d - 0.55\Delta y_t^d + 0.15\Delta y_{t-1}^d - 0.00\Delta I_t^d + 0.003\Delta I_{t-1}^d \\ & (-6.81)^{***} \quad (-4.05)^{***} \quad (-16.79)^{***} \quad (4.45)^{***} \quad (-0.01) \quad (5.39)^{***} \\ & -0.001\Delta\pi_t^d - 0.00\Delta D_{98Q2} + 0.04\Delta D_{00Q3} - 0.01\Delta D_{07Q3} - 0.02EC_{t-1} \\ & (-2.04)^{**} \quad (-0.08) \quad (4.19)^{***} \quad (-1.33) \quad (-13.82)^{***} \qquad (11)^{21}\end{aligned}$$

$$Q-stat = 15.09[0.236] \qquad LM(F-stat) = 0.80[0.526]$$

$$RESET(F-stat) = 4.03E-05[0.995] \quad ARCH(F-stat) = 3.44[0.060]$$

$$NO(\chi^2-stat) = 0.74[0.692]$$

[18]The imposition of economic sanctions, following the nuclear tests in 1998, the SBP introduced a number of measures, such as freezing of foreign currency accounts, adoption of two tier exchange rate systems from July 1998 and channeling the foreign exchange from Kerb market to interbank market through Kerb purchases, to steer the economy from the crisis [Khan (2008)].

[19]For example, worker's remittances increased from US$ 5,998 in 2007 to US$ 17,060 in 2014 registering 65 percent growth. The reason could be depreciation of domestic currency from Rs. 60.63/US$ in 2007-08 to Rs 96.73/US$ in 2012-13.The other reason of remittances growth could be because of civil conflict and unrest related to 'Arab Spring'.

[20] In August 2008 oil price was more than $147 per barrel. However, due to global economic recession oil price declined to $33 per barrel in December 2008. In February 2009, oil price increased from $35 per barrel to $71 per barrel in June 2009 and reached to $114 per barrel in mid-2014. Thereafter, oil price collapse again and reached to $28 per barrel by February 2016.

[21] $EC_t = s_t - 0.63m_t^d + .62y_t^d + 0.05I_t^d - 0.08\pi_t^d + 0.74D_{98Q2} - 2.10D_{00Q3} + 0.69D_{07Q3}$

The results shown in Equation (11) implies that the impacts of Δm_t^d and Δm_{t-1}^d are negative in the short-run which are inconsistent with the hypothesised relationship predicted by the monetary exchange rate model. This result supports the liquidity puzzle hypothesis that monetary expansion causes to appreciate exchange rate. The contemporaneous effect of economic growth, relative to foreign economic growth on exchange rate changes is negative and significant; while one quarter lagged effect of output differential is positive in the short-run. However, cumulative effect of domestic economic growth is negative that causes exchange rate to appreciate in the short-run, which is in line with the hypothesised relationships implied by the monetary model of exchange rate.

The cumulative effect of interest rate differential is positive and significant, suggesting that tight monetary policy depreciates exchange rate through its impact on money demand in the short-run. The short-run effect of inflation rate differential on the exchange rate changes is negative and significant, confirming the presence of price puzzle hypothesis. Furthermore, nuclear tests and global financial crisis have no significant effect on exchange rate changes, while changes in exchange rate regime from managed floating to free floating exerts depreciating impacts on the exchange rate in the short-run. Finally, the adjustment coefficient of exchange rate is –0.02, implying that the long-run relationship between exchange rate and monetary fundamentals drags down exchange rate towards long-run equilibrium. The speed of adjustment towards long-run equilibrium is about 2 percent per quarter, which indicates that the response of exchange rate is weaker and it takes about twelve and half years to achieve long-run equilibrium path. This pattern of adjustment may be due to the non-linearities in the exchange rate adjustment process, asymmetric information, trade barriers, transaction costs, foreign exchange rate intervention, imperfect competition, structural changes in exchange rate regimes, less developed domestic markets and productivity differential across countries. These factors may prevent the economic agents from getting profits from arbitrage, as a consequence, exchange rate exhibit sluggish behaviour. Various studies have shown similar results [Alquist and Chinn (2008); Chinn and Meese (1995); Junttila and Korhonen (2011); Mark (1995); Taylor and Peel (2000)].

Pakistan has made remarkable progress in reforming its exchange rates and payments system during the past two decades. Domestic financial markets are now more integrated with international financial markets as compared to the 1990s. However, monetary policy fails to reduce exchange rate volatility and inflation. The existence of transaction costs, interaction of heterogeneous market participants, sharp swings in the Pak-rupee exchange rate during 1980s and 1990s, ineffective domestic monetary policy and insufficiently developed domestic financial markets cause weak adjustment of exchange rate in Pakistan. Another possibility of slow adjustment could be that besides monetary fundamentals, real factors such as worker's remittances, foreign direct investment and government debt to GDP ratio, net foreign assets and relative price of non-tradable goods and terms of trade also determine the exchange rate [Cheung, *et al*. (2005)].

4.2.2. *Long-run and Short-run Relative Income Differential Model*

The long-run parameters with regard to real income differential can be depicted by Equation (12):

$$y_t^d = -0.05 s_t + 0.67 m_t^d - 0.17 I_t^d + 0.10 \pi_t^d - 1.87 D_{98Q2} + 5.19 D_{00Q3} - 1.34 D_{07Q3} \quad (12)$$
$$(-0.04) \quad (1.72)^{**} \quad (-0.56) \quad (0.51) \quad (-0.66) \qquad (0.58) \qquad (-0.64)$$

The results show that only m_t^d exerts significant positive impact on relative income differential in the long-run, indicating that an expansion in domestic money supply, relative to foreign money supply increases domestic real income in the long-run. For short-run analysis, an error-correction model based on the selected ARDL (4, 1, 0, 4, 1) model is estimated (Equation 13):

$$\begin{aligned}
\Delta y_t^d &= 0.14 \Delta y_{t-1}^d - 0.13 \Delta y_{t-2}^d - 0.11 \Delta y_{t-3}^d - 1.13 \Delta s_t - 0.05 \Delta m_t^d + 0.00 \Delta I_t^d \\
&\quad (3.31)^{**} \quad (-3.12)^{***} \quad (-2.55)^{***} \quad (-19.45)^{***} \quad (-1.30) \qquad (0.07) \\
&\quad + 0.005 \Delta I_{t-1}^d + 0.00 \Delta I_{t-2}^d - 0.003 \Delta I_{t-3}^d - 0.005 \Delta \pi_t^d - 0.01 \Delta D_{98Q2} \\
&\quad (5.50)^{***} \qquad (1.14) \qquad (-3.31)^{***} \qquad (-5.06)^{***} \qquad (-1.34) \\
&\quad + 0.06 \Delta D_{00Q3} - 0.02 \Delta D_{07Q3} - 0.01 EC_{t-1} \qquad \ldots (13)^{22} \\
&\quad (4.27)^{***} \qquad (-1.53) \qquad (-8.14)^{**}
\end{aligned}$$

$$Q - stat = 9.08[0.696] \qquad LM(F - stat) = 1.47[0.216]$$
$$RESET(F - stat) = 3.05[0.084] \quad ARCH(F - stat) = 30.01[0.915]$$
$$NO(\chi^2 - stat) = 38.48[0.000]^{*}$$

The short-run impact of exchange rate changes is negative and significant, implying that depreciation of Pak-rupee exchange rate exerts negative impact on the economic growth in the short-run. The possible reason could be that depreciation of exchange rate causes to increase imports bill and domestic prices of crude oil which in turn increases costs of production. Consequently, domestic production tends to decrease. Furthermore, the effect of monetary expansion on economic growth is insignificant in the short-run, while the interest rate and inflation differentials appear to be significant in the output growth equation, however pass-through effects are too small producing negligible effect on output growth in the short-run. The possible reason could be perhaps the weak transmission mechanism of monetary policy in Pakistan. The dummy variables D_{98Q2} and D_{07Q3} have insignificant effect on relative income differential, while the dummy variable D_{00Q3} is positive and significant. This reveals that flexible exchange rate regime produces significant positive impact on the economic growth. The error-correction term is negative and significant, showing 1 percent adjustment towards long-run equilibrium.

4.2.3. *Long-run and Short-run Interest Rate Differential Model*

The long-run and short-run estimates of interest rate differential are presented in Equations (14) and (15) respectively.

$$I_t^d = 8.14 s_t - 2.82 m_t^d + 9.14 y_t^d + 0.63 \pi_t^d + 15.79 D_{98Q2} - 7.31 D_{00Q3} + 1.59 D_{07Q3} \quad (14)$$
$$(1.33) \quad (-0.58) \quad (0.91) \qquad (2.71)^{**} \quad (5.14)^{***} \qquad (-2.20)^{**} \qquad (1.22)$$

[22] $EC_t = y_t^d + 0.05 s_t - 0.67 m_t^d + 0.17 I_t^d - 0.10 \pi_t^d + 1.87 D_{98Q2} - 5.19 D_{00Q3} + 1.34 D_{07Q3}$

$$\Delta I_t^d = -0.23\Delta I_{t-1}^d - 0.02\Delta I_{t-2}^d + 0.29\Delta I_{t-3}^d + 4.31\Delta s_t + 16.54\Delta s_{t-1} + 1.55\Delta m_t^d$$
$$(-2.61)^{**} \quad (-0.20) \quad (3.49)^{***} \quad (0.50) \quad (3.40)^{***} \quad (0.39)$$
$$+ 4.39\Delta y_t^d + 0.19\Delta\pi_t^d + 3.04\Delta D_{98Q2} - 2.62\Delta D_{00Q3} - 0.08\Delta D_{07Q3} - 0.22EC_{t-1}$$
$$(0.61) \quad (1.93)^{**} \quad (2.68)^{***} \quad (-2.10)^{**} \quad (-0.08) \quad (-4.44)^{***} \quad (15)^{23}$$

$$Q-stat = 18.73[0.095] \qquad LM(F-stat) = 2.93[0.024]$$

$$RESET(F-stat) = 1.57[0.120] \quad ARCH(F-stat) = 16.64[0.000]^{***}$$

$$NO(\chi^2 - stat) = 663.74[0.000]^{***}$$

The results reveal that exchange rate; real output and inflation rate differentials have positive impact on the interest rate differential in the long-run. This indicates that a 1 percent increase in domestic inflation, relative to foreign inflation rate causes to increase domestic interest rate for a given foreign interest rate by 0.63 percent in the long-run. The reason could be that the SBP has taken aggressive monetary policy stance against domestic inflation so as to keep real interest rate at constant level since 2004. This finding validates the Fisher hypothesis in the case of Pakistan. The long-run effect of D_{98Q2} is positive and significant on domestic interest rate. The reason could be that after the May 1998 nuclear tests, Pak-rupee exchange rate slid down immediately from Rs. 45 per US dollar to Rs. 70 per US dollar. This sharp depreciation of exchange rate together with economic sanctions imposed by the world community has created uncertain economic environment which encouraged capital flight. To cope with this situation, some drastic measures were taken by the Government of Pakistan, including tight monetary policy, freezing of foreign currency accounts, etc. Furthermore, changes in exchange rate regime exert negative impact on the domestic interest rate, while the effect of GFC on domestic interest rate remains insignificant.

In the short-run, interest rate differential significantly determined by its own past lags; past lags of nominal exchange rate, inflation rate differential and a stable self-feedback mechanism. It also reacts positively to exchange rate changes and inflation rate differential in the short-run. This reveals aggressive monetary policy stance of the SBP against exchange rate depreciation and inflation in the short-run. It also indicates that the SBP focuses more on exchange rate management and price stability in the short-run. The dummy variables D_{98Q2} and D_{00Q3} have significant positive and negative impact on interest rate differential in the short-run. This confirms tight monetary policy stance after the nuclear tests and exchange rate depreciation after the change in exchange rate regime. The adjustment coefficient is negative and significant, implying that 22 percent of the deviations are eliminated in exchange rate through changes in domestic interest rates to achieve long-term equilibrium.

4.3. The SVAR Analysis

To study the dynamic response of exchange rate to monetary fundamentals shocks, generalised impulse response functions based on SVAR model are estimated. The contemporaneous coefficient estimates of the SVAR model are given in Table 5. These

[23] $EC_t = I_t^d - 8.14s_t + 2.82m_t^d - 9.14y_t^d - 0.63\pi_t^d - 15.79D_{98Q2} + 7.31D_{00Q3} - 1.59D_{07Q3}$

contemporaneous coefficients indicate immediate response of exchange rate with respect to shocks originating from the money supply, real income and interest rate and inflation rate differentials.

Table 5

Contemporaneous Structural Coefficients

	Coefficient	z-statistic	p-value
a_{12}	0.27	7.69***	0.000
a_{13}	0.54	14.30***	0.000
a_{14}	–0.001	–1.84*	0.066
a_{15}	0.002	2.15**	0.032
a_{23}	–0.69	–9.80***	0.000
a_{24}	0.001	0.82	0.411
a_{45}	–0.10	–0.91	0.362
a_{52}	–5.16	–1.28	0.202
a_{53}	15.42	3.70***	0.000
b_{11}	0.01	15.49***	0.000
b_{22}	0.03	15.49***	0.000
b_{33}	0.03	15.49***	0.000
b_{44}	1.41	15.49***	0.000
b_{55}	1.14	15.49***	0.000
$LR-\chi^2(1)^a$	49.40E-05		[0.992]

Note: a = LR test for over-identifying restrictions. ***, ** and * represent 1 percent, 5 percent and 10 percent level of significance respectively.

Table 5 shows that the short-run estimates of m_t^d (a_{12}), I_t^d (a_{14}) and π_t^d (a_{15}) have expected signs and consistent to the real interest rate differential variant of the monetary exchange rate model. The short-run coefficient of y_t^d shock is positive, contrary to the theoretical prediction of the monetary exchange rate model. This finding is consistent with the prediction of the Mundell-Fleming "Traditional Flow" model which hypothesises that an increase in domestic income, relative to foreign income increases the demand for imports, which in turn worsens trade balance and hence a depreciation in exchange rate in the short-run. Bhatti (2001) also found similar results in the context of Pakistan. The positive coefficients of m_t^d, I_t^d and π_t^d innovations indicate that a positive one unit shock to m_t^d and π_t^d would lead to a depreciation of Pak-rupee exchange rate, while negative sign of I_t^d innovation would cause an appreciation in the Pak-rupee exchange rate in the short-run. In terms of significance, m_t^d, I_t^d and π_t^d are the key factors in explaining the nominal exchange rate movements in Pakistan. The significance of inflation rate differential reveals the importance of inflationary expectations in the determination of Pak-rupee exchange rate in the short-run. Based on these SVAR coefficients, we have computed IRFs of the exchange rate with respect to four innovations: m_t^d, y_t^d, I_t^d and π_t^d shocks. A positive one unit standard deviation shock is applied for each fundamental up to a limit of twenty four quarter horizon. Figure 1 shows the IRFs of the nominal exchange rate.

Fig. 1. Responses of the Nominal Exchange Rate to Monetary Fundamentals Shocks

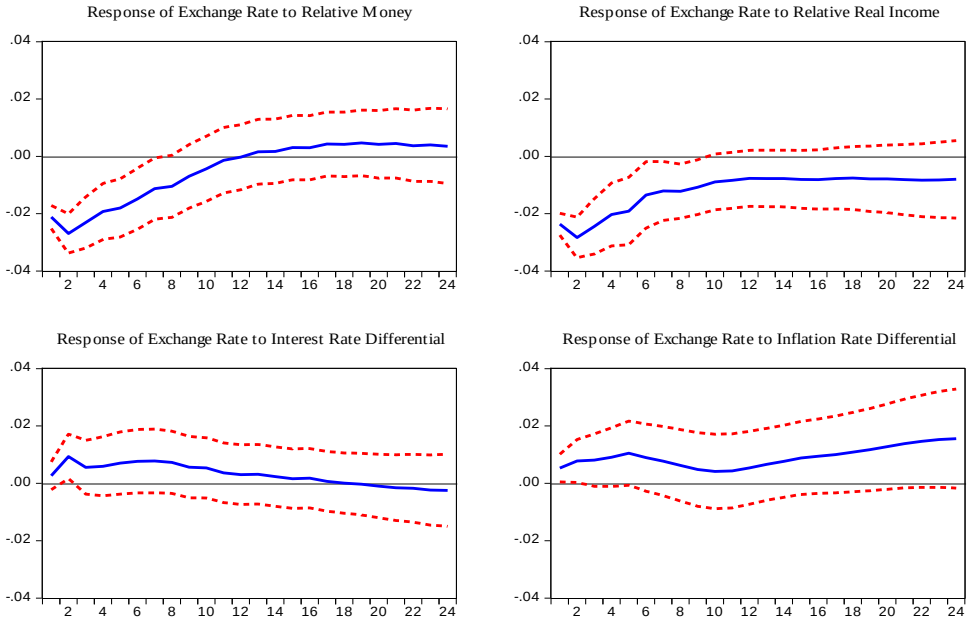

Figure 1 shows that a shock to domestic money supply for given foreign money, causes an appreciation of nominal exchange rate up to the eleventh quarter. Afterwards, the exchange rate touches the long-run path and starts depreciation. The point estimate shows that the impact effect is about –2.7 percent and this effect reached to 0.00 percent at the end of the eleventh quarters. Thereafter, the exchange rate starts depreciating slowly and at the end of twenty-fourth quarter it remains 0.03 percent. This hump-shaped adjustment pattern of nominal exchange rate confirms that exchange rate is deriving force from the transmission mechanism of monetary policy. However, this pattern of exchange rate adjustment confirms the existence of liquidity puzzle in Pakistan. A positive shock to domestic income, relative to foreign income causes a short-run exchange rate appreciation, as predicted by the monetary exchange rate model. Thereafter the response starts increasing up to the twelfth quarter and afterward it remains constant with point estimate of about –0.08 percent over the entire forecast horizon. However, it remains below the long-run steady state path over the entire forecast horizon. This implies that exchange rate has experienced persistent long-run appreciation following economic growth. A positive shock to domestic interest rate for given foreign interest rate leads to immediate jump in the nominal exchange rate in the first two quarters; thereafter it decreases up to the third quarter. Afterwards, it depreciates slowly and is seen peaked in the eighth quarter. After eighth quarter, it starts decreasing and becomes negative by the end of twenty-fourth quarter. This implies that an increase in domestic interest rate exerts depreciating effect on nominal exchange rate in the short-run. The slow response of exchange rate to interest rate differential shock implies a delayed overshooting and the depreciation process is too sluggish, thus violating the "uncovered interest rate parity" (UIP) condition. This pattern of exchange rate adjustment in response to tight monetary policy provides weak support for the Dornbusch's overshooting hypothesis. We observe

no exchange rate puzzle. Finally, the exchange rate responds positively to a one unit positive shock to inflation differential in the first five quarters after the shock. Thereafter, the response slowly decreases up to the tenth quarter, and then the response turns to be positive and increases slowly over the remaining forecast horizon. The point estimate shows that the impact reached to 1.6 percent in the twenty-fourth quarter. The slow response of nominal exchange rate with respect to inflation differential could be due to price stickiness, tariffs and transaction costs, insufficient developed domestic markets, productivity differential and asymmetric information.

We have computed generalised FEVD of exchange rate and results are reported in Table 6. The exchange rate itself explains 100 percent variation on the impact period, but it decreased to 84.54 percent in the twelfth quarters. The contribution of relative money supply shock to nominal exchange rate movements is 62.83 percent on the impact and on average the contribution remains 62.34 percent in the first three quarters. Afterwards, the impact of relative money decreased from 58.52 percent in the fourth quarter to 31.90 percent in the 12th quarter. This reveals that relative money supply shock significantly explains short-run fluctuations in the nominal exchange rate, however, the contribution gradually decreases over the longer horizon. Similarly, the share of income shock is 78.42 percent in the first quarter and has gradually decreased to 62.54 percent in the twelfth quarter. One standard deviation positive shock to the interest rate differential explains maximum variation within the first four quarters. From 0.98 percent in the first quarter, it rose to 24.16 percent in the fourth quarter, thereafter the contribution of interest rate differential gradually decreases and reaches 15.47 percent in the twelfth quarter. This implies that interest rate is an important factor that influences nominal exchange rate movements in Pakistan in the short-run. Finally, the contribution of inflation rate differential in exchange rate variation was 3.98 percent in the impact period which reaches to 7.73 percent in the third quarter. Thereafter, the impact gradually decreased and reached 6.94 percent in the sixth quarter. Afterwards, the impact of inflation differential on exchange rate reversed and reached 8.18 percent by the end of twelfth quarter. This implies that inflationary expectations play key role in explaining nominal exchange rate in the short-run.

Table 6

Generalised Forecast Error Variance Decompositions of Exchange Rate

Horizon	ε_{s_t}	$\varepsilon_{m_t^d}$	$\varepsilon_{y_t^d}$	$\varepsilon_{i_t^d}$	$\varepsilon_{\pi_t^d}$
1	100.00	62.83	78.41	0.98	3.98
2	96.16	62.83	77.44	16.08	7.71
3	96.12	61.37	75.87	20.44	7.73
4	95.23	58.52	72.88	24.16	6.86
5	94.07	51.69	72.66	23.61	6.31
6	92.32	46.93	72.30	22.18	6.94
7	91.00	42.84	70.94	20.79	8.37
8	90.19	40.28	70.49	19.28	9.30
9	89.33	37.33	69.02	17.90	9.48
10	88.32	35.12	67.15	17.04	9.04
11	86.57	33.15	64.91	16.09	8.53
12	84.54	31.90	62.54	15.47	8.18

5. CONCLUDING REMARKS AND POLICY IMPLICATIONS

This study examines the contribution of monetary fundamentals in explaining Pak-rupee *vis-à-vis* US-dollar exchange rate over the period of 1982Q2 to 2014Q2, using the cointegration and SVAR modelling techniques. The Johansen (1995) cointegration test supports the presence of unique cointegration relationship between exchange rate and monetary fundamentals, while three cointegration relationships were obtained using the ARDL-bounds cointegration test. The results reveal that money supply and real income differentials are the key drivers of exchange rate in the long-run, while money stocks, real income and interest rate differential are the key determinants of nominal exchange rate in the short-run. The results from the error-correction model reveal that exchange rate, money supply, interest rate and inflation rate differentials are important in the adjustment process in order to achieve long-run equilibrium path. The results further suggest that speed of adjustment towards long-run equilibrium is too weak. Finally, IRFs and FEVD analysis reveal that money supply, real income, interest rate and inflation differentials are the key factors that explain short-run variations in nominal exchange rate in Pakistan.

The policy implications that emerge from this analysis are: First, the existence of significant long-run and short-run relationships between exchange rate and monetary fundamentals indicate the effectiveness of monetary fundamentals, in explaining exchange rate movement in Pakistan. Policy-makers, therefore, may use these fundamental variables as stabilising tool for the prediction of Pak-rupee exchange rate in the long-run and in the short-run. Particularly, policy-makers can use monetary policy to induce changes in international competitiveness, by manipulating exchange rate. Exchange rate does in fact exert a significant influence on the direction and volume of international trade and capital flows. Second, money supply is another important determinant of exchange rate in Pakistan; therefore, any policy aimed at reducing monetary expansion would promote exchange rate stability in Pakistan. Among the monetary fundamentals, interest rate and inflation rate, differentials explain most of the variations in exchange rate in the first four quarters. Therefore, interest rate could be a more powerful tool in stabilising Pak-rupee exchange rate in the short-to-medium-run. This is because the rise in the domestic interest rates for given real money demand causes reduction in money supply. The rise in domestic interest rates results in capital inflows and causes nominal exchange rate to appreciate in the short-run. Therefore, tight monetary policy is needed to stabilise Pak-rupee exchange rate. The only caution is that the effectiveness of such policy stance will depend on the SBP's discipline and the coordination between fiscal and monetary authorities. To this end, there is a need for coordinated monetary and fiscal policies to enhance the exchange rate stability and external competitiveness. Stability of Pak-rupee exchange rate would also be helpful to encourage trade and investment linkages between Pakistan and regional economies under the China-Pakistan Economic Corridor (CEPC), as depreciation of exchange rate will increase external debt burden in the coming years.

The results of this study provide useful insights for understanding exchange rate dynamics in other countries of the South Asian region. Since, majority of South Asian countries are broadly similar in the sense that they are developing countries from the same geographical region and experience similar influence from the outside world. Particularly, these countries are homogenous in terms of their development strategies and

face similar issues with regard to monetary and exchange rate policies. The regional economies are struggling to establish stable a macroeconomic environment, which is necessary to enhance their ability to attract Foreign Direct Investment and promote trade and financial linkages in Asian region. Therefore, policy-makers can consider the monetary exchange rate model as a useful benchmark to understand the evolution of exchange rate movements. The findings of this study do provide support for the regional trade and financial integration, and monetary and exchange rate policy coordination in South Asia, as majority of Asian countries are using US dollar as base currency. Asian countries can reap the benefits from pursuing coordinated approach with regard to monetary and exchange rate policies in the core areas of trade, manufacturing and services through elimination of restrictions on regional trade. Furthermore, coordinated policies will also reduce harmful spillover effects from a country's unsound macroeconomic policies on neighbouring countries through exchange rates, interest rates and trade and capital flows. Regional economic policy coordination could also be helpful in lowering exchange rate fluctuations and keeping inflation rates low and stable [Rajan (2012); Kwack (2005)]. The results of this study can also be helpful for investors and financial managers in understanding the linkages between exchange rate and monetary fundamentals and for designing policies related to investment, hedging and risk management.

APPENDIX

Table 1a

Misspecification Tests for the Single Equation and VAR Estimation

Series: $z_t = (s_t, m_t^d, y_t^d, I_t^d, \pi_t^d)'$

Single Equation	Portmanteau (12)	AR (5)	Normality	ARCH (4)	Hetero
s_t	6.76	0.31 [0.904]	30.81 [0.000]***	0.10 [0.982]	0.27 [0.999]
m_t^d	6.55	0.32 [0.901]	4.36 [0.113]	0.69 [0.599]	0.31 [0.999]
y_t^d	4.15	1.87 [0.110]	133.16 [0.000]***	28.83 [0.000]***	0.99 [0.536]
I_t^d	14.20	2.21 [0.061]	65.39 [0.000]***	1.61 [0.180]	0.48 [0.990]
π_t^d	23.01	5.53 [0.000]***	1.13 [0.569]	0.29 [0.883]	0.29 [0.999]
VAR Statistic	185.689	1.28 [0.084]	578.22 [0.000]***	–	0.34 [0.999]

Note: Residuals diagnostics include AR (errors autocorrelation) test, Autoregressive Conditional Heteroscedasticity (ARCH), Normality of the distribution of the residuals and Heteroscedasticity (Hetero test). *** indicate significant at the 1 percent level and [.] indicates p-values.

Table 2a

Weak Exogeneity Test

	s_t	m_t^d	y_t^d	I_t^d	π_t^d
$\chi^2(4)$	15.27 [0.004]***	19.67 [0.001]***	5.38 [0.251]	17.77 [0.001]***	10.18 [0.038]**

Note: p-values are in parenthesis *** and ** indicate significant at the 1 percent and 5 percent levels respectively.

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Do Non-farm Enterprises Offer Pathways for Upward Mobility in Rural Pakistan? Evidence from Panel Dataset

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This study has analysed the dynamics of rural non-farm enterprises and their role in employment provision, equity enhancement and poverty alleviation in Pakistan. Multiple data sources have been used including cross-sectional and panel datasets. The results show that majority of the rural non-farm enterprises in Pakistan are micro-enterprises with only a limited share in manufacturing. They are informal and have poor forward and backward linkages and high closure rate. Despite the poor asset base, they are providing jobs to more than half of the rural population, contributing to reduction in poverty and equity enhancement among the rural masses. Rich households own enterprises and poor households gain employment from non-farm enterprises. Non-farm economy has a significant impact in reducing multiple deprivations and also has a significant positive impact in pulling households out of poverty with the passage of time. Pakistan, being a country where most of the population is still residing in rural areas and where rural land is not equitably distributed; such non-farm activities are highly important not only to tackle the ongoing food security challenges but also for resource diversification of households.

JEL Classification: I32, J21, J43, O14, Q10, R11
Keywords: Rural Development, Non-farm Sector, Employment, Poverty, Multidimensional Poverty

1. INTRODUCTION

With the process of industrialisation, the transformation of economy from agriculture to industry has resulted in structural movement of labour, from farm to off-farm sector all around the globe, as reasoned by Lewis Dual Sector Model (1954). Such shifts, both in economy and labour commenced firstly in developed countries in the mid-20th century and later in developing countries.[1] From policy point of view, the rural non-farm economy mostly remained neglected, especially in developing countries; its importance grew overtime with rural population facing rising risks of poverty, vulnerability and food insecurity. The importance is further underlined, because these off-farm activities in rural areas could be a potential source to stimulate economic growth and rural well-being. The 'non-farm' enterprises include all the economic activities in rural areas, except agricultural activities, including livestock, forestry, fishing and hunting.

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[1]Weersink, *et al.* (1998), Oldenhanna and Oskan (2001), Lamb (2003), Joliffe (2004).

Traditional economic theories have linked up rural development primarily with agricultural growth, due to its predominance in rural life. However, during 1980s and onward various socio-demographic and economic surveys, conducted in many developing countries revealed the growing dependence of rural population on non-farm sector [Malik (2008)]. This change commenced due to positive effects of globalisation and liberalisation policies, starting from the late 1980s and early 90s in various developing countries, including the South Asian countries, which opened new economic opportunities for the private sector and foreign investors to expand domestic markets and access new markets [Haggblade, *et al.* (2007)].

Presently more than half of the rural Pakistani labourers are employed in non-farm activities. Yet, the dominant growth-centric development paradigm in Pakistan has been looking to the farm sector for rural poverty alleviation. The rural non-farm sector is important for many reasons. First, poverty in Pakistan is predominately a rural phenomenon, especially in interior Sindh, Southern Punjab, south KP and Balochistan. Second, around 63 percent of the rural households are landless; therefore the impact of the agricultural policy may be quite small on these households. Third, non-farm activities also significantly support farm households through diversification of labour, both in farm and off-farm activities [World Bank (2007)].

A considerable body of literature has discussed the issues of agriculture and poverty in Pakistan; however, majority of the studies have ignored the role of rural non-farm economy in poverty alleviation and resources diversification. A few studies have analysed the role of rural non-farm economy but with a limited focus. For example, Nasir (1999) analysed the link of poverty with employment. Arif, *et al.* (2000) viewed the level of poverty among the various farm and non-farm groups. Sur and Jian (2006), World Bank (2007) and Malik (2008) have analysed the structure of rural non-farm economy; however, no comprehensive study has been carried out to analyse its structure, employment provision, labour diversification and contribution to household welfare. In view of the growing importance of rural non-farm activities, this research is essential for policy formulation to eradicate rural poverty. The present study aims to fill this gap by examining the structure of rural non-farm enterprises in terms of business and employment provision, household livelihood strategies i.e. labour diversification and the impact of household livelihood strategies on household welfare. For household welfare, headcount poverty, multidimensional poverty index (MPI) and child school enrolment status have been taken as the welfare indicators.

The paper is divided into 7 Sections. Section 2 presents the theoretical considerations of dynamics of rural non-farm economy, followed by data sources and methodology in Section 3. Profile of Pakistani rural non-farm enterprises is given in Section 4, while its role in employment provision and poverty reduction is discussed in Sections 5 and 6. Conclusion and policy recommendations have been reported in the last section.

2. DYNAMICS OF RURAL NON-FARM ECONOMY: THEORETICAL CONSIDERATIONS

The absence of land or poor land endowments are the key push factors to initiate non-farm activities. In parallel, higher wages in non-farm sector could be the major pull

factors. Both the push and pull factors become more significant if farm income is not sufficient to fulfill family needs [Barrett, *et al.* (2001)]. Traditional rural insight is considered as a low productivity sector, as argued by Hymer and Resnick (1969). Liberalisation policies after the 1980s have resulted in new opportunities to invest in rural areas. As a result, massive foreign investment was witnessed in Asia, Africa and Latin America with rising rural non-farm activities [Haggblade, *et al.* (2007)].

Compared to agriculture sector, rural non-farm sector is growing rapidly in many developing countries, therefore, it can play a key role to alleviate rural poverty and improve equality and equity [Arif, *et al.* (2000)]. There exists a positive relationship between non-farm activity and household welfare because it provides jobs opportunities, more income and even improves agricultural productivity [Lanjouw and Lanjouw (2001)]. In addition, employment provision through non-farm sector could be a key remedy to overcome the pressure of growing rural labour force, by absorbing surplus rural labour. Besides this, it can slow down rural-urban migration and can on the whole contribute to national income and productivity [Lanjouw and Feder (2001)].

The empirical evidence from Asian countries suggests that high agricultural production also promotes rural non-farm economy. The late 1970s agricultural reforms in China gave much freedom to farmers to diversify their production strategies. Massive public investment led to establishment of Township and Village Enterprises (TVEs) and specialised households [Ravallion (2009)]. Overseas remittances also stimulate rural economy by raising rural investment, construction activities and agricultural inputs [Ellis and Freeman (2004)]. In Pakistan, the return migrants from Middle East have been establishing their small level businesses, by utilising their experience and savings.

Non-farm enterprises can potentially contribute to economic growth both directly and indirectly. The direct channel depends on its size and its receptiveness to agricultural growth and linkages with export markets, while the indirect channel largely depends on the financing, processing and marketing structure through which both the agriculture and non-agriculture growth could be reserved. The rural population can adopt these non-farm activities as a potential source to diversify their incomes and smooth their consumption in case of various agricultural shocks, including price failure, droughts, floods etc. Amid growing landlessness, poor households largely depend on non-farm earnings for their survival [Stifel (2010)].

There is growing interest to observe the role of rural non-farm enterprises as a source of employment and income provision across the developing world. The primary employment shares of rural non-farm sector in total employment emphasise the importance of this sector in various continents, as shown in Table 1, suggesting that the rural non-farm economy accounts for about 19 percent employment provision share in Africa, 30 percent in Asia and Latin America and 24 percent in West Asia and North Africa. A significant share of women in rural non-farm sector in all the continents can also be seen in Table 1. Services sector dominates in employment provision while all the continents have roughly similar role of manufacturing in employment provision. Though secondary employment could be another contribution because of seasonal pursuit, however the results reveal only primary occupation, thus they may understate the importance of rural non-farm activities.

Table 1

Composition of Rural Non-farm Employment by Continent (in %)

Employment Provision	Africa	Asia	Latin America	West Asia and North Africa
Non-farm Share in Rural Labour (%)	19	30	30	24
Women Share of Total Rural Non-farm Labour (%)	35	25	40	8
Share of Rural Non-farm Employment by Sector (% Distribution)				
Manufacturing	19	27	22	23
Commerce and Transport	31	29	23	22
Personal Financial and Community Services	35	30	34	35
Construction, Utility and Mining	15	14	21	20

Source: Haggblade, *et al.* (2007).
Note: Results are weighted by population.

Various studies found negative correlation of non-farm activities with poverty. It not only offers higher income and consumption [Lanjouw and Feder (2001)] but also better nutrition [Barett, *et al.* (2001)]. A rising trend of rural non-farm activities can be seen in South Asian countries. All this implies that not only the links between agriculture and rural poverty should be examined, but also the role of rural non-farm sector in poverty reduction should be researched. A dynamic labour-intensive agriculture, combined with a modernised non-agricultural sector in Pakistan, can provide diversified employment opportunities to the rural households, resulting in rapid growth, classless distribution, diminishing rural unemployment and underemployment and lowering the pressure on rural-urban migration. Special policy orientated attention is required to eradicate rural poverty and hunger by promoting non-farm activities in rural Pakistan. The ongoing paper explores the linkages between non-farm activities and rural welfare in Pakistan.

3. DATA SOURCES AND METHODOLOGY

The present study has used multiple data sources, including various rounds of Labour Force Survey (LFS), to analyse employment trends; Pakistan Social and Living Measurement Surveys (PSLM) 2010-11 (micro dataset), to analyse the district level concentration of non-farm enterprises and Household Integrated Economic Survey (HIES) 2013-14 (micro dataset), to observe the linkages of non-farm activities with poverty and multidimensional poverty index (MPI). It is worth mentioning that during PSLM-2010-11, a district level representative dataset provides details of non-farm activities at household level while the later rounds of 2012-13 and 2014-15 lack such information. However, HIES 2013-14 round, a provincial level representative dataset details non-agricultural activities.

Since present study aims to analyse the dynamics of role of non-farm economy and its role in upward welfare mobility of households (dynamics of poverty), therefore the study has also used two rounds of Pakistan Panel Household Survey (PPHS), 2001 and 2010, conducted by PIDE [for details over PPHS sample size, see Arif and Shujaat (2014)]. It is worth mentioning that 2004 round of PPHS lacks module on non-farm activities.

The present analysis on non-farm activities is carried out only for rural Pakistan. Clarification on three concepts is necessary: 'non-farm', 'rural' and 'poverty'. Rural non-farm activities lie on or between the boundaries of usual rural-urban and agricultural and non-agricultural categories. The ongoing study has followed the 2010 official industrial classification, where agriculture, including crops, livestock, fishery and forestry has been considered as the farm activities, while the non-farm activities include all the other activities except agriculture. Regarding 'rural' clarification, both the PSLM and LFS follow the rural-urban definition of 1998 census, in which the 'rural towns' falling under administrative status are treated as the urban areas, therefore, these towns are not included in the present analysis. Regarding 'poverty' measurement for two rounds of PPHS, we have adopted the poverty series from Arif and Shujaat (2014), they have followed the official methodology as defined by The Planning Commission of Pakistan, which can be called the Food Energy Intake (FEI) approach. Poverty line was defined to impart 2,350 calorie in-take per adult per equivalent per day with an adjustment of non-food minimal requirement (Rs 723.4 for year 2001). The official poverty line for 2010 period was inflated (it was Rs 1671.9 for year 2010) by using the Consumer Price Index and applying it on PPHS 2010 rounds to measure headcount poverty. For HIES 2013/14 dataset, the Government of Pakistan has recently updated poverty line which is Rs 3030 per adult equivalent per month, instead of Rs 2400. The new measure is named as Cost of Basic Needs (CBN) approach and it considers additional non-food expenditures on education, clothing and shelter to be part of the poverty measurement. Using the CBN approach, this study has measured headcount poverty by using Rs 3030 per adult equivalent per month and found 29.5 percent poverty (18.2 percent in urban areas and 35.6 percent in rural areas), the same number reported by the government of Pakistan.

Household welfare is defined by headcount poverty, per capita real expenditure, child school enrollment and multidimensional poverty index (MPI). Both rounds of PPHS and HIES 2013-14 survey have a detailed consumption module on which headcount poverty is calculated, while MPI is calculated by following the Alkaire and Foster methodology, taking 3 dimensions and 14 indicators, using HIES 2013-14 survey. The detailed definition along with weights of indicators is given in Appendix 1. The following equation has been estimated to measure the impact of non-farm enterprises on dynamics of poverty;

$$PD_{01\text{-}10i} = \alpha_{01i} + \alpha_1 I_{01i} + \alpha_2 Hd_{01i} + \alpha_3 NF_{01\text{-}10i} + \alpha_4 Rg_{01i} + \alpha_5 \Delta S_{i01\text{-}10} + \mu_{1i}$$

The dependent variables $PD_{01\text{-}10i}$ represent the change in poverty status between two rounds (2001 and 2010) with four outcomes (never-poor, poor in two periods, moved out of poverty, and moved into poverty). On the right-hand side, vector I_i measures the characteristics of the head of household (gender, age, education), vector Hd_i measures the household characteristics (household size, dependency ratio, household structure, agriculture, remittances and livestock ownership) and Rg_i measures the province of residence. $NF_{01\text{-}10i}$ variable measures the ownership of non-farm enterprises by households in 2001 period. All the correlated are taken from 2001 round while $\Delta S_{i01\text{-}10}$ represents the vector of change variables during 2001 and 2010, which are: change in household size, dependency ratio, education of head, land and livestock (for details on dynamics of poverty, please see the study of Arif and Shujaat (2014)). Since dependent variable has more than two outcomes, the multinomial logistic regression has been applied.

4. RURAL NON-FARM ECONOMY: PROSPECTUS AND IMPORTANCE

There is no precise number of rural non-farm enterprises in Pakistan but extrapolation from 2013-14 HIES dataset reveals that there are more than 5 million rural non-farm enterprises.[2] On average, 19 percent of the rural households own non-farm enterprises with regional variations across the provinces.[3] Remoteness and poor access to both the physical and soft infrastructure are the major hurdles for households to establish these enterprises, other than access to finance, human capital, physical capital and access to markets. Districts having higher literacy and educational rates, as well as with better access to metallic road and financial sector, have more concentration of these rural non-farm enterprises [for details see Appendix 2].

Rural non-farm enterprises in Pakistan are primarily related to trade (50 percent) and services (38 percent) activities. The share of production enterprises is quite small (12 percent) and is less than other countries of the region: 27 percent in Bangladesh and 40 percent in Sri Lanka [World Bank (2007)]. Very few of them use the modern business practices i.e. marketing, accounting, insurance and information technology [for details see Appendix 3]. Using two rounds of PPHS panel dataset, majority of the enterprises are informal, not only do they employ few workers (Table 3) but very few of them (11 percent) pay taxes. As revealed by panel survey, they are progressing by improving their operational capacity with more assets and sale returns overtime (Table 2). They are fairly young, but their average age is rising. Asset and sale base is small but it improved during 2001-10 period.

Table 2

Profile of Rural Non-farm Enterprises in Pakistan

Profile Overtime	2001	2010
Average Age of Enterprise (Years)	9.3	11.3
Enterprise Operated 12 Months (%)	61.1	86.9
Consumed Part of Commodity by HH (%)	59.6	66.1
Annual Real Profit (in 000 Rs)	29.6	63.9
Annual Real Sale (in 000 Rs)	138.3	191.4
Real Value of Inventory (in 000 Rs)	40.5	27.9
Real Value of Raw Material (in 000 Rs)	7.9	12.7
Real Value of Building and Land (in 000 Rs.)	101.3	105.1
Real Value of Capital Assets (in 000 Rs)	22.7	66.5
Have to Pay Some Debt (%)	18.3	19.9

Source: Calculated from PPHS 2001 and 2010 micro dataset.
Note: For real value, Base 2001 is used where 2010 value is deflated by consumer price index (CPI).

[2]HIES 2013-14 Survey asked question "During the last 12 months was any HH member proprietor of or partner in a non-agricultural, non-financial establishment, business or shop (fixed or mobile), which employed no more than 9 persons on any day during the last 12 months.

[3]Rural households in province KP own 19 percent, Punjab with 22 percent, Sindh with 9 percent and households in Balochsitan own 14 percent non-farm enterprises.

Table 3

Employment Size of Rural Non-farm Enterprises in Pakistan

Employment Type	Start of Business	2001	2010
Average Full-time Workers			
Family Workers (in Numbers)	0.02	0.68	1.24
Total Workers (in Numbers)	0.04	2.19	2.23
Average Part-time Workers			
Family Workers (in Numbers)	0.01	0.35	0.22
Total Workers (in Numbers)	0.02	0.52	0.94
Employment Size Distribution of Enterprise (Full Time Only)			
Less than 2 Workers	98.6	86.0	74.3
2-5 Workers	1.4	11.8	16.0
More than 5 Workers	0.0	2.2	9.7

Source: Calculated from PPHS 2001 and 2010 micro dataset.
Note: Manager is not included in employment calculation.

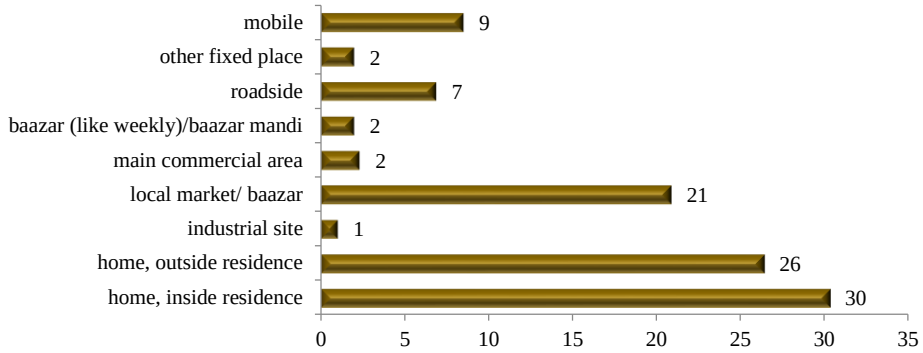
The recent Labour Survey statistics reveal that women have a very low proportion, of only 14 percent, in non-agricultural jobs in Pakistan. Though not listed here in table, women's share in the role of manager to run these enterprises, has significantly improved from 2 percent to 6 percent during 2001-10 period, as shown by 2001 and 2010 rounds of PPHS. Education of mangers also improved during 2001-10 period. Like other south Asian countries, rural non-farm enterprises in Pakistan are also primarily operated as sole-proprietorships, with more share of family and part-time workers. Table 3 shows that on average, these enterprises hire 2.2 full-time and 0.9 part-time workers, including the paid and family workers, thus totalling to 3.2 workers on average.[4] Nearly three-fourths of the rural enterprises hire only one worker, either paid or unpaid, while around 10 percent employ more than 5 workers.

With the passage of time (2001 and 2010 round), more enterprises shifted from homes to outside homes and other market places, but still more than half of the rural non-farm enterprises are located at homes, either inside or outside the residences, with a minor percentage at road side, main commercial area or industrial sites (Figure 1). PPHS 2010 survey reveals that 87 percent of the enterprises sell their products in the same village/town, followed by 6.9 percent to cities, 5.3 percent to other villages and only 0.7 percent to other provinces and countries (not listed in table).

The panel survey also reveals that 15.4 percent of rural panel households own enterprise in 2001 but not in 2010, reflecting the high closure rates. Only 5.4 percent of the households own in both the rounds. All this profile highlights that relatively fewer shares of production enterprises in Pakistan highlight the missed potential for value addition. There seems to be absence of the essential agricultural support services and linkages, necessary to stimulate the growth of non-farm sector. Poor equipment, including the human, physical and financial margins, along with regional disparities, often restricts low income households to run low productivity enterprises with higher labour intensity and lower financial returns.

[4]Paid workers can be calculated by taking the difference between total workers and paid family workers.

Fig. 1. Place of Business of Rural Non-farm Enterprises (%)



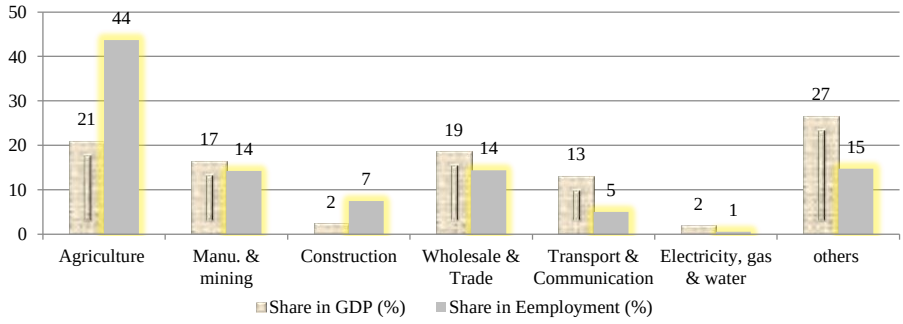
Source: Calculated from PPHS 2010 micro dataset.

5. ROLE OF NON-FARM ECONOMY IN EMPLOYMENT PROVISION

Historically, the economy of Pakistan has witnessed a sectoral shift of economy and labour from farm to off-farm by transforming agricultural share to industrial and services sector. In income share, major shift occurred only from agriculture to services sector, as share of industrial sector is almost stagnant over the last four decades. In parallel, inter-temporal labour movement also took place with more labour in non-farm activities, but still agriculture is the main source of livelihood with its employment share of 43 percent overall. One major realisation in Pakistan is that the share of labour associated with agriculture has not declined at the same pace as the share of agriculture in GDP growth has declined over time. On the other hand, despite being an agrarian country, share of non-farm employment is rising even in rural areas, especially in trade and construction activities (Appendix 4).

Within non-farm employment, four sub-sectors, including manufacturing, construction, commerce and service are more important for employment provision in rural Pakistan (Figure 2). Several reasons are considered to have contributed to this structural shift including; overseas and return migration to Middle East; unequal land distribution; stagnant agricultural productivity; rising pressures to improve the livelihoods and overall improvement in education and awareness.

Fig. 2. Share of Major Sectors in GDP and in Employment, 2015-16



Source: Government of Pakistan, 2015-16.
Note: 'others' include finance and insurance, housing, private and government services.

Both micro and macro level socio-economic factors determine the allocation of labour in farm and off-farm activities. These factors may vary across the individuals, households and regions as *per* available opportunities. Non-farm employment can further be classified into four major categories: employer, paid employed, self-employed and unpaid family helper. Paid employment category absorbs the largest share of off-farm labour (49 percent), followed by unpaid family worker (33 percent), self-employment (17 percent) and employer with only 1 percent. A significant industrial shift of employment can be observed overtime where manufacturing and wholesale activities gain shares, whereas construction and social and personal services **sector** lost **its** share during 1996-2014 periods (Table 4). During 1996-2014 periods, share of unpaid family worker has increased considerably and paid employment share drastically decreased by 25 percentage points. Within self-employed category, trade and transport are the major sources of employment sector, while manufacturing and service are other important sectors to provide jobs in this category. Services and construction activities account more than half of the rural non-farm employment for wage employees. Government employees, especially in education and health account for significant proportion of rural services sector.

Overall rural females occupy a very low share in off-farm labour and are limited to only few sectors. They also face quite different labour allocation than their male counterparts, with their major share in unpaid family worker (67 percent) category, while 27 percent are paid employed and only 6 percent fall in self-employment category. For all sorts of labour (paid, unpaid and self-employment), employment is mostly limited only to manufacturing and services sectors, except whole sale activities for unpaid family workers (Appendix 5).

Table 4

Rural Non-farm Employment in Pakistan by Employment Type and Status (in %)

	1996-97			2014-15		
Type of Industry	All Non-farm Workers	Self-employed	Paid Employees	All Non-farm Workers	Self - employed	Paid employees
Mining	0.5	0.4	2.9	0.7	0.1	0.9
Manufacturing	13.4	13.2	11.9	20.5	17.9	20.7
Electricity Gas and Water	1.5	0.1	1.9	0.9	0.1	1.3
Construction	24.1	2.5	31.7	20.0	2.4	29.6
Whole Sale and Retail Trade	16.6	53.3	4.0	21.3	46.6	7.8
Transport and Communication	12.1	12.4	12.5	11.5	16.1	10.1
Hotel and Restaurant	2.7	2.4	2.6	2.2	2.3	1.9
Professional Services	0.9	0.5	1.0	1.3	1.4	1.4
Social and Personal Services	28.3	15.2	31.4	21.7	13.2	26.3
% Share	–	20.2	73.6	–	24.3	48.5
Total	100	100	100	100	100	100

Source: Calculated from the PSLM 2014-15 micro dataset, Arif, *et al.* (2000) for 1996-97 numbers.

6. NON-FARM ECONOMY AND POVERTY ALLEVIATION

6.1. Non-farm Economy and Equity Enhancement

Wealthier households in Pakistan are more likely to own some non-farm businesses as compared to middle income and poor households, while these enterprises are the major sources of livelihood for poor households. Household's income sources have been explained in Table 5, which show that enterprise ownership tends to increase monotonically as per capita household expenditures (quintile)[5] improve. While the richest households own more enterprises, 57 percent of the poorest (lowest quintile) households obtain their income from off-farm activities, especially non-agricultural wages. This shows that non-farm income sources for the poorer reflect equity enhancing in Pakistan. In some developing countries, non-farm income sources are inequitable, as they have less contribution towards the poorer households i.e. Ecuador and Vietnam or neutral equitable i.e. India and Ethiopia [Malik (2008)].

Table 5

% of Rural Households with their Sources of Income

	Household's Per Capita Expenditure Quintile					
Ownership and Income Sources	Poorest Quintile	Quintile 2	Quintile 3	Quintile 4	Richest Quintile	Overall
Households Own Enterprise (%)	12.2	16.3	19.4	27.6	31.8	18.8
Household's Source of Income						
Agricultural Wages	11.3	8.4	5.3	4.3	1.2	7.3
Total Farm (Excl. Agric. Wages)	31.4	34.6	43.8	48.6	55.5	44.8
Net Business Income	11.1	13.1	14.6	15.6	16.2	13.8
Non-agricultural Wages	46.2	43.9	36.3	31.5	27.1	34.1
Total Non-farm	57.3	57	50.9	47.1	43.3	47.9

Source: Calculated from HIES 2013/14 micro dataset.

6.2. Role of Non-farm Economy in Household Welfare

Pakistan has not succeeded in reducing poverty on permanent basis, poverty rates fluctuated across the decades. Poverty rates in Pakistan are considerably higher in rural areas, with a gradual shift to rural areas rather than urban areas [Arif and Shujaat (2014)]. Two questions emerge here: First, *how do non-farm enterprises impact households in terms of poverty, education and multidimensional poverty (MPI)*? Second, *how do non-farm enterprises affect the movements of poverty across time*? To answer these questions, the two rounds of PPHS panel survey (conducted in 2001 and 2010) and HIES 2013-14 are used. As shown in Table 6, in both panel rounds, the incidences of headcount poverty rates are considerably lower among those households who own some non-farm enterprises. The farmer households also have higher real per capita consumption expenditures in both the rounds and their children are more enrolled in schools as well. Another interesting finding, as given in Table 6 is the incidences of MPI in rural areas, again the results of MPI support that rural households, having some enterprises, have a lower level of multidimensional poverty (17.3 percent), compared to those who don't own enterprise (26.8 percent).

[5]Using food and non-food consumption expenditures (non-food only durable good), per capita household monthly consumption expenditures (after adjusting household size were derived and five quintiles were established.

Table 6

Household Welfare by the Status of Non-farm Enterprises in Rural Areas

Household Welfare	2001	2010
Headcount Poverty (in %)		
HH Having Enterprise	21.1	19.4
HH Not having Enterprise	28.8	22.6
Overall	26.9	22.2
Real Per Capita Monthly Expenditures (in Rs)		
HH Having Enterprise	1290.3	1318.4
HH Not having Enterprise	1090.2	1121.3
Overall	1137.2	1197.7
Currently Enrolled Children of age 5-14 (in %)		
HH Having Enterprise	51.6	66.6
HH Not having Enterprise	50.8	52.8
Overall	51.2	59.6
Multidimensional Poverty Index*		
HH Having Enterprise	–	26.8
HH Not having Enterprise	–	17.3
Overall	–	25.0

Source: Calculated from the PPHS 2001 and 2010 micro dataset.
* Calculated from HIES 2013/14 micro dataset.

The question arises, how do poverty rates differ across various rural population groups, engaged in farm and off-farm labour activities? To answer, we have developed three categories of rural households: pure farm households (households where adult labour is employed only in agriculture activities), pure non-farm households (labour employed only in non-agriculture activities) and mixed households (labour employed both in agriculture and in non-agriculture activities). Table 7 shows that using various measures of household welfare (per capita consumption, headcount poverty and multidimensional poverty index (MPI)), non-farm households are comparatively better-off compared to the mixed and farm households.

Table 7

Poverty Rates among Farm and Non-farm Rural Households

Activity Type	Average per Capita Consumption (in Rs)	Headcount Poverty *(in %)*	MPI (at k=0.33) *(in %)*
Only Farm Households	3,401	40.0	32.6
Mix Households	3,298	40.2	26.7
Only Non-farm Households	3,574	35.2	18.5

Source: Calculated from HIES 2013/14 micro dataset.

Raw headcounts of multidimensional poverty index (MPI) are reported in Table 8, which can be defined as the percentage of households who are deprived in each one of the 14 indicators. Tables 6 and 7 concluded that households having non-farm enterprises and involved in non-farm labourer activities are comparatively better off than the others, while Table 8 shows that rural non-farm labour is a potential source of reducing long term deprivation on various soft and physical assets. All the indicators of raw headcount deprivation portray that non-farm households are comparatively less deprived of various assets, in terms of access to education and health of the children.

Table 8

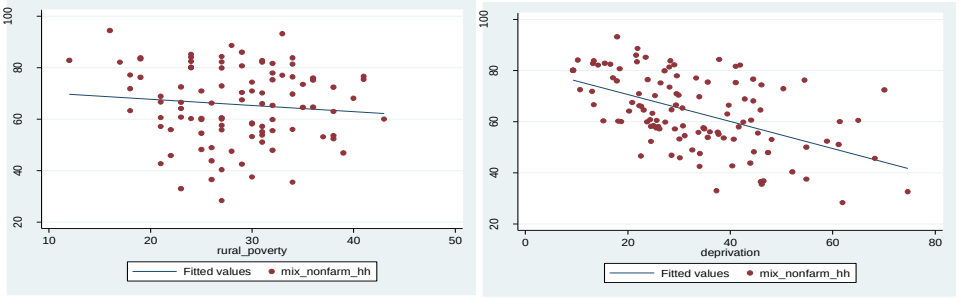
Percentage of Deprived Households in Rural Pakistan by Status of Farm and Non-farm Labour Activities

Dimension	Indicator	Only Farm Households	Mix Households	Only Non-farm Households
Education	Adult Male Schooling	47.1	30.9	27.8
	Adult Female Schooling	70.2	59.9	52.1
	Child School Attendance	25.4	25.3	15.2
	Educational Quality	18.6	18.5	9.5
Health	Access to Health Care Facility	6.5	6.1	6.0
	Immunisation	19.7	17.7	14.5
	Prenatal Care	15.4	15.9	15.0
	Institutional Delivery	5.4	6.7	5.4
Standard of Living	Overcrowding	46.5	53.7	45.9
	Water	13.2	11.3	12.0
	Sanitation	49.6	40.3	23.4
	Clean Energy	94.8	90.8	72.9
	Electricity	18.9	12.7	5.2
	Assets	57.4	52.5	52.5

Source: Estimated from HIES 2013/14 micro dataset.
Note: see Appendix 1 for detailed definition of each indicator.

Figure 3 shows that while district level poverty does not have a clear trend with the proportion of non-farm enterprises, the higher the proportion of non-farm activities, the lower the deprivation can be seen across the districts.

Fig. 3. District Level Rural Poverty and Deprivation by Share of Non-Farm Enterprises[6]



Two multinomial logit models have been estimated, using the two-wave PPHS data, whose results are presented in Table 9, covering 2001-10 period. In model 1, only 2001 correlated are used while in model 2 the changed variables between 2001 and 2010 are also added. Model 1 shows that gender of the head of household has not shown a significant association with poverty dynamics.

Table 9

Multinomial Logit Model: Effects of 2001 Socio-economic Characteristics on Rural Poverty Dynamics (2001-10)

	Model-1			Model-2		
Correlates (2001)	Chronic Poor/Non-poor	Moved out /Non-poor	Moved into /Non-poor	Chronic Poor/Non-poor	Moved out /Non-poor	Moved into /Non-poor
Sex of the Head (Male=1)	–0.95	–0.694	0.499	–1.199**	–0.813**	0.222
Age of the Head	–0.03	0.031	–0.044**	–0.007	0.036	–0.032
Age^2 of Head	0.000	0.000	0.001**	0.000	0.000	0.000
Education of the Head	–0.08*	–0.038**	–0.049*	–0.094*	–0.040**	–0.084*
HH Own Non-farm Enterprise (Yes=1)	–0.11*	–0.084	–0.133	–0.12*	0.087	–0.125
Household Size	0.14*	0.139*	0.037**	0.218*	0.123*	0.119*
Dependency Ratio	0.24*	0.084	0.133**	0.560*	0.171	0.370*
Household with One member Abroad (Yes=1)	–2.69	–0.246	–0.670	–2.823	–0.203	–1.224
House Structure (PACCA=1)	–0.94*	–0.443*	–0.451*	–0.880*	–0.454*	–0.467*
Electricity Connection (Yes=1)	–0.56*	0.096	0.161	–0.401**	0.162	0.122
Toilet facility (Yes=1)	–0.62**	–0.778*	–0.202	–0.628**	–0.766*	–0.158
Animals (Nos.)	–0.04*	–0.118*	0.002	–0.156*	–0.120*	–0.067*
Land Holdings (Acres)	–0.12*	–0.034*	–0.029*	–0.119*	–0.036*	–0.041*
Number of Rooms per Person	–2.11*	–2.295*	0.137	–3.607*	–2.402*	0.099
Presence of Disable Person (Yes=1)	0.21	0.057	–0.404	0.222	0.047	–0.491
South Punjab/North Punjab	1.55*	0.139	1.469*	1.391*	0.218	1.501*
Sindh/North Punjab	1.94*	0.744*	1.397*	1.466*	0.814*	1.140*
KP/North Punjab	–1.06**	–1.147*	–0.649**	–1.424*	–1.064*	–0.853*
Baluchistan/North Punjab	1.52*	0.993*	0.865*	1.586*	1.101*	0.780*
Constant	–1.81	–1.477**	–2.112*	–2.113**	–1.436	–2.602*
Difference in Household Size	–	–	–	0.131*	–0.031	0.139*
Difference in Dependency Ratio	–	–	–	0.373*	0.094	0.290*
Difference in Education of Head	–	–	–	0.021	–0.013	–0.074*
Difference in Land Holdings	–	–	–	–0.016	–0.006	–0.030*
Difference in Animals	–	–	–	–0.141*	0.000	–0.085*
LR chi-2		678.13 (54)			825.30 (69)	
Log Likelihood		–1827.00			–1706.83	
Pseudo R^2		0.1565			0.1947	
N		2,124			2,080	

*Denote significant at 5 percent, **denote significant at 10 percent.

Source: Authors' estimation from micro-data of PPHS 2001 and 2010.

[6]The district level rural poverty and deprivation data has been taken from Jamal (2011); deprivation includes education, health, housing quality, housing services and economic wellbeing. On y-axis, the percentage of non-farm households (pure non-farm and mixed households i.e. having agriculture and non-agricultural activities) are plotted.

Age of the head, however, has turned out to be negatively associated with poverty transit, while age^2 is positively associated with it. It suggests that an increase in the age of head of household first empowers households through his/her economic activities, not to fall into poverty but in old age this empowerment weakens and raises the probability of households to fall into poverty [Arif and Shujaat (2014)]. Education of the head of household has a significant and negative association with all the three poverty states, suggesting on the one hand that households headed by literate persons are less likely than illiterates to be in chronic poverty or falling into poverty. On the other hand, they are also less likely to escape poverty.

The results reveal that households who own non-farm enterprises in 2001 are less likely to be chronic poor or have moved into poverty. Two household-level demographic variables, family size and dependency ratio, have a positive and significant association with chronic poverty and the probability of falling into poverty. The household asset variables, including the ownership of land and livestock, housing structure *(pacca)* and availability of room have a significant and negative association with both chronic poverty and falling into poverty. But these variables also have a significant and negative association with the movement out of poverty. Though this association is also difficult to explain, possible explanation could be that households with a better economic position in terms of land, livestock and housing are less likely to be in poverty for longer duration or fall into poverty than staying in the non-poor status. In other words, they were relatively more likely to be in the non-poor status between the given two rounds (2001-10).

Regional dummies have some interesting findings. During the 2001-10 periods, the population of Southern Punjab was more likely than their counterparts in North/Central Punjab to be in the state of chronic poverty or falling into poverty. The dummies of Sindh and Balochistan provinces are similar to Southern Punjab, except that they also have a significant and positive association with making a transition out of poverty. Population of KP is less likely than North/Central Punjab to be in chronic poverty or making a transition into or out of poverty (Table 9). This supports the bivariate analysis, which has shown tremendous poverty movements in Southern Punjab and Sindh than in North/central Punjab. It further shows the vulnerable situation in Balochistan as well.

In model 2, five quantitative variables (household size, dependency ratio, education, landholding and animals), having difference between the 2001 and 2010 periods are added in the logit model. No major change was found as compared to model 1, except that the sex of the head of household now turned out to be significant in model 2; reverse is the case for the age (age^2) of the head of households. Male headed households are less likely than households headed by females to be in chronic poverty or to move out of poverty. However, all the new entered variables—different in two periods—have shown a significant and expected relation with poverty dynamics. The difference in household size has a positive impact on chronic poverty or falling into poverty. Same is the case for the dependency ratio. Difference in both the landholding and education has a negative and significant association with falling into poverty. The difference in livestock ownership has also shown a negative association with chronic poverty as well as falling into poverty. It suggests that not only the initial socio-demographic conditions of households but also a change in these conditions overtime, has a correlation with poverty dynamics. Thus, the message is that a positive change in socio-demographic and economic conditions of households can lead to some positive outcomes in

terms of improving the well-being of households. Our findings are to some extent consistent with Davis (2011), who shows that the tangible assets i.e. land and livestock are the important protective assets as compared to the less tangible assets i.e. education and social networks. The present analysis, however, shows the importance of both types of assets for poverty reduction.

7. CONCLUSION AND POLICY IMPLICATIONS

The present paper has examined the role of Pakistani rural non-farm enterprises in employment provision and household welfare, by taking a wide range of welfare indicators, including poverty, child school enrollment, multidimensional poverty index (MPI) and dynamics of poverty. The study found that majority of the rural non-farm enterprises are micro-enterprises with high closure rates. Most of the enterprises are informal and they have poor asset endowments and are highly influenced by the available soft and physical capital and infrastructure. Households, on average, own more enterprises in those districts that have good physical and human capital.

The present analysis shows that half of the rural labour is employed in non-farm activities which are the major source of livelihood for the poorest households, as the share of non-farm income for the poorest quintile is 57 percent. The availability of adequate non-farm income sources for the poorer contribute to equity enhancement in Pakistan. Non-farm enterprise households not only have high per capita real consumption, they are also less poor as suggested by both headcount poverty and multidimensional poverty. They are also more likely to send their children to school. The multivariate analysis also shows similar findings that those households who own non-farm enterprises are less likely to be chronic poor or to have plunged into poverty.

Several policy interventions are suggested here. First, inefficiency of institutions is one of the major barriers for the development of rural non-farm economy. The easy, smooth and equitable functioning of a market can be facilitated by supporting institutional mechanisms, which could help to promote economic activity, by reducing transaction costs and other hurdles. Increasing competition requires institutions for quality control, capacity building, research and development, along with reducing disputes, defining property rights and contracts and increasing healthy competition in markets. Third, public investment along with technical training is required to improve the productivity and size of this sector, especially to expand manufacturing base. Targeted policies are required to overcome the regional disparities by diverting resources towards the deprived and remote areas.

The low participation of poor households in non-farm activities can be improved through social and economic resource mobilisation. For rural development, a dynamic labour-intensive agriculture, along with a modern non-agriculture sector can provide better employment and income to rural households, with more egalitarian income distribution and elimination of rural poverty. Policy intervention to promote rural non-farm employment is also justified as a means of controlling, to some extent, migration to cities. The design of rural development and pro-agricultural policies needs to be revisited to address the needs of local non-farm activities. In particular, the growth and concentration of such activities in rural towns and villages will require adequate provision of physical and soft infrastructure services.

Appendices

Appendix 1

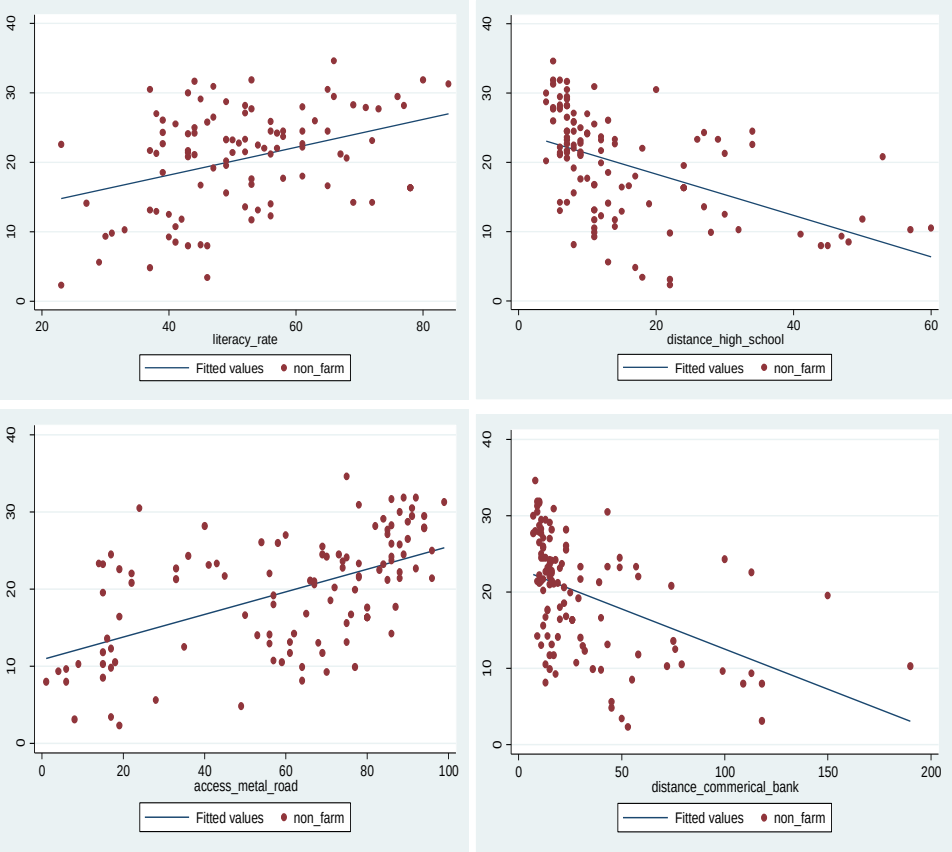
Dimensions, Indicators, Weight and Definitions

Dimension	Indicator	Weight	Definition
Education	Adult Male Schooling	1/12	No male over 11 years of age has completed 5 years and above of schooling
	Adult Female Schooling	1/12	No female over 11 years of age has completed 5 years and above of schooling
	Child School Attendance	1/8	Any school-aged child (6-11) is not attending school
	Educational Quality	1/24	If any person of age 6-16 does not attend school because of poor quality of education (too expensive, too far away, poor teaching behavior, no female staff, no male staff)
Health	Access to Health Care Facility	1/12	If any child in household of age under 5 year got diarrhea but not consulted or consulted to private due to poor government hospital facilities i.e. No Govt. facility, doctors never available, doctors not available, cannot treat complications, staff not helpful, too far away, no female staff, timing not suitable, medicines ineffective, not enough medicines OR If any child in household of age under 5 year got Malaria but not consulted or consulted to private due to poor government hospital facilities i.e. No Govt. facility, doctors never available, doctors not available, cannot treat complications, staff not helpful, too far away, no female staff, timing not suitable, medicines ineffective, not enough medicines
	Immunisation	1/12	If any child in household of age 12-59 months is not fully immunised
	Prenatal Care	1/12	If any women 15-49 who gave birth in last three years did not have antenatal care (include doctor, nurse, lady health visitor, TBA, hospital)
	Institutional Delivery	1/12	If any women 15-49 who gave birth in last three years did not have a safe delivery (born at home or is not facilitated by some skilled health person i.e. doctor, nurse, LHV and TBA)
Standard of Living	Overcrowding	1/18	If more than 3 people per room are residing
	Water	1/18	If water source does not meet MDG standards (unprotected well, surface water, tanker truck, other)
	Sanitation	1/18	If toilet facility does not meet MDG standards (digged ditch, no facility)
	Clean Energy	1/18	If household does not have gas connection Note: 2010 PSLM reported detailed source of cooking fuel i.e. wood, coal/charcoal, agricultural dung, crop residue, other, LPG, Gas etc.
	Electricity	1/18	If there is no access to electricity
	Assets	1/18	If HH doesn't have large asset motorcycle or refrigerator or car/vehicle

Source: Calculated from the HIES 2013/14 micro dataset.

Appendix 2

District Level Rural Infrastructure and Households own Non-farm Enterprise (in %)



Note: Mouza Statistics 2008 is used to calculate district level average literacy rate (%) of population age 10 and above, average distance to high school (in km), percentage of villages who have access to metallic road with less than 1 km (access to metallic road) and district level average access to commercial banks (in km). These four indicators are plotted with district level average percentage of households who own non-form enterprises. The data of non-farm district level enterprises is calculated from 2010/11 PSLM survey.

Appendix 3

Enterprises Using Modern Practice/Services (in %)

Type of Service	Retail	Wholesale	Storage	Transport	Overall
Engineering	13.4	11.8	33.2	42.4	16.7
Management	3.9	7.2	21.4	8.1	7.0
Marketing	15.5	21.0	26.5	23.2	18.7
Accounting	6.7	8.2	25.5	6.1	9.1
Legal	5.4	9.6	21.9	25.3	9.5
Insurance	3.6	3.4	12.2	21.2	5.5
Information Technology	5.1	5.2	15.3	2.0	6.1

Source: Malik (2008, Table 13).

Appendix 4

Sectoral Share in Gross Domestic Product Overtime in Pakistan

Type of Industry	1950s	1960s	1970s	1980s	1990s	2000s	2011-2015
				Sectoral Share in GDP			
Agriculture and Livestock	48.8	40.7	33.7	28.6	26.0	23.0	21.1
Industry	12.9	19.1	22.6	23.3	24.6	22.5	20.5
Services	38.4	40.2	43.7	48.2	49.3	54.4	58.4

Source: Various editions of Pakistan Economic Survey, Ministry of Finance, Islamabad.

Appendix 5

Rural Non-farm Employment in Pakistan for Females by Employment Type and Status—2014-15 (in %)

Type of Industry	All Non-farm Workers	Self-employed	Paid Workers	Unpaid Worker
Mining	0.2	–	0.2	0.3
Manufacturing	43.5	65.4	30.4	61.6
Electricity Gas and Water	0.1	0.1	0.1	0.2
Construction	1.6	0.2	2.1	1.9
Whole Sale and Retail Trade	5.5	9.5	0.8	19.6
Transport and Communication	0.9	1.0	0.8	0.9
Hotel and Restaurant	0.4	–	0.4	0.9
Professional Services	0.4	0.5	0.4	–
Social and Personal Services	47.5	23.4	64.8	14.7
% Share	–	6.2	26.5	67.2
Total	100	100	100	100

Source: Calculated from the PSLM 2014/15 micro dataset.

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Exploring the Structure and Performance of Petroleum Retail Outlets in Pakistan

OMER SIDDIQUE and HANZLA JALIL

The petroleum retail industry is one of the least researched industries in Pakistan due to, perhaps, unavailability of the relevant data. This paper aims to fill this gap. Specifically, the present paper examines the structure and performance of petrol pumps in Pakistan, using primary survey data. Analysis of the data reveals that operating a petrol pump is a profitable venture and both location and non-locational variables are important in contributing to the profitability of a petrol pump. The exploratory analysis shows that the petrol pumps in urban areas and those on highways have higher sales, indicating that the geographical location of a petrol pump is important in explaining a petrol pump's performance. According to the regression results, as the size of a petrol pump increases, its profitability increases and there is a non-linear relation between the distance variable and profitability of a petrol pump. The non-linearity implies that there exists optimal distance between two petrol pumps that maximises profits. This optimal distance is shorter for urban and non-highway petrol pumps, compared with rural and highway petrol pumps.

JEL Classification: D24, L81, R3
Keywords: Cost, Retail Business, Firm Location, Petrol Pumps

1. INTRODUCTION

It is generally assumed that since petrol pumps sell homogenous products, differentiated only by the identity of Oil Marketing Companies (OMCs), there is not much petrol pumps owners could do to increase their sales and profitability other than setting up petrol pumps on strategic locations. Indeed, a petrol pump in a rural area, away from a highway, cannot be expected to outperform a petrol pump that is in an urban area or on a highway. However, the literature that analyses the performance of petrol pumps shows that there are other factors as well that affect the performance of petrol pumps. Keeping in view the unavailability of any study on the petroleum retail industry in Pakistan, the objective of this paper is to contribute a better understanding of the structure and factors that affect the performance of the petrol pumps in Pakistan. Thus far, the analysis of the petroleum retail sector in Pakistan has escaped the attention of the researchers. As far as we know, prior to this study neither has anyone collected information on any aspect of the petrol pump industry in Pakistan nor has anyone analysed this industry.

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In 2013, the year in which the data for this paper was collected, there were 7,198 petrol pumps in Pakistan, up from 6,377 in 2009, translating to 3.07 percent growth per annum [Oil Companies Advisory Council (OCAC); unpublished figures]. At the same time, the demand for petroleum products has also increased over the years. In 2008-09, the transport sector consumed 8.84 million tonnes of oil equivalent (toe), which increased to 10.3 million toe in 2012-13 (Pakistan Economic Survey, 2015-16). This amounts to 3.90 percent increase in consumption of petroleum products by the transport sector.

The reason for the increase in the number of petrol pumps can be linked with the increase in the demand for petroleum products, especially in the transport sector. In Pakistan, the number of registered vehicles was 6.56 million in 2009, which increased to 13.67 million in 2013. This amounts to annual average growth rate of 20.15 percent. In turn, the reason for growth in the number of vehicles is due to several factors, including rising household incomes, increase in the size of the middle class, ease of getting car financing at attractive rates, and the import of used vehicles. The concomitant increase in the number of petrol pumps and demand for the petroleum products by the transport sector could have important implications for the owners, both current and potential, of petrol pumps.

Petrol pumps have often been a subject of public debate in Pakistan, mainly because their margins are fixed and the petrol pump owners demand for increase in those margins from time to time. The margins they receive from selling a litre of petroleum products are fixed by the government and they cannot charge higher prices (margins are a part thereof) than those declared by the government, which are determined by a government-approved formula. The petroleum dealers claim that margins they receive from the sale of a litre of MoGas and HSD are quite low and, therefore, they cannot run the petrol pumps profitably. This was also highlighted by the petrol pump owners during data collection. Thus, one of the motivations of the present paper is to take the claim of the petrol pump owners that they make low profits, or even incur losses, to the data and see what the survey data tells us.

Using the data on the cost structure, sales volumes, number of workers, and secondary activities, which include tuck shops, car washes, and tyre shops, we contribute to the empirical analysis of petrol pumps in Pakistan in two ways. Firstly, we analyse the structure of petrol pumps in Pakistan, that is, we analyse how costs are spread over various activities, which fuels have higher sales, which petrol pump employs higher number of which categories of workers, and what are some of the activities, other than selling fuels, in which petrol pumps are involved. The structural analysis of the petrol pumps in Pakistan helps us gain insights into the characteristics of the pumps that are related with profitability and cost efficiency. It helps us understand what differentiates those petrol pumps that are profitable from those that incur losses. It also highlights the features of the petrol pumps that make them more cost efficient than the others. Secondly, we analyse performance of the petrol pumps through econometric investigation. Based on the regression analysis carried out in the paper, we also calculate optimal distance between two petrol pumps that is profit and sale maximising. This could help the entrepreneurs interested in setting up petrol pumps in different regions and locations and it could also serve as a guideline for licensing authorities.

Our analysis is confined to two petroleum products, namely Motor Gasoline (which is simply called petrol in Pakistan; MoGas henceforth) and High-Speed Diesel (HSD; HSD henceforth) because these are the two main products that are sold at the petrol pumps. The petrol pumps sell other products as well, such as High Octane Blending Component (HOBC). However, we do not include it in our analysis mainly for two reasons. Firstly, because this product is not sold at every petrol pump and secondly because the sale of HOBC is very little compared to two other main fuels—MoGas and HSD.

The organisation of the rest of the paper is as follows. The next section reviews the relevant literature. In Section 3, an overview of the retail petroleum industry in Pakistan is presented. Section 4 explains the methodology used for collecting the data, the empirical model, and the methods used to analyse the data. The description of the sample is also presented in this section. The findings and results are presented in Section 5. The discussion is summarised and concluded in Section 6.

2. REVIEW OF LITERATURE

The relevant literature on the retail petroleum industry is scant. Most of the literature on petrol pumps focuses on the effect of a petrol pump's location on its performance. The effect of location is an application of the location theory and although our paper is not concerned with the location theory, or its application to the petrol pump industry per se, a few words outlining the location theory are in order. Although our paper does not dig deeper into the geographical location decisions of the petrol pump owners, it is, nevertheless, one of the factors that we consider in our analysis. Simply put, location theory addresses the question of what businesses are set up where and why.

One of the predictions of the location theory is that when the product is homogenous and businesses face stiff competition, the firms tend to differentiate spatially. On the other hand, according to Netz and Taylor (2002), firms may also locate their businesses closer to their competitors to attract more consumers. Using an econometric model based on the location theory, they found that petrol pumps in Los Angeles, USA, tend to be located farther away from each other because of stiff competition. They also found a positive effect of the presence of convenience stores on the performance of petrol pumps. Reviewing the choices of retail firms regarding location, Schmidt (1983) argued that retail firms' location decisions are "[…] judgmental, combining 'objective' economic or geographic elements, as well as 'intangibles', tempered by experience" (p. 68; emphases in original).

Chan, Padmanabhan, and Seetharaman (2005) developed a model of locational choice and pricing decisions in the gasoline market, which they also tested empirically using Singaporean data. The results suggested that the proximity of a petrol pump to a highway has positive effect on its sales. Using the data from Montreal to test the sales performance of petrol pumps, Gagné, Nguimbus, and Zaccour (2004) showed that geographical zone does not affect the sales of a petrol pump. However, they argued that this could be due to the inclusion of the traffic variable in their analysis, which, according to them, also captures the effect of geographical zone (e.g. urban area) on the sales performance of a petrol pump. Among the non-location variables, they found that the most important variables contributing to the better sales performance of a petrol pump are

the size (station service capacity) and identity of the marketing company. However, they did not include non-forecourt variables in their regression analysis.[1] This is surprising because non-forecourt activities could be an important determinant of the performance of a petrol pump, as suggested by other research on the topic. Therefore, in our analysis, we also include non-forecourt activities.

Using survey data and case study approach, Sartorious, Eitzen, and Hart (2007) analysed the variables influencing the retail fuel industry in South Africa. They found that the size of petrol pumps, measured by the number of bays, did not have a significant positive effect on their profitability. They used sales volume as a proxy for gross profits. This is problematic because higher sales do not necessarily translate into higher profits. Inefficient cost structure may lead to lower, or even negative profits, even if the sales are relatively high. Considering this fact, we use both sales volumes and profitability in separate models. Sartorious, Eitzen, and Hart (Ibid.) found that location is an important variable for the gross profitability of a petrol pump. However, they did not include convenience store in their econometric analysis to test its effect on the profitability of petrol pumps. Rather, employing the case study methodology, they asked the petrol pump owners about the impact of convenience stores on their businesses. The owners felt that the effect of having a convenience store was positive. In a study on the petrol pumps in the United Kingdom, the effect of non-fuel sales was also found to be positive [Deloitte (2012)].

3. OVERVIEW OF THE PETROLEUM RETAIL INDUSTRY IN PAKISTAN

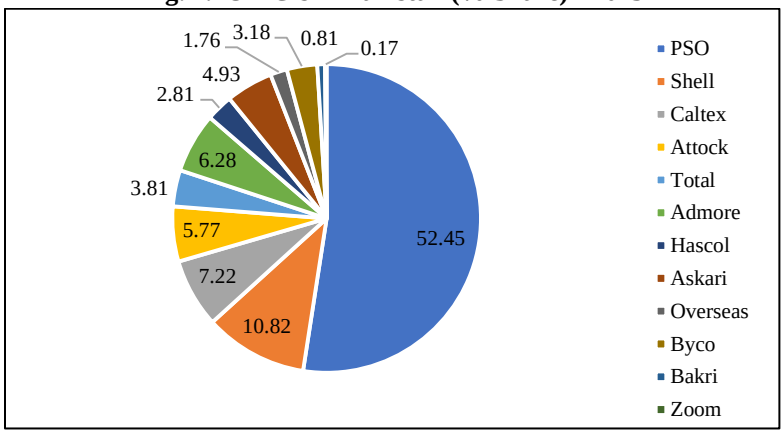
This section presents an overview of the petroleum retail outlet industry in Pakistan. In 2013, there were 12 OMCs that supplied fuel to 7,198 fuel stations, as per the data provided by the OCAC, Karachi (OCAC; unpublished figures). The petrol pumps in Pakistan do not operate in a competitive environment, as such. The prices of petroleum products, though deregulated over the years, are determined by a government approved formula and the petrol pumps are bound to sell different petroleum products at the declared prices. The petrol pump owners receive a fixed amount per litre as their margin. The margins, however, are not all profits. Since the petrol pumps must incur costs and bear overheads to sell their products, it leaves only a part of the margin as their profits. This contrasts with how petrol pumps operate in more developed countries where the petroleum industry is deregulated and petrol pumps are largely free to sell fuel at different prices, keeping in view the market conditions and the extent of competition in their respective areas.

3.1. OMC-Wise and Geographical Distribution

The biggest player in the petroleum industry is the Pakistan State Oil (PSO), which had 3,775 petrol pumps situated all over Pakistan in 2013. The second highest number of petrol pumps, 779, were those of Shell Pakistan Limited. Caltex and Admore operated 520 and 452 petrol pumps, respectively. The others were even smaller players in the petroleum retail industry. Figure 1 gives the petrol pumps operating under the banner of each OMC, as a percentage of total outlets, operated by all the OMCs.

[1]Activities at petrol pumps are typically divided into forecourt and non-forecourt activities. The forecourt activities refer to the selling of fuels and other related products, such as motor oil and non-forecourt activities refer to tuck shop, car wash, and tyre shops.

Fig. 1. OMC's in Pakistan (% Share) - 2013

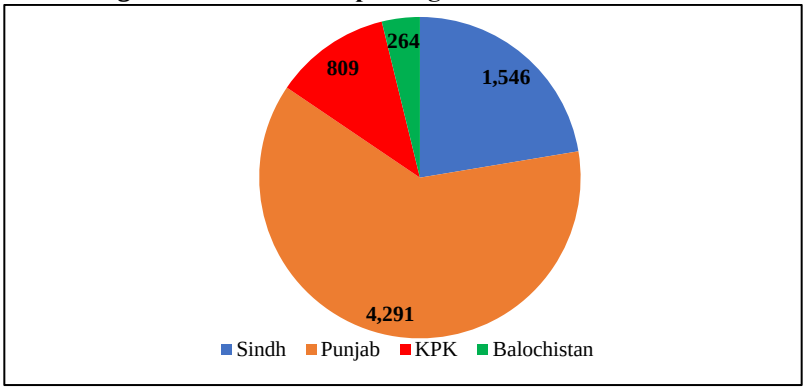


Source: Oil Companies Advisory Council (OCAC).

With the increase in demand and consumption of petroleum products, the number of petrol pumps has also increased. In 2009, the earliest year for which the data was available from the OCAC (unpublished figures), the number of petrol pumps was 6,377. The number increased to 7,198 in 2013. This amounts to an increase of 3.07 percent per annum, from 2009 to 2013. The number of registered vehicles in Pakistan in 2013 was 13.67 million, which increased from 6.56 million in 2009 (Pakistan Economic Survey, 2015-16). This translates to an increase from 1,029 vehicles per petrol pump in 2009 to 1,899 vehicles per petrol pump outlet in 2013. With the increase in vehicles on the roads due to different factors already discussed (see Section 1), the number of vehicles per petrol pump would probably increase over the years, given the modest growth in the petrol pumps. What these numbers imply is that the petrol pumps have become a lucrative business and with increase in vehicles, their sales and earnings are also expected to have increased over time.

As far as the regional distribution of petrol pumps in Pakistan is concerned, unsurprisingly, the highest number of petrol pumps in 2013 were in the province of the Punjab (4,291), followed by Sindh (1,546), KPK (809), and Balochistan (264). The regional breakdown of the petrol pumps is given in Figure 2 below.

Fig. 2. Petroleum Pumps' Regional Breakdown - 2013



Source: Oil Companies Advisory Council (OCAC).

3.2. Operations of Petrol Pumps

The activities of the petrol pumps are typically divided into forecourt (primary) and non-forecourt (secondary) activities. The forecourt activities include selling of fuels, which is the basic function of a petrol pump. Besides selling fuel, the petrol pumps also engage in other activities, which are known as non-forecourt activities. These activities include tuck shops, carwashes, and tyre shops. In more advanced countries, petrol pumps also have facilities such as auto teller machines (ATMs) but in Pakistan such an activity has only begun to appear and has not gathered pace. Moreover, in Pakistan, some of the pumps also sell compressed natural gas (CNG) but our analysis does not include this segment of the market because the operation of CNG stations is governed by entirely different procedures, and rules and regulations.

4. METHODOLOGY

This section contains discussion on the methodology employed to select sample and collect data, and methods used to explore the data to analyse the structure and determinants of the performance of petrol pumps.

4.1. Survey Design and Sample Selection

This study uses primary survey data collected in 2013. The survey was conducted for a larger study carried out for the Ministry of Petroleum and Natural Resources (MP&NR) on the margins of the OMCs and petroleum dealers in Pakistan. To the best of our knowledge, no other data on the retail petroleum industry in Pakistan was available at the time this paper was written. Until a newer dataset becomes available, the data used in our study is the best source that can be used for the analysis of retail petroleum industry in Pakistan. Also, the inferences drawn from a cross-section data are valid unless there are significant changes in the population from which the sample is drawn. In Pakistan, there have not been any significant changes in the market structure of the retail petroleum industry. Although a couple of new marketing companies have entered the market but those are very small players and their operations are geographically limited. Furthermore, it is pertinent to mention that the businesses in Pakistan are reluctant to share information, especially on the workforce and financial aspects, even for research and academic purposes. Collecting data, used in the present study, was made possible because of the involvement and financial assistance of a government agency. Without the involvement of an authority, collecting newer data is quite difficult due to reluctance of business entities to share information. Besides, collecting more recent data is not only time consuming but it also requires significant resources, financial and otherwise. Moreover, collecting data when the reference population is scattered geographically makes the task even harder. In the given scenario, it is safe to assume that the results of the present study are tenable.

The data on petrol pumps was collected through purposive sampling, using a structured questionnaire. The questionnaires were filled from the owners of the petrol pumps in most of the cases and in some cases from the managers of the pumps. Before proceeding to the data collection stage, we held numerous discussions with various stakeholders (OCAC, Pakistan Petroleum Dealers' Association, individual petrol pump

owners, and the MP&NR. During the discussions, it was inferred that due to spatial diversity of the petrol pump population that is scattered all over the country and due to security situation in some of the regions (especially Karachi and Balochistan), the most practicable sampling method would be purposive sampling**.** Handcock and Gile (2011) argue that in the cases when probability sampling is not possible, non-probability sampling is an effective mean to collect data.

Given the nature and scope of the study, petrol pumps were selected with certain cautions. Firstly, it was ensured that the sample covers major mix of petroleum products. Secondly, representation from highways and non-highways was also ensured as the nature and quantity of fuel sale (consumption), as well as structure and scale of pumps, vary by region (rural and urban) and location (highway and non-highway). For example, HSD is major fuel for long route transportation. Likewise, sale of MoGas in cities is higher as compared to the sale of MoGas at petrol pumps located on highways. Thirdly, to ensure proportional representation of population, petrol pumps in this case, 64 percent pumps were selected from urban areas. National urban to rural ratio is 57 percent to 43 percent. According to the data on the number of petrol pumps in Pakistan, there were 4,125 petrol pumps with modern facilities in 2013. This is almost 57 percent of the total pumps in Pakistan. It can be safely assumed that most of the pumps with modern facilities are in urban areas.

All these cautions, along with the disclosure of financial information involved in the process, forced us to follow purposive sampling. Petrol pumps were selected from the regions/areas in which authors have direct or indirect access so that petrol pump owners were ready to share financial information. Random sampling in this case would have resulted in a very high non-response rate, incurring monetary and time losses. Guided by lower intra-population variation, coupled with time and resource constraints, data were collected from 81 petrol pumps. Furthermore, the preference to probability sampling is emphasised because the non-probability sampling may lead to heteroscedasticity. To overcome this concern, we have used the heteroskedasticity-consistent estimation techniques.

4.2. Empirical Investigation

The data collected from the survey is analysed in two ways. Firstly, we use exploratory data analysis, which is carried out by disaggregating data on the bases of region (rural and urban) and location (highway and non-highway) of the petrol pumps. This is done because, as discussed above, the sales vary according to the region and location of the petrol pumps. The performance indicators we have used in our analysis are total costs, sales volumes, and profitability of the petrol pumps.

Secondly, regression analysis is done to understand the determinants of sales and profitability of the petrol pumps. We use profits per litre as a measure of profitability in our analysis, which are derived by dividing gross profits with total sales volume in litres. The gross profits, in turn, are defined as total revenues minus total variable costs, i.e.,

$$\Pi_i = TR_i - TVC_i \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (1)$$

where Π_i,TR_i, and TVC_i stand respectively for total profits, total revenues, and total variable costs, for the ith fuel station. Dividing Equation 1 with total sales volumes gives us profits in per litre terms, i.e.,

$$\pi_i = tr_i - tvc_i \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (2)$$

Lowercase letters are used for per unit (per litre) variables.

The profitability of a petrol pump may depend on several things. The literature review shows that the performance of petrol pumps is affected by the location of the petrol pump, size, and price of petroleum products. In the case of Pakistan, however, price is irrelevant because prices of MoGas and HSD are determined by the government approved formula and are the same across all petrol pumps. Including the price variable in the regression analysis, therefore, would give singular matrix and for this reason we do not include prices in our analysis. Moreover, since price is the same across all petrol pumps of different OMCs[2], consumers would not be concerned about the price of MoGas or HSD. Therefore, it would not be incorrect to assume that price does not directly affect the sales and profitability of a petrol pump.

Apart from the price of the petroleum products, other factors that might affect the profitability of a fuel stations are numerous. Below, we discuss the variables included in the econometric analysis and present the rationale for including them in the analysis, based on the literature explored.

4.2.1. *Identity of the OMC*

One of the important factors is the identity of the OMC. Although MoGas and HSD are homogenous products, consumers are sometimes partial to some brands and are loyal to one brand rather than the other. For this reason, we include OMC as one of the determinants of profitability and sales in econometric investigation.

4.2.2. *Size of the Petrol Pump*

The size of a petrol pump is measured by the number of fuel dispensers, or bays, installed on the premises. Higher number of bays allows petrol pumps to take advantage of the economies of scale as per-unit costs do not increase proportionately with the number of bays, thereby contributing to higher per-litre profitability. Additionally, a higher number of bays installed on a petrol pumps means that the customers do not have to wait long for their turn to get the fuel. In this way, throughput increases and may have a positive effect on the profitability of the business.

4.2.3. *Region and Location*

The literature that explores that petroleum retail business suggests that an important factor that affects the performance of a petrol pump is where it is situated. The survey data reveals that petrol pumps that are in urban areas have higher throughput as compared to the petrol pumps in rural areas (see Section 5 below). In addition, petrol pumps situated on highways sell more HSD as compared to MoGas. However, it could be that the petrol pumps that are in rural areas are situated on highways. To take care of

[2]The prices do vary between citied due to difference in freight but the prices are the same within a city.

these factors, we include three dummy variables in our analysis that control for the geography of the petrol pumps. Specifically, we include one dummy for the region (urban or rural), another for the location (highway or non-highway), and an interaction dummy for region and location. The literature suggests that these geographical divisions strongly influence the performance of petrol pumps [see, for example, Netz and Taylor (2002) and Chan, Padmanabhan, and Seetharaman (2005)].

4.2.4. *Distance*

According to the available literature on the retail petroleum industry, the performance of petrol pumps may be affected by their proximity to the next nearest petrol pump. For one thing, the competition among the petrol pumps may spur the owners to improve their services. Furthermore, closely situated petrol pumps may lead to increase in the sales of petrol pumps as the consumers will have more options to get fuel if there are long queues at a petrol pump during the rush hours. The flip side is that the presence of more petrol pumps in close vicinity can also affect the sale performance negatively. Since the prices MoGas and HSD do not vary within a city, presence of too many petrol pumps within a touching distance of each other may affect the sale performance of petrol pumps negatively. We also include the squared term of the distance variable to capture any possible non-linear relationship between the distance and dependent variables.

4.2.5. *Product Mix*

We have included the share of MoGas in total sales volume as one of the determinants of profitability of petrol pumps. In Pakistan, the margins petroleum dealers receive on each litre of MoGas and HSD are different. Since the margins they received in 2013 on each litre of MoGas (2.78 rupees per litre) wass higher than on each litre of HSD (2.30 rupees per litre), it implies that pumping an extra litre of MoGas is more profitable for the petrol pump businesses.

4.2.6. *Non-forecourt Activities*

To control for the non-forecourt activities of a petrol pump, we include dummies for tyre shop, car wash, and tuck shop. Availability of these services is postulated to affect sales and profitability of petrol pumps positively. Automobile owners may prefer those fuel stations to get fuel that also have services such as a tyre shop, a car wash, and a convenience store. The literature also shows a positive effect of non-forecourt activities, particularly a tuck shop, on the performance of petrol pumps.

4.3. Empirical Model

Based on the discussion above, analysis we use the following model to analyse the determinants of profitability of petrol pumps in Pakistan in the econometric analysis.

$$Profits = f(distance, distance^2, size, amenities, location, region, location * region, share) \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (3)$$

According to Equation 3, petrol pumps' profitability is postulated to depend on the traveling distance (of the petrol pump from the nearest petrol pump), distance squared,

size of the petrol pump (bays), MoGas share, non-forecourt activities (tuck shop, tyre shop, and car wash), region (rural or urban), location (highway or non-highway), and an interaction of region and location.

Thus, our econometric specification is as following:

$$\pi_i = \alpha + \beta_1 S_i + \beta_2 D_i + \beta_3 D_i^2 + \sum_{i=1}^{3} \gamma_i A_i + \emptyset_1 R_i + \delta_1 L_i + \beta_5 M_i + \epsilon_i \quad \ldots \quad (4)$$

In Equation 2 above, α is the constant term, D_i and D_i^2 are distance and distance-squared, respectively, S_i is the size, and M_i is the share of MoGas in total sales of the *i*th firm. D_i, D_i^2, S_i, and M_i are continuous variables. A_is are dummy variables for tuck shop, tyre shop, and car wash, which are defined as $A_i = 1$ if the petrol pump does not have a tuck shop, tyre shop or a car wash, and 0 otherwise. R_i and L_i are region and location dummies, which are defined, respectively, as $R_{\mathrm{i}} = 1$ if rural, 0 otherwise, and $L_{\mathrm{i}} = 1$ if non-highway, 0 otherwise. I is interaction of R_{i} and L_{i}, which is defined as $I = 1$ if petrol pump is urban and highway, 0 otherwise. ϵ_i is the error term.

Similarly, to check the determinants of sales volumes of the petrol pumps the specification is as following.

$$Z_i = \alpha + \beta_1 S_i + \beta_2 D_i + \beta_3 D_i^2 + \sum_{i=1}^{3} \gamma_i A_i + \emptyset_1 R_i + \delta_1 L_i + \epsilon_i \quad \ldots \quad \ldots \quad (5)$$

Z_i is the sales volume of the *i*th petrol pump. The description of the rest of the variables is the same as in Equation (4). It is plausible to assume the determinants of the sales volumes are the same as that of the profitability of the petrol pumps. However, in the total sales volume equation, we have not included the share of MoGas as an independent variable because total sales volume is sum of MoGas and HSD volumes.

We have used OLS technique to estimate the models, with robust standard errors. Robust standard errors are used to tackle the problem of heteroskedasticity. There could also be the problem of endogeneity. For example, as pointed out by Chan, Padmanabhan, and Seetharaman (2005), an unobserved advantage due to a station's location may impact its profit per litre (and sales) at the same time leading the station owner to install more bays. They have termed such endogeneity as "characteristic endogeneity" (pp. 15-16). However, they pointed out that they could not find valid instruments to take care of this problem. Other relevant literature also does not point to any instruments, guided by the theory, that could be used in such a case. Furthermore, Gagné, Nguimbus, and Zaccour (2004), who estimated a model similar to the one we have estimated, also used the OLS estimation method. In view of unavailability of instruments and the use of OLS in the existing literature on the topic, we also use the same estimation technique.

4.4. Description of the Sample

In the survey, information was collected from 81 petrol pumps. Out of these 81 petrol pumps surveyed, 52 were situated in the urban region and the rest of 29 pumps were in rural areas. The location-wise breakdown shows that out of 81 petrol pumps, 39 were on the highways and 22 were on non-highways. Since most of the petrol pumps are in the Punjab, therefore, our sample also included more petrol pumps from the Punjab, which were 57 in number. The breakdown of the sample according to region (urban and rural), location (highway and non-highway), and provinces is summarised in Table 1. The data collected and reported below pertains to monthly figures.

Table 1

Sample Breakdown—Regional, Locational, and Provincial

	Numbers
Region	
Rural	29
Urban	52
Total	*81*
Location	
Highway	42
Non-Highway	39
Region and Location	
Rural and Non-Highway	14
Rural and Highway	15
Urban and Non-Highway	25
Urban and Highway	27
Total	*81*
Province	
Punjab	57
Khyber Pakhtunkhwa	9
Sindh	10
Islamabad Capital Territory	5
Total	**81**

The sample also included most petrol pumps of PSO, amounting to 25, because most of petrol pumps in Pakistan are operated by PSO, as per national figures (OCAC; unpublished figures). PSO is followed by Shell Pakistan in terms of the number of petrol pumps linked with each OMC. Our sample included 17 petrol pumps operated by Shell Pakistan. The OMC-wise breakdown is given in Table 2.

Table 2

Sample Breakdown—OMCs

Oil Marketing Company (OMC)	Numbers
Attock	5
Admore	9
Byco	1
Caltex	9
Hascol	1
PSO	25
Shell	17
Total	14
Total	**81**

5. FINDINGS AND RESULTS

5.1. Sales Volumes

Table 3 provides a snapshot of sales volumes of MoGas and HSD. MoGas is used mainly in Light Transport Vehicles (LTV), such as cars and motorcycles. HSD, on the other hand, is used as a fuel in trucks, tractors, and other Heavy Transport Vehicles (HTV). Table 3 shows that the sale of MoGas was higher in urban areas because most of the vehicles that consume MoGas are in urban areas. On the other hand, the sale of HSD was higher on highways because most of the HTVs, which use HSD, travel on the highways. On average, a petrol pump sold 284,915.60 litres of fuel (MoGas and HSD) per month. The mean was higher for the urban areas (367,017.3 litres) and for the highway petrol pumps (361,364.2 litres) as compared to rural (137,798.7 litres) and non-highway petrol pumps (202,586.3 litres). The sale of HSD was also higher in urban areas (200,479.5 litres) because urban petrol pumps also included those petrol pumps that were situated on highways. The petrol pumps on highways sold lower volume of MoGas (118,147.9 litres) as compared to non-highway pumps (140,901.3 litres). On the other hand, the highway petrol pumps sold significantly higher volume of HSD (243,216.3 litres) as compared to the non-highway petrol pumps (61,684.98 litres).

Table 3

Sales Volumes (Per Month; Thousand Litres)

Variable	Mean	Std. Dev.	Minimum	Maximum
Total Volume (MoGas+HSD)	**284.92**	**331.64**	**33.46**	**2,129.40**
Region				
Rural	137.70	80.45	48.67	380.25
Urban	367.02	387.01	33.46	2,129.40
Location				
Non-Highway	202.59	158.05	33.46	882.18
Highway	361.36	423.10	39.55	2,129.40
MoGas (Overall)	**129.10**	**137.48**	**0.00**	**760.50**
Region				
Rural	61.98	43.50	0.00	162.15
Urban	166.54	156.90	6.08	760.50
Location				
Non-Highway	140.90	137.16	9.13	760.50
Highway	118.15	138.52	0.00	608.40
HSD (Overall)	**155.81**	**260.05**	**0.00**	**1,673.10**
Region				
Rural	75.72	59.27	6.08	243.36
Urban	200.48	313.80	0.00	1,673.10
Location				
Non-Highway	61.68	44.44	0.00	182.520
Highway	243.22	337.44	6.08	1,673.10

The survey data also included a petrol pumps that had zero sale volume of MoGas. The petrol pump was in a rural area, on a highway. Even though, as discussed above, MoGas sales were lower in rural areas, zero sale of MoGas is surprising since there must be some vehicles that use MoGas at a pump in rural area. On the other hand, zero sales volume of HSD at a petrol pump in urban area, which was not situated on highway, is not surprising. Diesel engine cars are becoming rarer in Pakistan and mostly the vehicles that need HSD, get fuel at the pumps that are on highways.

5.2. Workforce

The workforce at a petrol pump typically consists of managers, supervisors, cashiers, and attendants, commonly referred to as fillers in Pakistan. Some of the petrol pumps did not employ all the categories of workers as in some cases one category of worker performed multiple tasks. Table 4 shows the number of workers, employed, on average, at petrol pumps. For the sake of brevity, we have lumped all the categories together and have given statistics for total workers. The breakdown of the workers' categories is discussed below without tabulation. Table 4 shows that the urban petrol pumps employed higher number of workers as did the highway petrol pumps.

Table 4

Total Workers (Numbers)

	Mean	Std. Dev.	Minimum	Maximum
Total Workers (Overall)	**13.79**	**8.75**	**2**	**48**
Region				
Rural	9.90	5.74	2	26
Urban	15.96	9.42	2	48
Location				
Non-Highway	12.54	7.37	4	43
Highway	14.95	9.82	2	48

In one case, petrol pump employed as many as 48 workers in an urban petrol pump, on a highway. In total, there were 2 petrol pumps that employed 40 or more workers, both of which were in urban areas. This shows that the variation is quite large, given the fact that some petrol pumps only operated with 2 workers. There were 3 petrol pumps that employed only 2 workers. All these 3 petrol pumps were in rural areas.

As far as categorical breakdown is concerned, overall there were 12 petrol pumps that did not employ a manager and 40 pumps operated without a supervisor. Most of the petrol pumps that employed more than 2 managers and supervisors were in urban areas and/or were situated on highways.

According to the data, there were 29 pumps that did not employ any cashier, whereas, as expected, there was no petrol pump that was without a filler. This means that the filler is the only category of the workforce that is indispensable. In one case, a petrol pump, which was located on a highway, had as many as 38 fillers at the site. There were also several pumps that employed 10 or more fillers, most of which were either in urban areas or were on highways. The absence of a manager, cashier, or a supervisor is not surprising as during the survey it was revealed that in some cases it is the fillers, or even the owners themselves in some cases, that perform the job of managing, supervising, and collecting cash from the customers. But that is true mostly of the petrol pumps that do not have very high throughput.

5.3. Costs

To analyse the structure of costs and expenses incurred in running a petrol pump, we have bifurcated the costs into labour and non-labour costs. The labour costs comprise the wage bill of the workforce. Added together, labour costs formed the largest chunk of total costs of running a petrol pump. The other substantial cost was the expense on electricity. Some petrol pumps also spent a sizeable amount on running a generator to be able to keep on operating during power outages that were prevalent across the country during the time the survey was conducted.

5.3.1. *Labour Costs*

Table 5 below reports salaries of the different categories of workers involved in running a petrol pump. As it can be seen from the table, managers commanded the highest remuneration among all the categories of workers. Unsurprisingly, the maximum salary was also paid to a manager working in a petrol pump in urban area. The trend is the same for all other categories as the highest salary in each of the other three categories of workers went to those who worked in a petrol pumps located in urban areas. It is interesting to note that in quite a few cases, the workers at petrol pumps were given salaries that was below the legal minimum wage prevailing in 2013, which was rupees 10,000. In 34 out of 81 cases, the fillers were given salary which was below the minimum wage. As it can be seen from the table, the minimum salary for fillers was rupees 4,000.

To present the overall picture of the labour costs incurred in running a petrol pump, average total labour costs are presented in Table 6. On average, total labour costs stood at rupees 124,083.30, with the highest being rupees 454,000 and the lowest rupees 15,800, which is surprisingly quite low. However, on closer observation, it turns out that such a small wage bill was for the petrol pump which employed only two workers. The petrol pump was in a rural area.

Table 5

Employees' Salaries (Per Month; Thousand Rupees)

Variable	Mean	Std. Dev.	Minimum	Maximum
Managers (Overall)	**15.54**	**6.58**	**6.50**	**50.00**
Region				
Rural	12.83	4.32	6.50	25.00
Urban	17.18	7.18	7.00	50.00
Location				
Non-Highway	16.10	8.19	6.50	50.00
Highway	14.96	4.40	7.00	30.00
Supervisors (Overall)	**10.44**	**4.44**	**6.00**	**34.00**
Region				
Rural	8.88	2.37	6.00	15.00
Urban	11.50	5.20	7.00	34.00
Location				
Non-Highway	10.52	5.65	6.00	34.00
Highway	10.35	2.70	6.00	16.00
Cashier (Overall)	**9.03**	**1.96**	**5.00**	**15.00**
Region				
Rural	9.06	2.29	5.00	15.00
Urban	9.01	1.80	6.00	15.00
Location				
Non-Highway	8.63	1.66	5.00	13.00
Highway	9.50	2.21	6.00	15.00
Fillers (Overall)	**7.88**	**1.73**	**4.00**	**15.00**
Region				
Rural	7.38	1.60	4.00	10.00
Urban	8.16	1.74	5.00	15.00
Location				
Non-Highway	8.05	1.83	4.00	15.00
Highway	7.72	1.63	4.00	10.00

Table 6

Total Labour Costs (Per Month; Thousand Rupees)

Variable	Mean	Std. Dev.	Minimum	Maximum
Total Labour Costs (Overall)	**124.08**	**85.64**	**15.80**	**454.00**
Region				
Rural	82.11	47.46	15.80	212.00
Urban	147.49	93.32	15.80	454.00
Location				
Non-Highway	113.62	76.26	30.00	454.00
Highway	133.80	93.38	15.80	380.00

5.3.2. *Other Costs*

In our analysis, the "other costs" comprise electricity expenses, generator expenses (i.e. fuel for running generator), product loss, and sub-costs. The sub-costs, in turn, comprise telephone, water, uniform, stationery, and maintenance expenses. We have lumped these costs into a single sub-cost category because these costs alone are miniscule. Before moving further, a few words on explaining the product loss category are in order. MoGas is a volatile product and tends to evaporate easily. HSD, on the other hand, is less volatile than MoGas and does not evaporate as much as MoGas does, while stored. International practices also allow for 0.5 percent product loss for MoGas whereas, normally, no allowance is given for the loss of HSD. The respondents of the survey also told that they only factored in the loss of MoGas due to evaporation. Such losses are called normal loss and are a part of the cost of goods sold.

The breakdown of the other costs is given in Table 7. The table shows that the mean of the generator expenses (rupees 81,746) was higher than the mean of electricity expenses (rupees 48,866.81). The data shows that the highest expenditure on generator was for the petrol pump that also had the highest throughput. Similarly, the petrol pump that had the lowest electricity expense also was the pump that did not have generator installed at their site. Expenditure on electricity was higher in urban areas and for the petrol pumps on highways. The sub-costs were also higher in urban areas and highway petrol pumps because this is where most of the petrol pumps that had the highest throughputs in our sample were situated.

Table 7

Other Costs (Per Month; Thousand Rupees)

Variable	Mean	Std. Dev.	Minimum	Maximum
Electricity (Overall)	**48.87**	**48.58**	**4.00**	**300.00**
Region				
Rural	28.45	14.35	4.00	80.00
Urban	60.25	56.74	6.69	300.00
Location				
NHW	35.28	24.65	4.00	110.00
HW	61.48	60.85	12.00	300.00
Generator (Overall)	**81.75**	**68.38**	**10.00**	**350.00**
Region				
Rural	58.52	40.50	13.21	150.00
Urban	91.50	75.39	10.00	350.00
Location				
NHW	60.48	33.60	10.00	125.00
HW	99.19	83.67	13.21	350.00
Product Loss (Overall)	**17.61**	**18.20**	**0.85**	**105.71**
Region				
Rural	8.92	5.92	1.27	22.54
Urban	22.28	20.76	0.85	105.71
Location				
NHW	19.59	19.06	1.27	105.71
HW	15.72	17.37	0.85	84.57
Sub Costs (Overall)	**17.53**	**21.17**	**1.25**	**109.00**
Region				
Rural	11.10	16.05	1.70	87.50
Urban	21.11	22.92	1.25	109.00
Location				
Non-Highway	16.36	15.53	1.70	58.33
Highway	18.61	25.47	1.25	109.00

The product loss, which is calculated at 0.5 percent of the total volume sold, would rise as sales volume increases. The calculation of product loss can be explained with the help of the following hypothetical example, for the sake of exposition. Let us assume that the price of 1 litre of petrol is rupees 100 and a petrol pump gets a 100 litre of MoGas from an OMC. The total cost of MoGas, thus, would be rupees 10,000 and the product loss would be 10,000 x 0.5 percent = 50, i.e. rupees 50.

Table 8 below combines electricity, generator, product loss, and sub-costs. Summary statistics of "Total Other Costs" are obtained by simply adding together the costs reported in Table 7.

Table 8

Total Other Costs (Per Month; Thousand Rupees)

Variable	Mean	Std. Dev.	Minimum	Maximum
Other Costs (Overall)	**155.44**	**128.20**	**10.77**	**722.43**
Region				
Rural	90.55	61.92	10.77	247.93
Urban	191.62	141.23	46.02	722.43
Location				
Non-Highway	120.85	71.83	10.77	287.16
Highway	187.55	158.41	22.70	722.43

To give an overall picture of how much total costs petrol pumps bear in running a petrol pump, Table 9 reports total costs. These total costs are the sum of total labour costs and total other costs. Table 10 shows that the highest cost was associated with the petrol pump in urban area, on a highway. On average, the lowest costs were borne by the petrol pumps located in rural areas. Similarly, average costs of running a petrol pump were lower for petrol pumps situated in non-highway areas. Costs would naturally be lower in rural areas because not only the workers employed at these petrol pumps were lower, total sales volumes were also lower in rural areas as compared to urban areas.

Table 9

Total Costs (Per Month; Thousand Rupees)

Variable	Mean	Std. Dev.	Minimum	Maximum
Total Costs (Overall)	**279.52**	**199.85**	**38.70**	**1,102.43**
Region				
Rural	172.66	91.83	38.70	425.36
Urban	339.11	218.88	102.27	1,102.43
Location				
Non-Highway	234.47	135.03	50.77	741.16
Highway	321.35	239.39	38.70	1,102.43

Presenting costs in per unit (i.e. in rupees per litre) terms would be more illuminating of the cost structure besides showing which petrol pumps are cost efficient. Thus, we have presented per-unit total costs in Table 10. We have only reported total per-unit costs because some of the per-unit costs were very small. The table clearly shows that the per-unit costs were higher in rural areas as compared to those in the urban areas. Further, the total per-unit costs were the lowest for the highway petrol pumps. One of the reasons is higher throughput, which results in economies of scale. Another reason could be that the petrol pumps that had lower per-unit costs were more efficient.

Table 10

Per-Unit Costs (Per Month; Rupees Per Litre)

Variable	Mean	Std. Dev.	Minimum	Maximum
Total Costs (Overall)	**1.35**	**0.82**	**0.34**	**4.70**
Region				
Rural	1.41	0.73	0.44	3.59
Urban	1.32	0.87	0.34	4.70
Location				
Non-Highway	1.43	0.74	0.44	3.74
Highway	1.28	0.89	0.34	4.70

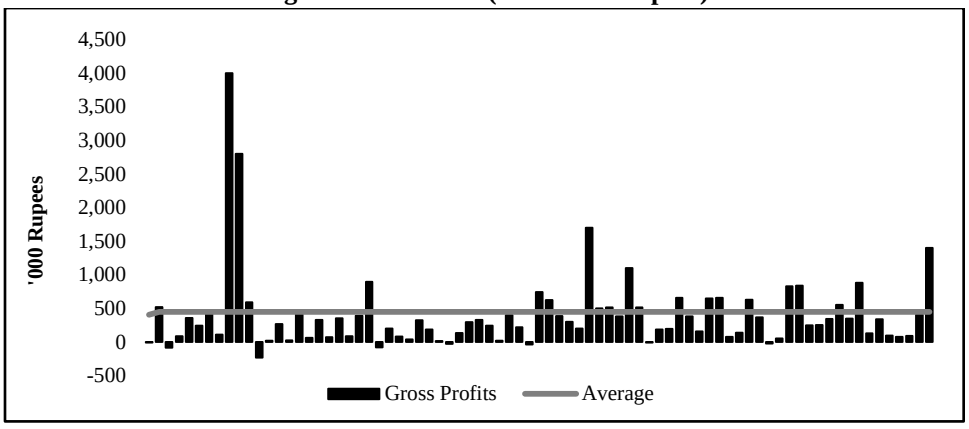
5.4. Profitability

The profitability of petrol pumps is analysed in two ways. Firstly, we have calculated gross profits, which are total revenues minus total costs. Secondly, we have calculated profits per litre, which are obtained by dividing gross profits with total sales.

5.4.1. *Gross Profits*

Gross profits for the entire sample are presented in Figure 3. The figure clearly shows that most of the petrol pumps were profitable. Some petrol pumps had profits that were substantially higher than the sample average, and quite a few were near the average. Thus, the data from the survey sample clearly shows that most of the petrol pumps had positive profits and the claim of the petrol pump owners that they make incur losses is not corroborated, at least by the data of this study. There were only 8 petrol pumps that incurred losses.

Fig 3. Gross Profits (Thousand Rupees)



5.4.2. *Profits Per-Litre*

The gross profits do not necessarily reflect the efficiency with which a company operates, so to take this factor into account, in Table 11 below, we have given the summary statistics of profits per litre. As it can be seen from the table, profits per litre, on average, were the highest in the urban areas. Although the total costs were also highest in the urban areas, these were more than offset by higher sales volumes, which in turn result in higher total revenues.

Table 11

Profits Per Litre (Rupees Per Litre)

Variable	Mean	Std. Dev.	Minimum	Maximum
Profit Per-Litre (Overall)	1.19	.82	-2.37	2.14
Region				
Rural	1.11	.75	-1.12	2.14
Urban	1.23	.86	-2.37	2.14
Location				
Non-Highway	1.18	.73	-1.13	2.14
Highway	1.19	.90	-2.37	2.14

Similarly, profits per litre were also higher for highway petrol pumps as compared to non-highway petrol pumps for the same reason as they were higher in urban areas as compared to the rural areas. Some of the petrol pumps also incurred losses on each litre of fuel sold. The highest loss incurred was rupees 2.37 per litre and the lowest was rupees 0.11 per litre. Out of the 8 petrol pumps that incurred losses, 3 were in the rural areas and 5 were in urban areas.

Interestingly, all the 8 petrol pumps that incurred losses, did not have amenities (tuck shop, car wash, or a tyre shop) at their sites. Further, the share of MoGas in their total sales was less than 50 percent. Since the petroleum dealers get higher margin on selling a litre of MoGas than selling a litre of HSD, it is more profitable for them to pump a litre of MoGas as compared to pumping a litre of HSD. Further exploration of the data reveals that the pumps with negative profits had high per-unit total costs. Their per-unit labour costs were also higher than the average for the whole data. The average labour cost per unit for the entire sample was 0.64 rupees per litre, whereas for the petrol pumps making losses, it was 1.61 rupees per litre. Although it may be difficult to bring down other costs, it is possible for these pumps to curtail labour costs since their throughput is also lower and they might not be needing as many workers as they currently employ. As far as the total number workers employed at the petrol pumps is concerned, the average for the whole sample was 13.79 workers. The loss-making petrol pumps, on the other hand, employed 12.88 workers, on average, which is close to the sample mean. Given the fact that their average throughput was significantly lower than the sample mean (284,915.6 litres versus 75,289.5 litres), the number of workers employed at these pumps was quite high.

Analysing the petrol pumps whose per-unit total costs were lower than the sample mean, which is 1.35 rupees per litre, shows that there were 52 such petrol pumps in our

sample. Most of these petrol pumps, which were 37 in number, were in urban areas. Similarly, on highways, there were 31 petrol pumps, which had per-unit total costs lower than the sample mean. Moreover, the sale of MoGas was higher at these petrol pumps as compared to the sample average. The sample average MoGas sale is 129,103.3 litres; compared to this, the average sale of MoGas at the petrol pumps, which had per-unit total costs lower than the sample average, was 161,124.6 litres. The data also shows that 65 percent of the petrol pumps that had tuck shops are those that had per-unit total costs lower than the sample mean.

5.5. Non-Forecourt Activities

Table 12 reports the breakdown of non-forecourt activities.

Table 12

Petrol Pumps with Amenities (Numbers)

	Tuck Shop	Tyre Shop	Car Wash
Overall	**17**	**22**	**17**
Region			
Rural	6	6	5
Urban	11	16	12
Location			
Non-Highway	11	16	12
Highway	6	6	5

There were 17 petrol pumps that also operated a tuck shop, 6 of them were in a rural area while the rest were in urban areas. Similarly, 11 of the petrol pumps that had a tuck shop were non-highway petrol pumps. It can be seen from the table that most of the petrol pumps that had different amenities were in the urban region.

5.6. Size of the Petrol Pump

Table 13 summarises the size of the petrol pumps, measured by the number of bays installed. The table shows that the petrol pumps in urban areas and those on highways had a higher number of bays. The minimum number of bays at any petrol pump was 2 and the highest number was 14.

Table 13

Size (Number of Bays Installed)

Variable	Mean	Std. Dev.	Minimum	Maximum
Bays (Overall)	**4.05**	**1.96**	**2.00**	**14.00**
Region				
Rural	3.55	0.99	2.00	6.00
Urban	4.33	2.29	2.00	14.00
Location				
Non-Highway	3.74	1.93	2.00	13.00
Highway	4.33	1.96	3.00	14.00

5.7. Distance

We calculated the distance variable using the Google Maps. We had the addresses of the fuel stations we surveyed and names and addresses of all the fuel stations in Pakistan, accessed at the Oil and Gas Regulatory Authority (OGRA) website. We calculated the shortest traveling distance between the surveyed fuel station and the closest fuel station by entering the addresses of the two fuel stations into the Google Maps utility, giving us the required distance in kilometres between the two fuel stations. Table 14 below summarises the distance variable. According to the table, the mean traveling distance of the petrol pumps, included in the sample, from the nearest petrol pump was 6.25 kilometres. The distance between two petrol pumps increased in the rural areas by about 2.25 kilometres, on average, as compared to the petrol pumps in the urban areas. The average distance was also higher for highway petrol pumps as compared to the non-highway petrol pumps.

Table 14

Distance from the Nearest Petrol Pump (Kilometres)

Variable	Mean	Std. Dev.	Minimum	Maximum
Distance (Overall)	**6.25**	**4.38**	**0.70**	**22.00**
Region				
Rural	7.70	5.11	1.20	22.00
Urban	5.44	3.74	0.70	18.00
Location				
Non-Highway	5.74	4.34	1.50	21.10
Highway	6.72	4.42	0.70	22.00

5.8. Regression Results

The regression results are given in Tables 15 and 16 below. We have presented results of the determinants of profits per litre and sales in Tables 15 and 16, respectively. Equation 1 in both the tables is the base equation in which neither the quadratic term of the distance variable nor the interaction term of the region and location variables are included. Equation 2, on the other hand, includes the quadratic term of the distance variable but does not include the interaction term of the region and location variables. The interaction term is included in Equation 3. As it can be seen from the results, the predictive power of the models increases with the inclusion of quadratic term of the distance variable and the interaction term. To see if there was a problem of heteroskedasticity, we used Breusch-Pagan test. The test results show that the null hypothesis of homoskedastic variance is rejected and therefore we use robust standard errors to correct for the problem of heteroscedasticity. In the regression analysis, we excluded the Byco and Hascol petrol pumps from the estimation because there was only one petrol pump each of these OMCs. Including these observations in the analysis would have resulted in the covariance matrix to be of lower rank than the number of covariates, which would have made it impossible to calculate the overall model F-statistic in robust regression.

Most of the results are in accordance with the expectations, both in terms of signs and significance. The linear term of the distance variable is significant and its sign is positive. It means that the profitability of a petrol pump increases as its distance from the nearest petrol pump increases. This could be an evidence that petrol pumps that are spatially differentiated are more profitable. Furthermore, it also implies that since the prices of the petroleum products are the same across all petrol pumps, the consumers are distributed among petrol pumps located close by. This results in reduced sales and possibly hurts a petrol pump's profitability. The sign of the squared term of distance is negative, as expected, and significant. This indicates that the profits per litre and sales volumes have a non-linear relation with the distance variable. An implication of this result is that as this distance increases beyond a certain optimal level (discussed below), it starts to impact profitability and sales negatively. The size of the petrol pump is also positive and significant. It is highly significant in the sales volume model. The explanation for this is straightforward. The consumers prefer those petrol pumps where waiting time is lesser owing to higher number of bays installed.

Table 15

Regression Results—Profitability Determinants

Independent Variables	Equation 1 Coefficient	Equation 2 Coefficient	Equation 3 Coefficient
Distance	.03	0.13	0.13
	(1.48)	(1.90*)	(1.88*)
Distance-squared	–	–0.005	–0.005
		(–1.67*)	(–1.66*)
Size	0.04	0.04	0.04
	(1.87*)	(1.75*)	(1.68*)
MoGas Share	.61	0.63	0.72
	(1.39)	(1.44)	(1.53)
Admore[+]	–0.13	–0.15	–0.12
	(–0.31)	(–0.37)	(–0.31)
Attock	0.06	0.17	0.17
	(0.12)	(0.33)	(0.33)
Caltex	0.30	0.45	0.46
	(0.70)	(1.00)	(1.02)
PSO	0.64	0.65	0.64
	(2.03**)	(2.14**)	(2.06**)
Shell	0.29	0.34	0.35
	(0.89)	(1.02)	(1.03)
Tuck Shop	–0.26	–0.22	–0.22
(=1 if no Tuck Shop)	(–1.35)	(–1.22)	(–1.17)
Region (=1 if Rural)	–0.13	–0.14	–0.01
	(–0.60)	(–0.73)	(0.28)
Location	–0.13	–0.08	–0.08
(=1 if Non-Highway)	(–0.73)	(–0.41)	(0.03)
Region*Location (=1 if Urban & Highway)	–	–	0.28
			(0.76)
Constant	0.57	0.14	–0.14
	(1.14)	(0.20)	(–0.18)
Number of Observations	79	79	79
F Value	1.82*	1.97**	1.99**
Prob>F	0.067	0.04	0.04
R^2	0.19	0.22	0.23
Breusch-Pagan Test [$\chi^2(12)$]	17.94***	21.55***	21.19***

Note: ***, **, * denote significance level at 1 percent, 5 percent, and 10 percent, respectively. Figures in parentheses are t-values. [+]Total (OMC) is the base category.

Table 16

Regression Results—Determinants of Sales

Independent Variables	Equation 1 Coefficient	Equation 2 Coefficient	Equation 3 Coefficient
Distance	12874.27	43104.53	43201.29
	(2.25**)	(2.59***)	(2.57***)
Distance-squared	–	–1577.77	–1571.73
		(–2.12**)	(–2.11**)
Size	102976.10	103302.3	103212.7
	(3.89***)	(4.06***)	(4.22***)
Admore[+]	–14119.42	–17844.12	3476.43
	(–0.17)	(–0.21)	(0.04)
Attock	–104285.6	–73461.94	–82049.46
	(–1.63)	(–1.07)	(–1.20)
Caltex	–94893.69	–52282.32	–47958.02
	(–1.32)	(–0.71)	(–0.66)
PSO	136404.3	137511.7	130257.4
	(1.94**)	(2.02**)	(1.99**)
Shell	40338.00	54717.8	59533.3
	(0.54)	(0.76)	(0.82)
Tuck Shop	23288.1	35753.54	40003.75
(=1 if no Tuck Shop)	(0.38)	(0.57)	(0.63)
Region (=1 if Rural)	–160726	–166745.2	–84948.51
	(–4.08***)	(–4.23***)	(–1.68*)
Location	–86269.19	69585.02	31802.16
(=1 if Non-Highway)	(–1.79*)	(–1.39)	(0.57)
Region*Location (=1 if Urban & Highway)	–	–	159463.1
			(1.91*)
Constant	–156798.9	–281376.8	–415879.1
	(–1.10)	(–1.64*)	(–2.15**)
Number of Observations	79	79	79
F Value	3.69***	3.64***	3.72***
Prob>F	.0006	0.0005	.0003
R^2	0.63	0.65	0.66
Breusch-Pagan Test [$\chi^2(12)$]	54.08***	53.54***	52.36***

Note: ***, **, * denote significance level at 1 percent, 5 percent, and 10 percent, respectively. Figures in parentheses are t-values. [+]Total (OMC) is the base category.

As far as the identity of the OMC is concerned, only PSO's dummy is significant, which is also positive. This means that the petrol pumps working under the PSO banner are more profitable. One of the explanations for this result could be the higher labour productivity of PSO. Total sales per unit of labour is the second highest for PSO, which is 27,095.42 litres per unit of labour.[3]

Results regarding the region and location of the petrol pumps are also interesting. The region and location dummies are negative, implying that the performance of the

[3]To calculate labour productivity, we divided total sales volumes (MoGas *plus* HSD sales volumes) with the total number of workers (sum of all categories of workers, i.e. managers, supervisors, cashiers, and fillers).

urban and highway petrol pumps is better than the performance of the rural and non-highway petrol pumps. The coefficient of the interaction dummy of region and location variables is positive, in both the models (profitability and sales volume). It is significant in the case of sales volume model. It shows that petrol pumps that are in urban areas and are on highways are more profitable as compared to those located in rural areas and are non-highway petrol pumps.

From the equations that include the quadratic terms of the distance variable, we have calculated optimal distance between two petrol pumps that maximises profits and sales. The results of these calculations are reported in Table 17 below.

Table 17

Optimal Distance (Kilometres)

Region	Optimal Distance
Rural	11.8
Urban	8.4
Non-Highway	10.6
Highway	12.8

Authors' calculations.

The table shows that the optimal distance that maximises per-litre profits (and total sales) is greater for the rural and highway petrol pumps, whereas it is shorter for the urban and highway petrol pumps. Since in rural areas there is less traffic compared to traffic in urban areas, it would be beneficial for the potential petrol pumps owners to set up petrol pumps further apart in rural areas than in the urban areas. On the other hand, the optimal distance that maximises profits (and sales) is shorter for non-highway petrol pumps than for the highway petrol pumps. The traffic on the highways usually travels long distance, making fewer stops for refuelling and other needs. Therefore, the optimal distance that maximises per-litre profits should be longer for highway petrol pumps.

6. SUMMARY AND CONCLUSIONS

The results of the present paper are in line with the existing literature on the topic, which suggests that both geographical and non-geographical factors are important in affecting the sales and performance of petrol pumps. The results show that throughput and profits per litre are higher and per-unit costs are lower for the petrol pumps in urban areas and on highways. An important finding of the present study is that petrol pumps, in general, are profitable. The petrol pumps that incur losses are the ones that do not have non-forecourt activities on their sites. These petrol pumps also have high per-unit labour costs. An implication of this result is that petrol pump businesses need to employ workforce that is commensurate with their throughput since loss-making petrol pumps have lower sales.

Our results also show that the size is an important determinant of a petrol pump's performance and sales. The distance variable is positive and significant whereas its non-linear term is negative and significant. The result that there is a non-linear and statistically significant association between distance and performance of petrol pumps could have important implications for potential entrepreneurs who wish to set up a petrol

pump as strategically locating a petrol pump could help boost the petrol pumps sales and profitability. In this connection, an important contribution of this study is the calculation of profit-maximising distance between two petrol pumps. This threshold distance could serve as a guideline for the entrepreneurs wishing to set up petrol pump business and a guideline for the licensing authorities. Our results also show that although, petrol is a homogeneous product, identity of the marketing company is important, which is also the evidence found by Gagné, Nguimbus, and Zaccour (2004).

There are some limitations that must be kept in mind while interpreting the results. Although, most of the petrol pumps in our sample make positive profits, it must be borne in mind that we could not get data on some of the financial aspects of the petrol pumps. Land is an expensive factor of production and the land on which petrol pumps are set up could have huge opportunity cost. Therefore, taking fixed costs into account could potentially change the picture. Similarly, the start-up cost of a petrol pump is high, which must be dug deeper into in future research.

As we discussed in the description of the sample, our ability to collect more in-depth data and larger sample was hampered by numerous considerations. Although, our results are in line with the existing literature but to have a better understanding of the petrol pump business, future research should be based on a larger sample. The theoretical literature shows that why and where a retail business is placed is very important, therefore, the process of finding a location for petrol pump should be one of the focal points of the future research. The caveats notwithstanding, our results show that a petrol pump is a lucrative business. This finding is contrary to what the normal perception is about the viability of opening and running a petrol pump, under the current rules and regulations.

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Book Review

Sara Rizvi Jafree. *Women, Healthcare, and Violence in Pakistan.* Karachi, Pakistan: Oxford University Press. 2017. 292 pages. Price Pak Rs 950.00.

Sara Rizvi Jafree's book titled *Women, Healthcare and Violence in Pakistan* is a detailed explanation and analysis of various forms of violence perpetuated and exercised against women professionals in the field of healthcare. The book details the quantitative and qualitative evidences of violence against women in the healthcare domain of Pakistan. For quantitative evidence, the author has cited sources from the reports published by the World Health Organisation and academic materials published in medical journals in the context of Pakistan. For the qualitative evidence, the author has included both event-based and experiential narratives of women who shared lived experiences of violence with the author while she conducted her research with the female health professionals of Punjab. The book is divided into seven chapters, each highlighting the evidence of gendered violence in a synchronic and hybridised way.

The first chapter, "The Women Healthcare Profession in a Patriarchal World", lays the foundation and sets the context for the prevalence of workplace violence and its different types, the incidence of workplace violence across the globe and the existing scholarship in Pakistan, the contextual analysis of workplace violence in the Pakistani media, and the legal status of working women who experience workplace violence. Public-sector hospitals are mostly visited by the poor and illiterate people in Pakistan. These hospitals are also inexpensive as compared to costly private hospitals. The paucity of financial resources allocated to the public-sector hospitals has deflated the quality of services provided by this sector, which leaves the public, who are at the receiving end of these services, frustrated and dissatisfied. The author claims that this dissatisfaction causes men in particular to be violent against women practitioners as they are easier to be targeted in non-punitive environments. Among the women practitioners also included are lady health workers who are more vulnerable to physical and sexual abuse due to their deliverance of services to the impoverished and illiterate communities where they interact with conservative men. These men view women functioning in open spaces (as opposed to confining within the walls of domesticity and in *purdah*) as "radical agents", hence increasing the propensity of violence against women practitioners.

The situation is not any different on the organisational front. Male physicians and administrative staff occupy powerful positions and are insensitive to issues such as the dearth of medical equipment, inadequate training of the staff, the lack of financial incentives for the working mothers, and the lack of communication between workers. In addition to these identifiable issues are the issues of verbal and physical violence, and the lack of reporting of violence by the women practitioners. The author cites that as per male practitioners, beating women is a norm within domestic spheres, which can

transcend to the public domain and that ought to be dealt with in routine. Also confirming to the existing scholarship, the media discourse recognises the prevalence of workplace violence against women and more so in Pakistan due to patriarchal organisational structure.

In the second chapter, titled "Theories of Workplace Violence", the works of Sigmund Freud, Michele Foucault, Anne Campbell, and Emile Durkheim are reviewed. Borrowing the constructs and concepts from the works of these theorists, the author has conceptualised a theoretical framework in which the causes of violence against women healthcare providers are reasoned. The framework explains that cultural traditions, social norms, and conservative understanding of religious texts aggrandises the violence against the working women. Furthermore, the socio-religious and politico-economic statutes tend to increase the state of conflict in Pakistan. Situated within these statutes are the organisational spaces in which incapability of individuals to understand the organisational nomenclature, workplace stress, and the fear of losing control can trigger violence against women at the workplace. The structural theories, on the other hand, synthesise the fact that economic globalisation, economic modernisation, global media, and capitalism has bifurcated the gender roles and delineated the gendered spaces. Moreover, the intersection of gender violence in public spaces with gender violence in private domains is the result of early socialisation of men within homes and during early years of academic training. Having witnessed violence, abuse, and aggression against women in their families, the male members think it is legitimate to practice violence against the women and expect the women to accept and internalise it, which is viewed by the author as a serious threat to the safety of women in the healthcare organisations. The victim theories provide a layered explanation to the workplace violence against women by asserting that women usually find it difficult to report any type of violence they have been subjected to as the fear of reporting violence culminates into the fear of disclosure, losing a job, and family honour. The scenario further becomes troublesome for women to prove their victimhood because the perpetrators have powerful positions within organisational settings. For these women, discussing experiences of violence is difficult the result of which is that they turn to adaptive strategy of internalising these experiences of violence.

The third chapter, titled "Quantitative Evidence of Workplace Violence", starts with typifying the types of women healthcare practitioners in Pakistan, which are the Lady Health Workers (LHWs), nurses, and female doctors. The common belief that LHWs have been trained by the West to strengthen their agenda in Pakistan has caused to increase the rate of violence against them. Nurses, on the other hand, are no less vulnerable to violence due to insufficient resources provided to them and an unsafe working environment. Relatively better off in this regard are the women doctors but the fact that they are not elected as representatives of institutionalised health bodies in Pakistan (such as the Ministry of National Health Services and Regulations) reflects the skewed authority and hierarchy within the broader power dynamics of the healthcare setup. In addition, the author describes the poor conditions of public hospitals in Pakistan and details that women in these hospitals are discontented with minimal career development opportunities, dried up salaries, lack of organisational support for the educational infrastructure and day care centres, and the absence of structural support to

workplace benefits. Through reports, the author highlights the prevalence of forms of violence in the healthcare settings in Pakistan, which include physical, verbal, and sexual violence. The victims are women, both married and unmarried, relatively younger, mostly from Punjab, experience income inequality, reside in private accommodation, and work after hours. The author also signifies that violence is being practised to various degrees across different health care departments, and designatory classifications. The under-reporting of violence is another issue highlighted by the author. The lack of sharing experiential realities for the fear of being termed as "unprofessional", slurring family's name, and lacking corroboration of violence are stated as the reasons for this underreporting.

Next in discussion is "Voiced Experiences of the Workplace: Learning by Listening", which is the title of the fourth chapter. The excerpts of interviews in this chapter are taken from the women healthcare practitioners who were approached for conducting interviews from rural and urban areas of Punjab across a four-year period. Among the reasons for violence stated by women practitioners include: unequal treatment in the households with respect to women; the culturalisation of gender violence and patriarchy; polygamy and sexual aggression; culturalised gender segregation; low professional status; negative connotations linked with women practitioners; general misperception about women nurses not being Muslims, and violence with respect to class. Among the reasons stated by women for bad governance and poor organisational structure include staff shortages, professional bullying, VIP male culture, verbal harassment, power driven male social networks, male professors as sexual predators, lack of security and monitoring, poor laws and accountability, sensational media, and religious misinterpretations. In the light of these reasons the author has provided a substantiated account of Pakistan struggling against the structural and cultural forces that perpetuate violence against women.

The fifth chapter, titled "Women Practitioners in Support of Cyclical Violence", ideates the reasons for the lack of support to women who have lived through the experiences of workplace violence. One of the significant reasons cited by the author is the lack of support by the upper and middle-class women practitioners who are encouraged to become part of higher echelons of medical profession, leaving women from lower classes to become nurses and lady health workers. This class-based inequality is explicitly cited as the cause of disunity among these women who have been stratified along the axis of socio-economic statuses. The women, despite knowing the stories of perpetuation of violence against women practitioners, tend to maintain silence for two reasons, namely retaining the collective honour of women in a society and lacking the defence mechanism in the case of disclosure.

Chapter six titled, "The Perpetrators' Silent Allies", helps us to understand that men who are not actively practising violence are passively part of the institutionalised and misogynistic setups of healthcare organisations. Those who support women are shamed by the brotherhood community. Moreover, violence is being exercised to an extent that it has not just become a cultural norm but also an organisational norm. The author has also highlighted those men who acknowledge the prevalence of gender violence but also blame women for exaggerating their experiences and inciting violence against them for their inadequacy and incompetence.

The last chapter of the book, titled "Women Practitioners Matter: Contesting Patriarchy for Care-Providers", gives holistic review of the book contents and typifies what needs to be done on the policy front. It emphasises outlining the professional rights that should be given to the women healthcare professionals in Pakistan. The politics of silence needs to be broken to encourage women in narrating their experiences. Regardless of the existing ministerial bodies, there has to be collective and unionised efforts on the part of women practitioners, donor groups, and women development groups to frame workplace violence bill for women.

The author being a woman herself has written this book with an effective tone of empathy and sensitivity. The author's subjectivity is situational that has also efficaciously positioned her within social constructivist on ontological and interpretative on epistemological fronts. The book is also a valuable addition in highlighting violence against women within the medical professional spaces, which in any way is not a contradistinction to experiences of violence as prevalent in other spaces of Pakistan. The author, though effective in her narrative of lived experiences of violence against women, has presented a gendered conceptualization of workplace violence. The recent scholarship on the workplace violence across different professional spaces highlights that both men and women are subjected to it. The book stays silent on this domain. Moreover, one of the reasons for the workplace violence is the economic disparities between male and female medical professionals. The book has not touched upon the reasons explaining how these disparities can be one of the explanations for the workplace violence against women. In other parts of South Asia, recent literature has highlighted stories of agency and collective action on the part of women victims. This argentic dimension has not been reasoned by the author in the book.

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