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Gender and Ultimatum in Pakistan: Revisited

SAIMA NAEEM and ASAD ZAMAN

Razzaque (2009) studied the role of gender in the ultimatum game by running experiments on students in various cities in Pakistan. He used standard confirmatory data analysis techniques, which work well in familiar contexts, where relevant hypotheses of interest are known in advance. Our goal in this paper is to demonstrate that exploratory data analysis is much better suited to the study of experimental data where the goal is to discover patterns of interest. Our exploratory re-analysis of the original data set of Razzaque (2009) leads to several new insights. While we re-confirm the main finding of Razzaque regarding the greater generosity of males, additional analysis suggests that this is driven by student sub-culture in Pakistan, and would not generalise to the population at large. In addition, we find strong effect of urbanisation. Our exploratory data analysis also offers considerable additional insights into the learning process that takes place over the course of a sequence of games.

JEL Classification: C78, C81, C91, J16
Keywords: Ultimatum Game, Gender Differences, Exploratory Data Analysis

1. INTRODUCTION

Since the beginning of the twenty first century, thousands of papers have been published on the Ultimatum Game (UG) because it clearly demonstrates the social aspects of decision making in the simplest context possible. In the UG, two players share some money according to a simple set of rules. The proposer is given an amount of money—say $10—to share with the responder. The proposer makes an offer (i.e. I keep $7 and you get $3). If the Respondent accepts, both get the proposed allocation. If respondent rejects then both get $0.

Economic theory leads to a straightforward solution to this game. The proposer will maximise utility by keeping $9 and offering the minimal possible amount, $1. Economic theory predicts that the responder will accept this offer, since $1 is better than $0. However, experimental results are strongly in conflict with economic theory. The vast majority of responders reject offers of less than 20 percent, regarding them as unfair. They are willing to suffer a loss, to punish the unfair behaviour of the proposer. Knowing this, the vast majority of proposers offer more than the minimal amount, typically above 30 percent of the total. Thus, both proposer and responder strategies differ greatly from the theoretical Nash equilibrium strategy. Behaviour in the ultimatum game reflects cultural norms related to sharing and perceptions of fairness. Because of this aspect, experiments on this game have been conducted in a vast variety of different cultural contexts. Camerer (2003) provides a convenient summary of the voluminous literature.

Saima Naeem <saima.mahmood@sbp.org.pk> Research Economist, Research Department, State Bank of Pakistan, Karachi. Asad Zaman <vc@pide.org.pk> is Vice-Chancellor, Pakistan Institute of Development Economics, Islamabad.

Some materials especially relevant to our topic are also surveyed in Razzaque (2009) and Zataari and Trivers (2007).

In this context, we re-analyse an experimental study originally conducted by Razzaque (2009) to explore gender differences in the ultimatum game. Our main goal is to show that how exploratory data analysis techniques allow for detection of unusual patterns in data. Our analysis also highlights how local cultural patterns among students drive most of the results, which are very different from standard results on effects of gender in the UG.

EDA—exploratory data analysis—is generally not taught to students of econometrics, we note two key points about it. First, the object of an EDA is to generate interesting hypotheses; to find patterns in the data which are worth investigating or exploring further. The standard package of techniques taught in econometrics textbooks consists of Confirmatory Data Analysis (CDA), which is done when hypotheses are in hand and the goal is to prove or disprove them. EDA is often used to supplement CDA rather than replacing it; however, CDA without EDA is seldom warranted [Behrens (1997)]. EDA provides useful insights, and picks up unexpected or misleading patterns even if we have well defined hypotheses at hand. Small samples are not a serious handicap to an EDA, since our goal is not to find significant evidence for or against a hypothesis, but to generate them. The second point is that use of relevant graphical techniques is much more suited to the discovery of patterns. The patterns in the data stand out visually in the boxplots, and are hidden in the tables or in formal models.

Detailed description of the experiment is provided in Razzaque (2009). We summarise the elements relevant to our analysis briefly. Equal numbers of male and female students were selected from universities in five cities to participate as subjects in the experiments. There were fifteen pairs each in Ghizer, Kharan, Rawla Kot and Nawabshah, and ten pairs in Lahore, for a total of 65 males and 65 females. The first two rounds were blind and anonymous, so as to establish a baseline and to allow all students to play as Proposers and as Responders. The third and fourth rounds were played by matched couples. Males were proposers in the third round while females were responders. The roles were reversed in the fourth round. This design creates a confounding effect, since the effects of reciprocity and gender cannot be disentangled. Nonetheless, the experiment yields a substantial amount of interesting information. Parallel to Razzaque, we do an analysis of the results for each of the four rounds.

Offers in Round 1

Razzaque (2009) finds that the pattern of offers of males in the first round differs significantly from that of females. He also finds that the males make larger offers—i.e. they are more generous. This is rather surprising since the typical finding is the reverse of this; females are found to be more generous, and make larger offers. A detailed analysis reveals much more variation, and interesting patterns in the data. One of the key results that emerges from this analysis is that the behaviour of students in the small cities (Ghizer, Kharan and Rawla Kot) differs significantly from that of the larger cities, Nawabshah and Lahore. We first provide a tabulated summary of the data, which is a typical data summary produced by standard statistical packages.

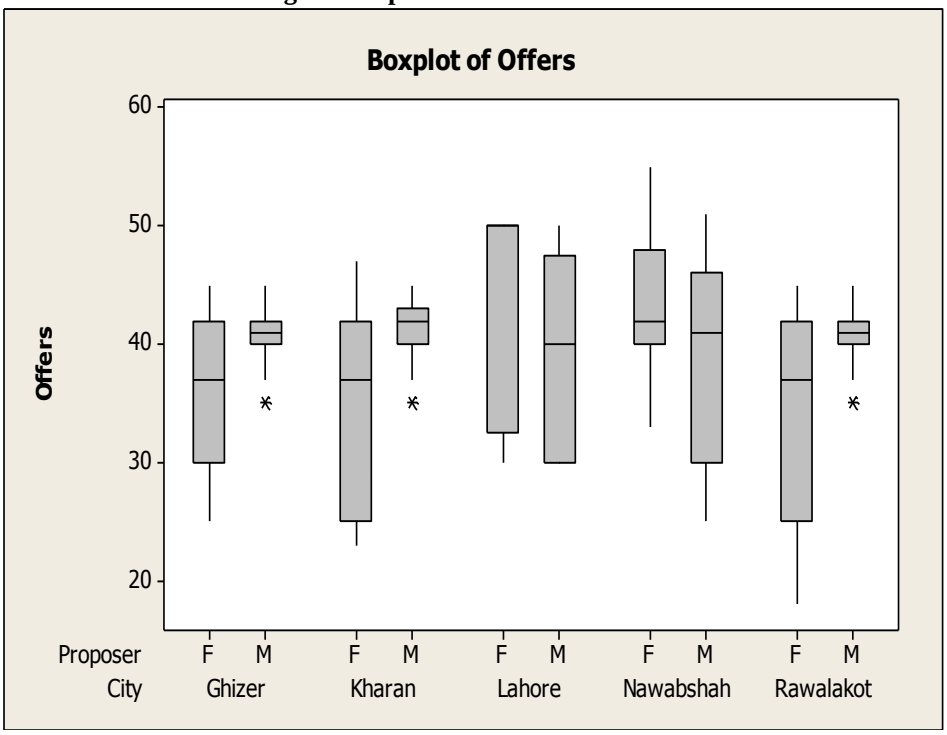
Table 1

Summary Statistics for First Round Offers

City	Gender	N	Mean	SE(M)	StDev	Min	Med	Max
Ghizer	F	15	36.2	1.7	6.6	25	37	45
Ghizer	M	15	40.8	0.7	2.7	35	41	45
Kharan	F	15	35.1	2.2	8.4	23	37	47
Kharan	M	15	41.6	0.7	2.8	35	42	45
Rawla Kot	F	15	34	2.5	9.5	18	37	45
Rawla Kot	M	15	40.8	0.7	2.7	35	41	45
Nawab Shah	F	15	43	1.7	6.4	33	42	55
Nawab Shah	M	15	39.3	2.1	8.3	25	41	51
Lahore	F	5	43	4.4	9.8	30	50	50
Lahore	M	5	39	4	8.9	30	40	50
Small Cities	F	45	35.1	0.604	8.098	10	40	55
Small Cities	M	45	41.1	0.549	7.363	30	45	65
Big Cities	F	20	43.0	1.513	13.533	10	46	100
Big Cities	M	20	39.2	0.709	6.339	25	46	55

Although the patterns that we detect with the boxplot are present in the numbers above, it would require some detective work to find them. However, a boxplot of the data makes these patterns visually obvious, as we can see from the graphs given below.

Fig. 1. Boxplot of First Round Offers



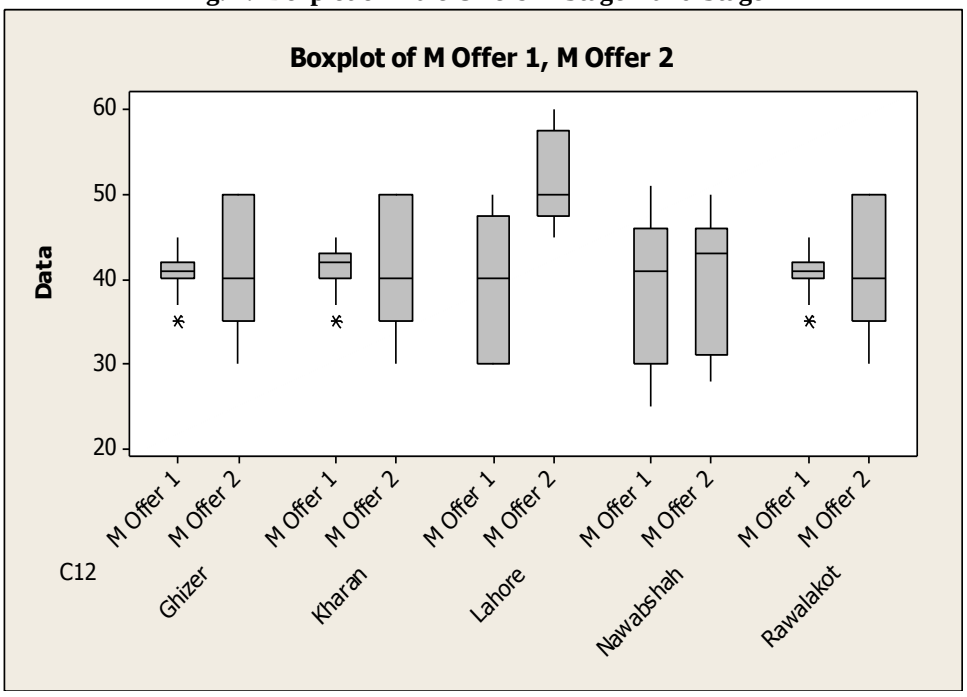
It is immediately obvious visually that male offers in Ghizer, Kharan and Rawala Kot are quite similar to each other, and very different from all other offer patterns. These offers are tightly concentrated around 40 percent. Male offers in the big cities (Lahore and Nawab Shah) also average around 40 percent, but are much more spread out. Male offers differ in small and big cities in terms of variation but not in terms of mean. Female offers show the opposite picture. The mean offer of females is 35 percent, or about 5 percent lower than that of males in the small cities. In the big cities, the mean offer is around 43 percent or about 3 percent higher than that of the males. The spread or variation of the female offers does not show any significant differences among big and small cities.

Our observation of behavioural differences for geographical background or urbanisation were significant in many previous studies; specifically, Barr (2014) shows that urban-born player makes higher offers in the UG, while rural-born player is less certain about sharing norms in UG. Similarly, Paciotti and Hadley (2003) also argued that ethnicity has a greater effect on offers and rejections than individual economic and demographic characteristics. Oosterbeek, Sloof, and Van De Kuilen (2004), on the contrary, found significant differences in respondents' behaviours instead of offers across regions. Botelho, *et al*. (2000), on the contrary, found geographic variable as irrelevant.

Offers in Round 2

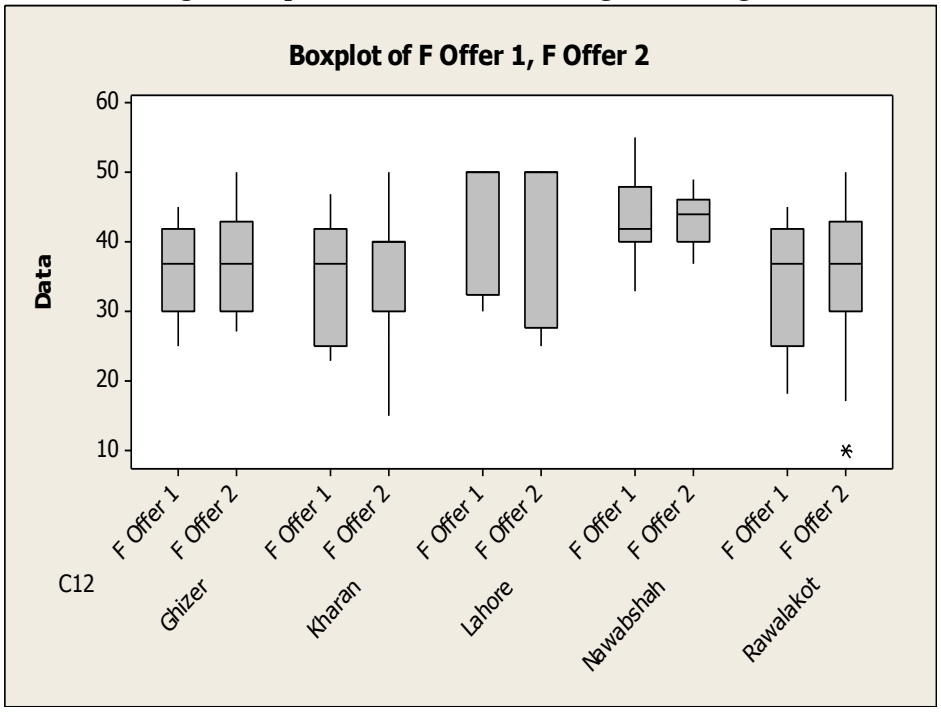
Of course a key question is: why do these differences exist? Before attempting an answer, it is useful to look at the pattern of offers in round 2. Below are the boxplots for the male offers.

Fig. 2. Boxplot of Male Offers in Stage 1 and Stage 2



Because both rounds one and two were conducted under anonymity, there should have been no systematic difference in the results. However, observations turned out differently. In all three small cities, the male offers spread out over a wider range, while the mean remains the same at around 40 percent (Table 1 in Appendix). The spread of these offers is similar to the spread of the offers in all other cases. From the brief interviews conducted it seemed that the male students relaxed, and became more comfortable with game environment—a "game learning effect". It seems plausible that in small cities, male students suffered from performance anxiety on initial contact in environments where they were together with females as subjects in an experiment. Roth and Erev (1995) in their learning model also showed that small initial differences between subjects become larger as subjects gain experience with the UG. However, big cities in our sample did not show any learning effect. In Nawab Shah, there is no change in the male offers. In Lahore, there is dramatic shift upwards in the offers. Exploring this, we find from the experimenter that due to an accident, the male subjects in Lahore learnt that their offers were going to females. This clearly caused a dramatic shift upwards in the male offers. Again there was a strong and clear response to gender; males increased their offers hugely. While the pattern and its explanation seem clear through an analysis via boxplots, similar patterns are very hard to find and explain in standard regression analyses run on aggregated data. Indeed, there is no mention of these patterns in the original analysis of Razzaque. Again this highlights the merits of an exploratory data analysis. Next we look at the analysis of the female offers in round 2. The boxplots are presented below:

Fig. 3. Boxplot of Female Offers in Stage 1 and Stage 2



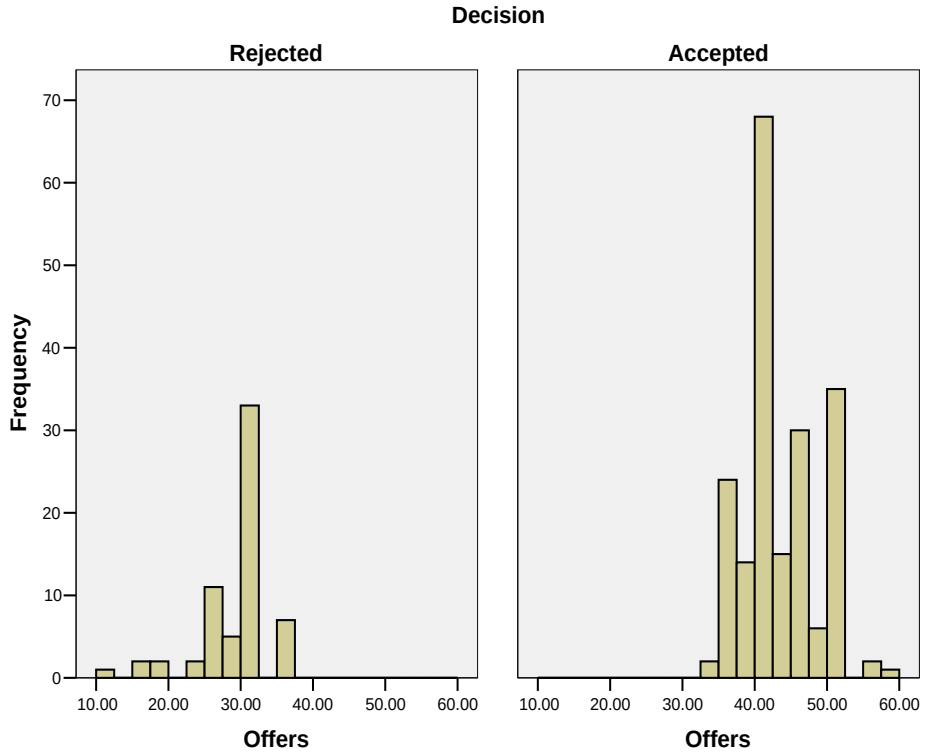
There is not much change in female offers in moving from round 1 to round 2. The means in the small cities remain at 35 percent, well below male mean offers of 40 percent. In Lahore and Nawab Shah, the mean offers of the females remain the same, around 43 percent. This is as one would expect, given that there is little change in conditions going from round 1 to round 2. Whereas female offers were more generous than males in the big cities, this pattern no longer holds in Lahore because of the gender revelation which occurred to males in Lahore. The Lahore offers jumped in response to this, making it appear as if females are less generous. However, this pattern of hyper fair offers is highly unusual, and would likely not be observed in cultural contexts other than cross-gender interactions among students.

An important finding of the first two rounds, when UG was played in anonymity, is that female proposers remained less generous than the male proposers, even if we exclude the Lahore data where male proposers by experimental error proposed hyper fair amounts. This is contrary to typical finding that females are more generous [Andreoni and Vesterlund (2001); Eckel and Grossman (2001); Piper and Schnepf (2008); Naeem and Zaman (2013)] also show that Pakistani females are more generous in giving charity. This creates a puzzle: why are females in small cities offering significantly less than their counterparts in the big cities? The small offer of females is contrary to both local cultural patterns, as well as typical findings of greater generosity of females. Again a plausible explanation stems from the finding of Croson and Gneezy (2009) and Della Vigna, *et al.* (2013) that females are more prone to social norms and social pressure and so they react more to such phenomenon. In small cities where cross gender interactions are not frequent, females are wary and on their guard in an experimental environment where they are interacting with male students. We saw that males in the small cities were also not comfortable in making offers, though the effect of male offers vanished in the second round. In large cities, cross gender interaction is a commonplace, so females behave normally in such environments.

Responder Behaviour in Rounds 1 and 2

Regarding responder behaviour, Razzaque (2009) uses logistic regressions to come to conclusions similar to what we observe, using EDA methods. However, a direct data analysis of the type that we do here provides clear evidence, since it is not based on unnecessary auxiliary assumptions required by more formal statistical methods. In analysing the behaviour of responders, a straightforward analysis shows that there are no significant differences by gender or by city or by round. In fact the responders' behaviour is very clear: All offers of less than 33 percent are rejected in both rounds. All offers of above 37 percent are accepted in both rounds. Only in the very narrow range of offers between 33 to 37 percent do we see any differences in rejection behaviours. Among the total of 260 offers in the two rounds (130 each per round), only 33 offers lie within critical range of 33 percent to 37 percent. Within these 33 offers, there are exactly 6 rejections; the remaining 27 offers are accepted. There are no significant differences in behaviour of responders by gender or by city or any other observable factor.

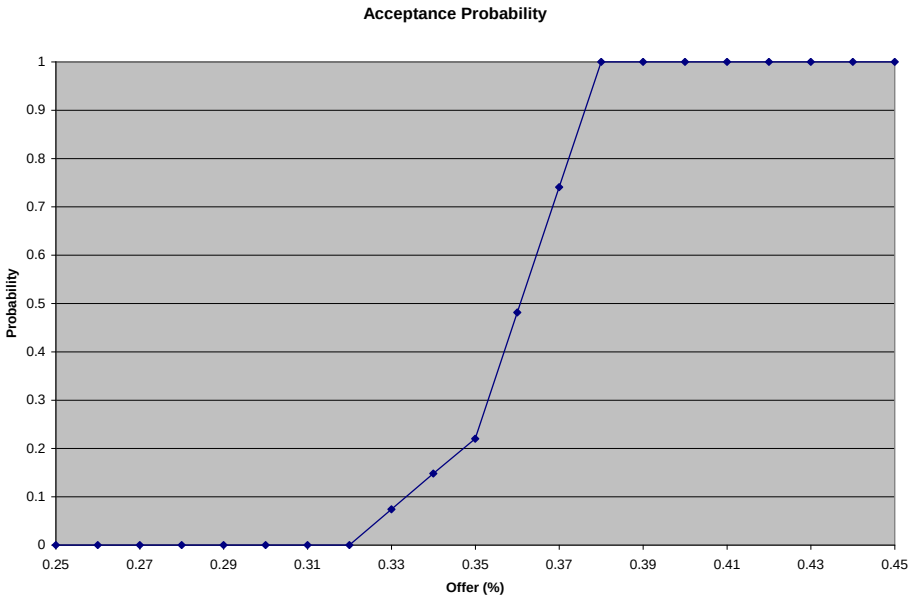
Fig. 4. Bar-plot of Decisions in Stage 1 and Stage 2



We can be misled if we look at overall rejection rates, instead of focusing on the critical region of 33 percent–37 percent. For example, in small cities, the median offer of females is around 35 percent which lies within this critical region. The median offer of males is around 40 percent, which lies above this region. Thus, even though responder behaviour is identical, overall rejection of female offers would be higher than overall rejection of male offers. For example, 30 out of 48 rejections in small cities are by females—the rejection ratio is 62.5 percent for female responders compared to 18/48=37.5 percent for male responders. But within these 48 rejected offers, 39 originate from females. Also, the experimental design is such that in the second round there are only FF and MM pairings, while in the first round FF and FM pairings are approximately equal in number. Among the 130 offers made to females, 35 are made by males, while 95 are made by females. Thus the dramatic difference of 62.5 percent for female rejections compared to only 37.5 percent for males is not due to any differences in responder behaviour by gender. It is due to a combination of two factors. Females offer less, and the experimental design is such that FF pairings are 95/130 = 73 percent of total pairings with female responders.

Given that responder behaviour is identical across genders and cities, we can directly plot the probabilities of rejection of offers from the data on the 260 offers as follows:

Fig. 5. Acceptance Probability

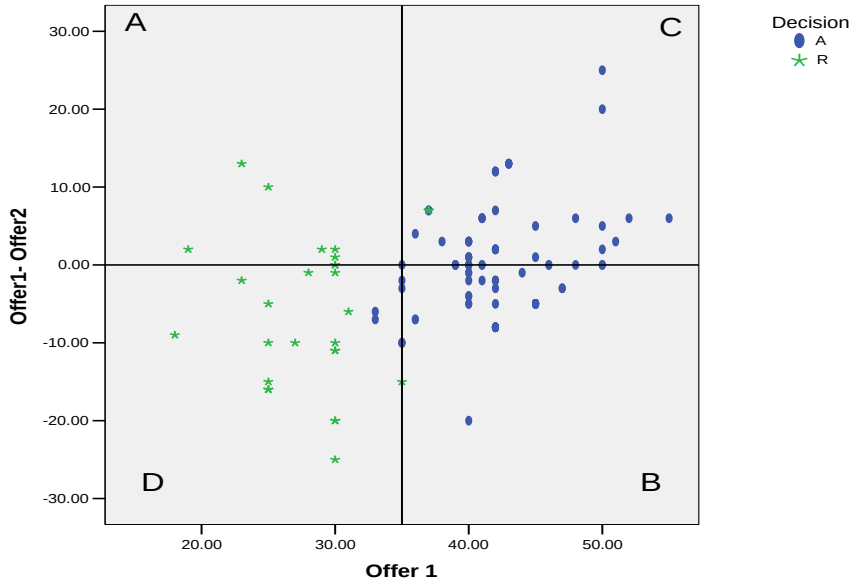


Empirically, probability of acceptance of an offer of 32 percent is zero, while at 38 percent the probability climbs to 100 percent. Within this range, we look at the data for the rejection rates and use linear interpolation. This data-based curve is better than the logistic curve plotted to the same data by Razzaque (2009) because it does not impose an arbitrary functional form.

Learning from Experience

Over the course of a repeated sequence of games, people learn from experience. We examine how subjects learn in going from round 1 to round 2 of the ultimatum game under study. We only consider how the proposers learn; the question of how responders learn is very complicated and cannot be considered here—see Camerer (2003) for some discussion of this issue. If the offer of the proposers is too low, it will be rejected. Learning means that the proposers should raise their offers to prevent rejections in the future. If the proposer keeps the same offer, or lowers it, then he or she has failed to learn from the rejection. If the offer of the proposer is high enough, it will be accepted. In this case, profit maximisation means that the proposer should keep the offer the same, or else lower it, trying to keep a bigger share. Lowering the offer corresponds to experimenting to see if you can make a bigger profit. Increasing the offer corresponds to not learning, since acceptance of the current offer means that the same offer should also be acceptable in the future. Making the same offer will generate a larger share for the proposer, while an increased offer will lead to a smaller share. In light of these considerations, the following graph looks at the difference D = Offer(1)—Offer(2) on the y-axis, plotted against Offer(1) on the x-axis. The rejected Offers(1) are plotted as stars, while the accepted Offers(1) are plotted as solid dots:

Fig. 6. Scatter Plot of First Round Offers with Of1-Of2



Region A: Rejected Offer is decreased—shows lack of learning. Region B: Accepted Offer is increased—Lack of learning. Region C: Accepted Offer is decreased: Learning. Region D: Rejected Offer is increased: Learning.

Learning from Rejections*:* Note that the x-axis is centred at 35 percent. Nearly all of the stars (rejected round 1 offers) are on the left hand side of the x-axis. Furthermore, most of these stars are in the lower quadrant, where Offer(1)-Offer(2)<0, meaning that Offer(2) is bigger than Offer(1). This means the most subjects whose offers were rejected, learned from this experience and increased their offers on the next round. There are a total of 27 rejections in the first round; of these, 6 are male offers while 21 are female offers. Among these, 18 subjects increase their offers in the second round, while 9 subjects decrease, so we could say that 66.7 percent of the subjects learned, while 33.3 percent failed to learn from the first round rejection. If we subdivide by gender, we find that 13 out of the 18 subjects who increased their offers are females, while 5 are males. So this seems to suggest the females learned more, as Razzaque (2009) writes. In fact, of the total of 6 males who were rejected, 5 of them learned from the experience and revised their offers upwards, leading to a learning percentage of 5/6= 83 percent. Of the 21 females who were rejected, 13 increased their offers, leading a learning percentage of only 13/21=62 percent. The sample size is too small to derive firm conclusions, but the null hypothesis that females and males learn equally from rejections cannot be rejected. The stronger tendency of learning in rejected offers in our experiment can be attributed to loss-aversion [Kahneman and Tversky (1979)].

Learning from Acceptances*:* A visual examination of the accepted offers in the above graph shows that they seem spread out equally over the upper and lower half. The

upper half corresponds to learning, where the accepted offer is reduced. The lower half corresponds to failure to learn, where the accepted offer is increased. There are a few outliers in the upper right quadrant corresponding to the hyper fair offers made by males in Lahore. In general the graph shows that there is no learning from acceptances, and that this tendency is also equal among males and females. In an experiment, Brenner and Vriend (2003) show that high general acceptance leads to significantly lower offers. Slonim and Roth (1998) in a high stake experiment also find that proposers learned to make lower offers with experience; however, our experiment does not show this learning effect—acceptances do not lead to lower offers. This may be because there was too little time—too few rounds were played. Also, only the first two rounds could really be considered to judge learning effects, because the face-to-face with opposite gender created a vastly different environment. Analysing the learning by gender, we find that among the 59 accepted offers of males, only 24 decreased their offers, leading to a learning ratio of 24/59 = 40 percent. If offers are changed at random than they would be increased by 50 percent, implying that there is no learning going on at all. Similarly, 16 out of 42 females with accepted offers decreased their offers, again showing no learning. There is no difference by gender or city in learning from acceptances.

Analysis of Rounds 3 and 4

Third Round Male Offers

The third and fourth rounds were played by matched pairs sitting across the table, but not allowed to communicate in any other way. In the third round, all males made offers to females, while in the fourth round, the roles were reversed. We first consider the offers in the third round, all of which are male offers by the design of the experiment.

In the first two rounds, male offers averaged around 41 percent in both rounds and in all cities—the solitary exception was Lahore in round 2, which has an average male offer of 50 percent, due to accidental revelation of gender of responders. In the third round, average male offers increased to 49 percent, in all cities, which shows a strong and significant response to gender. Again, the solitary exception was Lahore, where the average male offer jumped to 67 percent and nearly all males made hyper fair offers.

As discussed earlier, the experiment design has certain confounding factors built in. Here, we cannot assess whether the increased offer is due to gender, or due to lack of anonymity. It is well established that subjects care about approval of the experimenter, as well as the approval of other subjects. For example, offers decrease substantially in anonymous Dictator games, compared to situations where the offer of the Dictator can be seen by others [Hoffmann, *et al.* (1994) and Franzen and Pointner (2012)]. Thus we can expect offers to increase from anonymous and blind setting of the first two rounds, when the responder sitting across the table changes. Thus, in the current experiment, it is impossible to say whether the increase in offer was a response to gender, or just a response to a human responder sitting across the table. In fact, there are three possible explanations for the clearly observed increased offer by males in round 3.

(1) Desire to please the opposite party, as well as the experimenter, in conformity with standards of chivalry and courtesy.

(2) According to local cultural norms, males are responsible financially for females. Recognition of this responsibility led to higher offers to females.
(3) Courtship gestures, in conformity with the student culture governing cross gender interactions.

It seems likely that a mix of all three motives was involved. Bicchieri (2006) argues that all forms of human interactions are governed by social norms, at least to some degree.

Third Round Female Responses

As we saw, all responders behaved in the same way regardless of gender or city in the first and second rounds. However, in the third round, the females clearly shifted the minimum acceptable offer upwards. Summary of the data evidence in this regards is as follows.

In the first and second round, there are 43/130 = 33 percent and 46/130=35 percent offers below 38 percent. Rejections are 29/130 = 22.3 percent and 34/130 = 26 percent respectively. In this respect, there is not much difference between rounds 1 and 2. However, the male offers show a substantial increase from 40 percent to 49 percent in going from round 2 to round 3. This leads to a total of only 9/130 = 7 percent offers below 38. All 9 of these offers were rejected—the minimum acceptable offer for females is 40 percent in the third round. In rounds 1 and 2, 10 females accepted offers of 38 percent or less, so the higher level of rejection in round 3 is a clear response to the treatment.

Why did females raise their minimum acceptable offer to 40 percent? The simplest explanation is that low offers were viewed as discourteous, violating previously mentioned norms of chivalry. It is well known that social norms are maintained by punishing violators within communities [Bicchieri (2006)]. So any perceived violation of local cultural norms was punished by rejections, even at cost to self-interest.

Fourth Round Female Offers

In fourth round females were asked to make offers within same pair to males. Average offers increased from 38 percent in first two rounds to 43 percent. It is clear that female offers increased significantly due to the treatment. Qualitatively, the number of females who increased their offers (105/130 = 81 percent) is similar to the numbers of males who increased their offers (114/130 = 88 percent). Quantitatively, the magnitude of the increase by females is around 5 percent, which is significantly less than the 9 percent increase by males.

Due to experimental design we cannot differentiate between the following possible causes for the increase in the female offers in the fourth round:

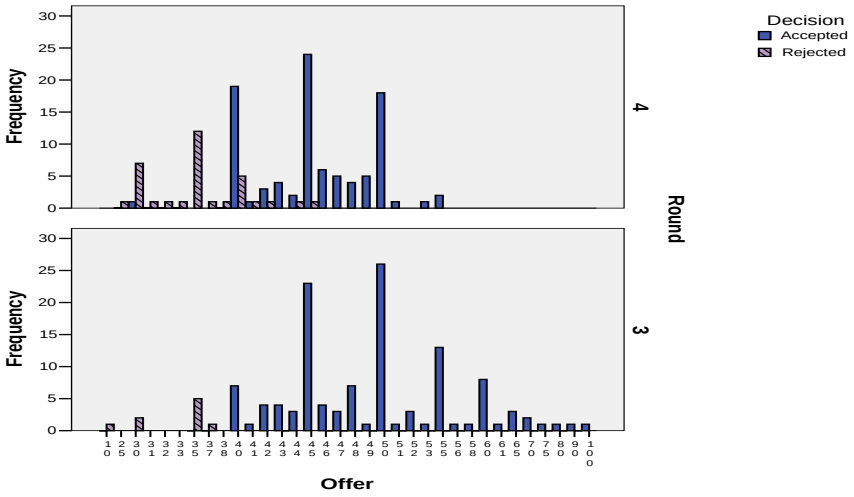
- Revelation of gender i.e. purely gender effect
- Effect of being face to face i.e. peer pressure
- Reciprocity just because of hyper fair offers in the third round as the pairs remained same for third and fourth round

While males made generous offers in the third round, they were not fully reciprocated by females on the fourth round. Razzaque (2009) mentions the most likely reason for the somewhat subdued response by females: high offers would be considered as forward and flirtatious behaviour, which is not socially acceptable within local cultural norms. Strong evidence for this is provided by the fact that there were 38 hyper fair offers by men, but only 4 hyper fair responses by females. All of the four female hyper fair responses were 55 percent, which is only slightly over the 50 percent boundary, while males offered 100 percent, 90 percent and similarly high proportions.

Fourth Round Male Responses

The acceptance/rejection behaviour by males in round 4 is shown in Figure 7. For comparison, this is super-imposed on top of the female acceptance/rejections in round 3. In general, the two pictures are similar. Overall, the males also increased their minimum acceptable offer to 40 percent, just like the females.[1] While females accepted all offers of 40 percent or above, among the males we find some rejections of offers between 40 percent and 45 percent. A total of 48 percent of offers lie in this area, 85 percent of these are accepted and only 15 percent are rejected.[2] In all such cases, the males made large offers (greater than 40 i.e., minimum accepted offers) and obviously expected reciprocation (this was also stated in post experiment interviews).

Fig. 7. Offers in Last Two Rounds



CONCLUSIONS

Overall, the goal of this article was to advocate the use of exploratory data analytic techniques, and graphical methods for obtaining an intuitive and visual understanding of

[1]There is one exceptional case: an offer of 30 is accepted by the male. In the previous round the male offered 30 to the female and was rejected. The female made the same offer back, which was accepted by the male.

[2]Out of these 9 offers, 3 were hyper fair offers, one was fair offer. Three of these cases were very unique in the sense that last offers were within similar ranges and were accepted.

the data. As we have seen, these techniques provide a lot of new insights into the data set for ultimatum and gender previously handled by Razzaque (2009) using standard regression techniques, and formal statistical methods.

Some of the key new findings were that there is a strong effect of urbanisation—probably related to ease and comfort of cross-gender interactions on campus. The earlier finding of Razzaque (2009) that men are more generous than women is called into question; this behaviour is restricted to cross gender interactions in small cities, and may not generalise to the population as a whole. There is strong evidence of reciprocity, and strong gender effects of different types, which have been discussed in detail earlier.

Because samples were small and non-random, and there were many untreated confounding factors, none of these results can be taken as conclusive. Indeed, this is one of the virtues of the exploratory data analysis techniques—it generates interesting hypotheses to explore in subsequent work. As we have seen, a number of hypotheses are generated by graphical analyses of the data. With a sharp hypothesis in hand and a pilot sample, it becomes possible to design a more scientific study with a randomised sample of planned size and careful controls for potential confounders. The confirmatory data analysis techniques which are studied in conventional econometrics courses are much better adapted to deal with such studies, as opposed to observational studies of the type done by Razzaque (2009).

APPENDIX

Table 1

Comparison of Male Offers during First Two Rounds

C12	N	Mean	SE	StDev	Min	Q1	Med	Q3	Max
Ghizer R1	15	40.8	0.7	2.65	35	40	41	42	45
Ghizer R2	15	40.5	1.9	7.37	30	35	40	50	50
Kharan R1	15	41.6	0.7	2.77	35	40	42	43	45
Kharan R2	15	41.3	1.9	7.43	30	35	40	50	50
Lahore R1	5	39.0	4.0	8.94	30	30	40	47.5	50
Lahore R2	5	52.0	2.5	5.70	45	47.5	50	57.5	60
Nawab Shah R1	15	39.3	2.1	8.27	25	30	41	46	51
Nawab Shah R2	15	39.4	2.0	7.80	28	31	43	46	50
Rawala Kot R1	15	40.8	0.7	2.65	35	40	41	42	45
Rawala Kot R2	15	40.5	1.9	7.37	30	35	40	50	50

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The Impact of Institutional Quality on Economic Growth: Panel Evidence

SAIMA NAWAZ, NASIR IQBAL and MUHAMMAD ARSHAD KHAN

The aim of the present study is twofold. First, we develop a theoretical model which incorporates the role of institutions in promoting economic growth. The theoretical model predicts that rent seeking activities decrease as institutional quality improves, and hence income increases and vice versa. Second, we conduct an empirical analysis to quantify the impact of institutions on economic growth in selected Asian economies over the period 1996-2012 by employing both static and dynamic panel system Generalised Method of Moments (GMM) technique with fixed effects. The empirical results reveal that institutions indeed are important in determining the long run economic growth in Asian economies. However, the impact of institutions on economic growth differs across Asian economies and depends on the level of economic development. The results reveal that institutions are more effective in developed Asia than developing Asia. This evidence implies that different countries require different set of institutions to promote long term economic growth.

Keywords: Institutions, Economic Growth, Panel Evidence, Asia

1. INTRODUCTION

The path breaking studies by North (1981), Jones (1987) and Olson (1982) inspired the researchers as well as policy-makers to investigate the impact of institutions on economic growth. Earlier empirical studies, inter alia by Knack and Keefer (1995), Mauro (1995) and Barro (1997) reveal that institutions are important for investment and long term sustainable growth. Hall and Jones (1999) demonstrate that differences in the institutions across the globe cause huge variations in capital accumulation, education attainment, and productivity growth, hence account for income disparities. More recently, Rodrik, Subramanian, and Trebbi (2004) find that rule of law has a positive impact on economic growth. Similarly, Acemoglu, Cutler, Finkelstein, and Linn (2006) concluded that private property right institutions are the main drivers of long run economic growth, investment and financial development. These studies suggest that institutions are the fundamental determinants of the long run economic growth across countries.

The existing literature primarily indicates a positive association between institutions and economic growth. However, institutions do not exert similar impact on economic growth across different set of countries. The positive contribution of

Saima Nawaz <saima.nawaz@comsats.edu.pk> is Assistant Professors at COMSATS Institute of Information Technology, Islamabad. Nasir Iqbal <nasir@pide.org.pk> is Assistant Professor at Pakistan Institute of Development Economics, Islamabad. Muhammad Arshad Khan <arshad.khan@comsats.edu.pk> is Associate Professor at COMSATS Institute of Information Technology, Islamabad.

institutions is shaped by various factors like the perception of the individual about the institutions and the social norms and community rules of a particular group of individuals. Sometimes institutions with similar characteristics produced extremely different outcomes across different groups, regions and societies. For example, in Latin American countries similar laws and solutions were adopted to achieve different levels of economic growth and development [Yifu Lin and Nugent (1995)]. In this context, Alonso and Garcimartín (2013) signify the role of stages of economic development in determining the growth effects of institutions and found that level of development determines the quality of institutions which, in turn, enhances higher economic growth.

Few studies have empirically investigated the growth effects of institutions at various stages of development [Nawaz (2014); Valeriani and Peluso (2011)]. These studies have shown that the impact of institutions on economic growth is different across countries. These studies conclude that institutions perform better in developed countries as compared to developing ones. A study on transitional economies shows that control over corruption is growth enhancing if complemented by strong democratic institutions not necessarily otherwise. Institutional measures promote economic growth in strongly democratic economies and fail to boost growth in weakly democratic countries [Iqbal and Daly (2014)]. However, these studies lack a theoretical foundation to capture the linkages between institutions and economic growth, and also suffered from possible endogeneity problem. It can be argued that theoretical foundation is essential to understand the mechanism though which institutions are linked with economic growth. Furthermore, controlling endogeneity is important for reliable and robust empirical findings. Nawaz (2014) has investigated the impact of different institutions on economic growth assuming different stages of development using the SYS-GMM estimation technique. However, this study fails to control the possibility of heterogeneity by combining different countries into one group. The present study fills that gap in literature after taking care of above mentioned shortcomings.

The main objective of this study is to develop theoretical model that incorporates the role of institutions with respect to economic growth. Furthermore, the present study empirically estimates the impact of various institutions on economic growth at the cross-country level. Particularly, we examine the impact of institutions on economic growth by classifying developed and developing Asian economies over the period 1996-2012. This study contributes to the existing literature in various ways. First, this study develops a theoretical model by incorporating the role of institutions on economic growth following Gradstein (2007) and Chong and Gradstein (2007). Second, this study addresses the issues of heterogeneity and endogeneity using the SYS-GMM estimation technique. Third, this study develops institutional quality index to capture different dimensions of the institutions. Fourth, this study quantifies the impact of institutions at different stages of development.

The rest of the paper is structured as follows: Section 2 provides theoretical framework based on extended version of the endogenous growth theory to incorporate the impact of institutions on economic growth. Section 3 explains the data sources, and outlines estimation methodology. The empirical results and discussion are presented in section, while conclusion and policy implications are given in Section 5.

2. THEORETICAL FRAMEWORK

Traditional economic growth theories postulate that level of output per capita is determined by the amount of physical and human capital and level of technology in a country. In the production process, economic growth is linked with the ability of the nation to enhance its physical and human capital along with the technological developments. Acemoglu and Robinson (2010) however, state that:

> *"[The] differences in human capital, physical capital, and technology are only* ***proximate causes*** *in the sense that they pose the next question of why some countries have less human capital, physical capital, and technology and make worse use of their factors and opportunities. To develop more satisfactory answer to question of why some countries are much richer than others and why some countries grow much faster than others, we need to look for potential* ***fundamental causes****, which may be underlying these proximate differences across countries"[p.2]*

Acemoglu and Robinson (2010) argue that institutions are the fundamental determinant of economic growth and cause development differences across countries. North (1981) defines institutions as the rule of the game in a society or, more formally the humanly devised constraints that shape human interaction. This means that institutions shape the incentive structure in the society that may increase or hamper the economic activities. Poor quality institutions may slow down the economic activities by providing room to economic agents to remain busy in redistributive politics with lower economic returns rather than growth promoting economic activities [Murphy, Shleifer, and Vishny (1993)]. On the other hand, good quality institutions may promote incentive structure that leads to higher economic growth through reducing uncertainty and promoting efficiency [North (1990)]. Hall and Jones (1999) argued that overall productivity of factors of production in a country is driven by the quality of its institutions. Efficient, well developed and uncorrupt institutions guarantee that labour can only be used for productive purposes and not wasted in rent seeking activities, which leads to higher economic growth [North (1990)]. Good quality institutions enhance the ability of a country to adopt new technologies invented elsewhere which may play an important role in upgrading the development process of a country [Bernard and Jones (1996)].

Iqbal and Daly (2014) argue that weak institutions divert resources from productive sector to unproductive sector hence promote rent seeking activities. While, strong institutions reduce the chances of rent seeking activities and accelerate economic growth process and productivity of the reproducible factors. This study argues that weak institutional framework creates an opportunity for rent seeking behaviour that may divert resources to unproductive sectors.[1] The consequences of these activities for growth can be negative: resources may not be efficiently allocated, externalities may be ignored, transaction costs may be increased. North (1990) argues that institutional weaknesses

[1]Rent seeking activity is defined as an activity through which public power is exercised for private gain; this may involve misuse of public resources or, more generally, any attempted capture and commodification of state, social or commercial authority by politicians, public officials, elites and private interests [Iqbal and Daly (2014)].

lead to rent seeking activities hence low development. The incomplete rule of law, non-enforcement of property rights, inadequate policies and the lack of reliable infrastructure constitute a weak institutional framework that may promote rent seeking activities [Iqbal and Daly (2014)].

To put the above discussion in a framework, we use the endogenous growth model. Following the Gradstein (2007) and Chong and Gradstein (2007), we specify Cobb Douglas type production function of the following form:

$$y_{it} = Ak_{it}^{\alpha} \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (1)$$

where y is output per worker, k is the stock of physical capital per worker which includes both private and public capitals, A>0 represents total factor productivity. Countries are indexed by i and t represents time period, α is the elasticity of output per worker with respect to physical capital per worker and $0 < \alpha < 1$. To incorporate the role of institutions in promoting economic growth, we modify the basic endogenous growth model. The above discussion reveals that weak (strong) institutions divert resources to unproductive (productive) sectors hence cause low (high) development. Gradstein (2007) and Chong and Gradstein (2007) also argued that weak institutions divert resources from productive sectors to unproductive sectors and promote rent seeking activities. However, strong institutions reduce the chances of rent seeking activities and accelerate economic growth and productivity of the reproducible factors. To capture this notion, we redefine production function specified in Equation (1) by including rent-seeking activities that act as a distortion in the production process. Now the production function takes the following form:

$$y_{it} = (1 - r_{it})Ak_{it}^{\alpha} \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (2)$$

where $r_{it} \in [0, \hat{r}]$, $\hat{r} \ll 1$ indicate rent seeking activities. $\hat{r}$ is a ppoint at which institutional quality is degraded to such an extent that the modeling framework ceases to apply. Assume that appropriate share of rent-seeking by each firm depends on the amount of rent seeking and quality of institutions. With *strong institutions*, the value of rent seeking r_{it} is close to 0, whereas with *weak institutions* the value of r_{it} is close to 1 and the marginal utility of rent-seeking is maximal. Higher marginal utility of r_{it} implies weak institutions and hence low productivity of factors of production and vice versa. This augmentation provides meaningful explanation about the cross country differences in long run growth rates.[2] Thus r_{it} reduces the marginal product of reproducible factors due to economic distortions resulting from low quality institutions. To determine the long run growth patterns across countries, we need to examine the consumption and investment decisions made by the individuals. Consider one representative agent facing an infinite planning horizon and maximising intertemporal utility subject to dynamic budget constraint. The representative agent's preferences have the following form:

$$U_{it} = \int_0^{\infty} \frac{c_{it}^{1-\sigma} - 1}{1-\sigma} e^{-\rho t} dt \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (3)$$

[2]Steger (2000) introduces the similar index (distortion index in the production function to capture the role of detrimental government policies on economic growth. Iqbal (2013) incorporates instability index in the model using similar formulation to capture the impact on macroeconomic instability due to weak institutions and macroeconomic policies on output.

where c_{it} represents private consumption in per capita form and $\sigma > 0$ and $\sigma \neq 1$ which shows that the elasticity of marginal utility equals the constant $-\sigma$. The other multiplier, $e^{-\rho t}$, involves the rate of time preference, $\rho > 0$. Positive time preferences rate ρ means so that utils are valued less the later they are received. The dynamic budget constraint in per capita terms is given by the following equation:

$$\dot{k_{it}} = \frac{dk}{dt} = (1 - r_{it})Ak_{it}^{\alpha} - c_{it} \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (4)$$

It is assumed that the initial capital stock at time 0 is 1 i.e. $k_{(0)} = 1$. The terminal condition is defined as $\lim_{t\to\infty} k\lambda e^{-\rho t} = 0$ which indicates that the capital stock left over the end of the planning horizon, when discounted at the time discount rate is zero. This restriction rules out the type of chain-letter finance. Equation (4) suggests that increase in the capital stock equals the total saving, which in turn, equals to the difference between output and consumption. The individual chooses optimal consumption $\{c_{it}: t \geq 0\}$ and investment path to determine the level of capital stock $\{k_{it}: t \geq 0\}$. To find this optimal allocation of resources by the individual, we can write the Hamiltonian as:

$$H = \frac{c_{it}^{1-\sigma}-1}{1-\sigma} e^{-\rho t} + \lambda[(1 - r_{it})Ak_{it}^{\alpha} - c_{it}] \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (5)$$

The expression within bracket is equal to $\dot{k}$ and λ is Lagrange multiplier representing the present value of shadow price of income. Differentiation of Lagrange function with respect to c_{it} and k_{it} and the first order conditions give us Equations (6) and (7).

$$\frac{\partial H}{\partial c_{it}} = 0 \Rightarrow c_{it}^{1-\sigma} e^{-\rho t} - \lambda = 0 \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (6)$$

$$\frac{\partial H}{\partial k_{it}} + \dot{\lambda} = 0 \Rightarrow \lambda(1 - r_{it})A\alpha k_{it}^{\alpha-1} = -\dot{\lambda} \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (7)$$

Using first-order conditions; fixing the initial capital stock $k_{(0)} = 1$; applying transversality condition $\lim_{t\to\infty} k_t \lambda e^{-\rho t} = 0$; the budget constraint is given in Equation (4), we find the growth rate of per capita consumption which is the same as the capital and the output growth rate. The growth rate of the economy is given as follows:

$$\frac{\dot{y}_{it}}{y_{it}} = \frac{\dot{c}_{it}}{c_{it}} = \frac{1}{\sigma}[(1 - r_{ir})A\alpha k_{it}^{\alpha-1} - \rho] \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (8)$$

$$\frac{\dot{y}_{it}}{y_{it}} = \frac{\dot{c}_{it}}{c_{it}} = \frac{(1-r_{ir})}{\sigma} (A\alpha k_{it}^{\alpha-1}) - \frac{\rho}{\sigma} \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (9)$$

Equation (8) shows that as institutional quality improves, the rent seeking activities decrease and hence consumption (or income) increases. Now differentiating with respect to $r_{it} = \frac{\partial\left(\dot{y}_{it}/y_{it}\right)}{\partial r_{it}} = -\frac{A\alpha k_{it}^{\alpha-1}}{\sigma^2} > 0$. This shows that as the value of r_{it} increases, the output decreases as $\sigma > 0$.

Propositions: *The larger the r_{it}, the lower will be the growth rate of the economy and vice versa. As institutional quality improves, the rent seeking activities decrease and hence consumption/income increases and vice versa.*

We consider two cases for example for validation, these include:

(i) *When* $r_{it} = 0$ *(strong institutions): Under strong institutions regime, economic growth is with* $\frac{1}{\sigma}[A\alpha k_{it}^{\alpha-1} - \rho]$

(ii) *When* $0 < r_{it} < \hat{r}$ *(weak institutions): Under weak institutions regime, economic growth is with* $\frac{1}{\sigma}[(1 - r_{ir})A\alpha k_{it}^{\alpha-1} - \rho]$

In essence, the theoretical model highlights that long run growth rate of per capita output is a function of physical capital and rent seeking—a proxy for institutions. After logarithmic transformation, Equation (9) can be rewritten as:

$$\dot{y}_{it} = \alpha_0 + \varphi \mathrm{I}_{it} + \theta \mathrm{k}_{it} \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (9)$$

where $\dot{y}_{it}$ represents GDP growth rate across cross-section i at time period t. I_{it} represents institutional quality index and k_{it} indicates physical capital. We use Equation (10) to examine the impact of institutions on economic growth.

3. DATA AND METHODOLOGY

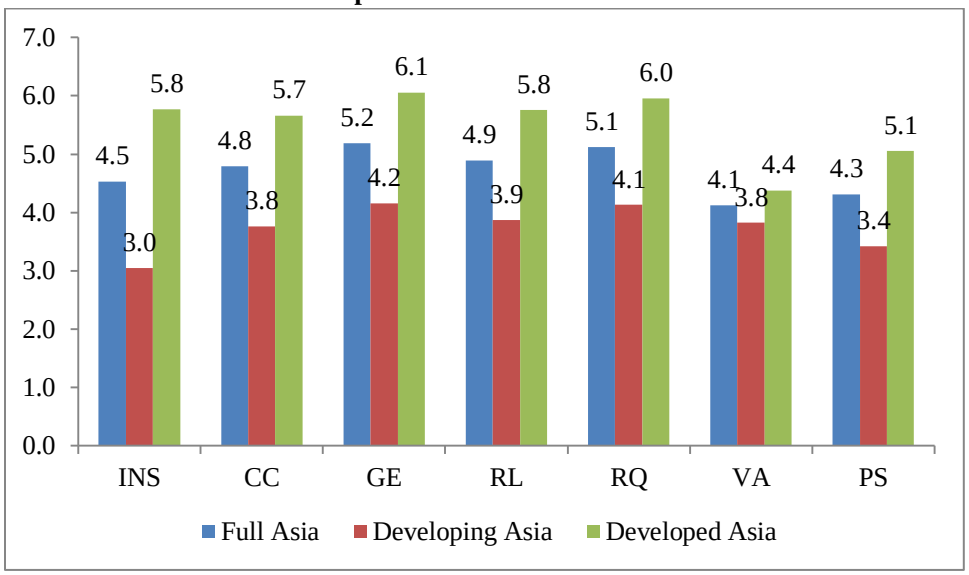
To determine the impact of institutions on growth, we employ a panel data set of 35 Asian countries over the period 1996-2012.[3] The selected countries are divided into developed Asia and developing Asia on the basis of income levels following the World Bank classification.[4] The data on the institutional variables are collected from the Worldwide Governance Indicators (WGI) published by the World Bank. The database provides six different measures capturing different dimensions of the institutional framework. These indicators include: (i) control of corruption, (ii) government effectiveness, (iii) political stability and absence of violence/terrorism, (iv) regulatory quality, (v) rule of law, and (vi) voice and accountability. The indicator ranges from –2.5 to +2.5. The low value indicates bad quality institutions and vice versa.

It is expected that these indicators are likely to be correlated, therefore, we construct institutional quality index using the Principle Component Method (PCM) methodology. The PCM indicates how much variance of a variable is explained by a specific principal component. The principal component is derived by computing the eigenvalues of the sample covariance matrix. These eigenvalues are the variances of the variables (institutional indicators in this case). Therefore, the number of principal components is equal to the number of variables. Typically most of the variance is explained by the first principal component and therefore its value is used for computation of the index. The main advantage of PCM is that the weights to be assigned to the variables are determined by the data itself. The Figure 1 depicts the average quality of institutions across full sample, developing Asia and developed Asia. The average value of institutional quality index across the full sample is 4.5, while this value is 5.8, 3.0 for developed Asia and developing Asian countries respectively during the period 1996-2012. The individual indicators also show similar behaviour.

[3]The choice of 35 countries is mainly based on the availability of data on all variables.

[4]The World Bank classifies the countries on the basis of income per capita. The sub-groups are: (i) Low income countries/Developing countries and (ii) High income countries/Developed countries. In developing countries sub-group, we have selected 16 countries, while in developed countries sub-group we have selected 19 countries.

Fig. 1. Average Quality of Institutions across Full Sample, Developing Asia and Developed Asia



Source: Authors' own calculation. We normalised the values between the ranges of 1 to 10. 1 implies low quality of institutions and 10 means high quality of institutions.

The data on all economic variables are taken from the World Development Indicators (WDI) published by the World Bank. These variables include GDP per capita growth, investment, trade openness, inflation and the government size. Investment is measured as the Gross Fixed Capital Formation as a percent of GDP. Openness is the sum of exports and imports divided by the GDP. Inflation is measured by the log difference of consumer price index (CPI). We use general government final consumption expenditure relative to GDP as a proxy for the government size. The descriptive statistics (Table 1A appendix) show that the annual average GDP per capita growth rate is 3.7 over the period 1996-2012. The annual average investment as percent of GDP is 24 over the same period. The annual average inflation across the full sample is 7.15, while annual average inflation is relatively high in developed countries (5.35) as compared to developing countries (9.29) over the period 1996-2012. The average government size as percent of GDP is 13 over the same period.

The model described in previous section emphasises the role of institutions as determinants of output per capita. Based on the theoretical framework an empirical model can be written as:

$$\dot{y}_{it} = \alpha_0 + \varphi \mathrm{I}_{it} + \theta \mathrm{k}_{it} + \beta \mathrm{X} + \varepsilon_{\mathrm{it}} \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (11)$$

where $\dot{y}_{it}$ represent GDP growth rate of country i at time period t. I_{it} represents institutional quality index (INS Index) and k_{it} indicates physical capital, and X is the set of control variables, while $\varepsilon_{\mathrm{it}}$ is the disturbance term which is assumed to be serially uncorrelated and orthogonal to the explanatory variables. The vector of control variables X includes: investment (INV), government size (EXP), inflation (INF) and trade openness (OPEN). These variables have been frequently used in growth literature and have been

identified by Mankiw, Romer, and Weil (1992), Levine and Renelt (1992) and Barro and Lee (1996).

The choice of appropriate estimation technique is important for obtaining robust estimates. To measure the impact of institutions on economic growth we, employ panel data estimation technique. The panel data estimation technique is considered as an efficient analytical method, since it allows combining different cross sections and time periods, and provides more reliable and robust inference. We use the Fixed Effects Model (FEM) based on the Hausman test. Before proceeding further, it is important to highlight the possibility of endogeneity between institutions and economic growth. Acemoglu, Johnson, Robinson, and Yared (2009) conclude that traditional empirical literature generally carries problems like endogeneity, measurement errors and omitted variables bias.

A popular method to tackle the endogeneity is the Generalised Method of Moments (GMM). The GMM estimator is as an extension of Instrumental Variable (IV) methodology. The main advantage of GMM estimation is that the model need not be homoscedastic and serially independent. Another advantage of the GMM estimation is that it finds the parameters estimates by maximising an objective function which includes the moment restriction that the correlation between error term and lagged regressor is zero. In essence, the GMM takes into account the time series dimension of the data, non-observable country specific effects, inclusion of lagged dependent variables among the explanatory variables and the possibility that all explanatory variables are endogenous [Bond, Bowsher, and Windmeijer (2001); Caselli, Esquivel, and Lefort (1996)]. In particular, the system GMM, developed by Arellano and Bover (1995) and Blundell and Bond (1998) and applied by Bond, *et al.* (2001) to the growth equation, was found to reduce a small sample bias that characterises the first differenced GMM used by Caselli, *et al*. (1996).

Anderson and Hsiao (1982) propose a strategy to choose instruments to solve the endogeneity. This study suggests transforming to first differences to eliminate the time-invariant fixed effects and applying IV with lagged difference or level as instruments. Anderson and Hsiao (1982) estimator is an example of simple IV estimation, in which there is one instrument for each endogenous variable. A simple generalisation of this estimator is the GMM in which the number of instruments is permitted to exceed the number of endogenous variables. Arellano and Bond (1991) suggest using all valid lags of all the regressors as instruments. The efficiency of GMM estimation generally increases in the number of valid and effective moment conditions. Therefore, Arellano and Bond (1991) estimator should be superior to Anderson and Hsiao (1982) estimator. However, this superiority might be minimal if the panel has a shorter time span. Given that our data span over 30 years, there is limited opportunity for applying the Arellano and Bond (1991) instrumentation method. To solve this problem, Arellano and Bover (1995) and Blundell and Bond (1998), assuming stationarity justify additional zero-moment restrictions that can be applied to a model in levels, instrumented with lagged differences. These additional moment restrictions can be combined with those in Arellano and Bond (1991) to provide a "system-GMM" estimator in which GMM is applied to a system of two equations: an equation in difference form instrumented by lagged levels, and an equation in levels instrumented by lagged difference.

For lagged endogenous variables and weakly exogenous variables to be valid as instruments, it is necessary that the transient disturbances are free of autocorrelation in the basic model [Blundell and Bond (1998)]. This implies that disturbances in the differenced model have significant first-order correlation and insignificant second-order autocorrelation. For this purpose, the Arellano-Bond tests for first-order and second-order serial correlation in the first-differenced residuals are used [Arellano and Bond (1991)]. As the first difference of independently and identically distributed idiosyncratic error will be serially correlated, rejecting the null hypothesis of no serial correlation in the first-differenced error at order one does not imply that model is misspecified. Rejecting the null hypothesis at higher orders, however, implies that the moment conditions are not valid. Therefore, to establish the robustness of the estimates, we employ SYS-GMM.

4. EMPIRICAL RESULTS AND DISCUSSION

We have estimated equation (10) to examine the impact of institutions on economic growth for a panel of 35 Asian countries over the period 1996-2012 using the Fixed Effects Model. The estimation results are presented in Table 2. The estimation has been carried out separately for the whole panel of countries as well as for the developed and developing Asian economies. We have used various diagnostics to ensure the adequacy of the estimated models. The results of diagnostics are reported below in Table 2. These results confirm that the estimated models are well specified.

As shown in Table 2 that institutions have a positive impact on economic growth in Asian countries which implies that institutions are growth enhancing. The value of estimated coefficient of institutions is 0.7 and significant at the 5 percent level of significance. This implies that an increase in institutional quality by 1 percentage points increases the long term economic growth rate by 0.7 percentage points. This result is consistent with the hypothesis that institutions play a critical role in the growth process. For example, North (1990) argues that institutions increase the productivity of factor inputs by improving the incentive structure. Similarly, Acemoglu, Johnson, Robinson, and Yared (2008) showed that good quality institutions enhance a country's ability to utilise modern technologies which, in turn causes economic growth. Many other empirical studies provide evidence that institutions promote economic growth [Acemoglu, *et al.* (2006); Acemoglu, Johnson, and Robinson (2001); Barro (1997); Hall and Jones (1999); Iqbal and Daly (2014); Knack and Keefer (1995)].

To examine the role of institutions on economic growth at various stages of economic development, we have disaggregated our sample into developed Asia and developing Asia. We find that the impact of institutions on economic growth is positive for both developed as well as developing Asia. However, the contribution of institutions to economic growth is relatively high in developed Asian countries than in developing Asian countries. The value of estimated coefficient of institution index is 0.4 for developing Asian countries, while it is 1.17 for developed Asian economies. This shows that a one percentage point improvement in the quality of institution leads to 0.4 percentage point increase in GDP per capita in the developing Asian economies and 1.17 percentage point increase in GDP per capita in the developed Asian countries. The low contribution of institutions to economic growth in developing Asian nations could be attributed to several reasons. One reason could be that the political system in these

countries is weak. The politicians and public officials have fewer checks on their power, making it easier for them to engage in rent seeking. This inefficiency may act as binding constraint in making institutions growth enhancing. Various studies have shown that under weak democracy, institutions may not work effectively [Aidt, Dutta, and Sena (2008); Drury, Krieckhaus, and Lusztig (2006); Iqbal and Daly (2014); Méndez and Sepúlveda (2006)]. Iqbal and Daly (2014) find that corruption has an insignificant impact on economic growth under weak democracy. Other reason could be that the institutional framework in developing countries is still underdeveloped and in the transition stage. This transition process undermines the effectiveness of institutions. For example, frequent changes in the design of institutional framework are not effective to promote economic growth. Another reason could be that the quality of institutions could be below the certain minimum threshold level. Zhuang, De Dios, and Lagman-Martin (2010) argue that institutions are only effective when they are above the world average values. Economies with strong institutions show higher growth than those with institutions below threshold level. Finally, causality between institutional quality and economic growth also explains different impacts on institutions in developed and developing countries [Fukuyama and McFaul (2008)].

Table 2

Impact of Institutions on Economic Growth (Institutional Quality Index)

Variables	Asia	Developing Asia	Developed Asia
INS Index	0.702	0.406	1.172
	(0.30)**	(0.21)*	(0.48)**
EXP	–0.369	–0.441	–0.300
	(0.08)***	(0.14)***	(0.11)***
INV	0.087	0.191	0.031
	(0.03)***	(0.05)***	(0.05)
OPN	0.034	–0.001	0.041
	(0.01)***	(0.02)	(0.01)***
INF	–0.037	–0.025	–0.028
	(0.02)**	(0.02)	(0.03)
Constant	0.259	3.707	-4.591
	(1.91)	(2.02)*	(3.50)
Observations	595	272	323
R-squared	0.083	0.106	0.102
F-values	10.10	5.97	6.78
Hausman test	29.83 (0.00)	25.37 (0.00)	33.62 (0.00)
Number of Countries	35	16	19

Standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1.

Numerous control variables have been used in the empirical analysis. For example, our results show that the impact of government size measured by government consumption is negative on economic growth for the whole Asian countries, developing Asia and developed Asia. Our results are consistent with earlier studies that government

size has a negative impact on economic growth [Agell, Lindh, and Ohlsson (1997); Barro (1991); Bergh and Karlsson (2010); Cameron (1982); Grier and Tullock (1989); Landau (1983); Marlow (1986); Romero-Avila and Strauch (2008); Saunders (1986)]. The results show that the impact of investment on economic growth is positive. This finding is in line with existing literature [Barro (1991); Rebelo (1991)]. Inflation has a negative association with growth in GDP per capita, implying that inflation hurts the growth process. Many empirical studies have found similar results [Fischer (1993); Sirimaneetham and Temple (2009)]. Higher inflation produces detrimental impact on the economic growth. This result could be justified in many ways. It causes reduction in investment and productivity by generating uncertainty in the economy [Fischer (1993)] and produces adverse effects on the productivity of inputs through distorting the price mechanism [Smyth (1995)]. High inflation also increases the risk premium and hinders the smooth functioning of financial markets through the reduction of saving and investment. Trade openness has a positive and significant impact on the economic growth, implying that trade is beneficial for economic growth. The positive association of trade openness and economic growth is due to the benefits emerging from specialisation, competition and economies of scale. This result is consistent with the earlier studies [Balassa (1978); Din, Ghani, and Siddique (2003); Edwards (1998); Sachs, Warner, Åslund, and Fischer (1995); Tyler (1981)].

4.1. Institutions and Growth: A Disaggregated Analysis

In the previous analysis we used a composite index of institutional quality to quantify the impact of institutions on economic growth. We concluded that institutions perform better in developed Asian economies as compared to developing economies. However, this provides a limited picture in explaining the influence of institutions on growth assuming different stages of development. The findings based on composite institutional quality index do not identify the effect of individual components of institutional quality. Zhuang, *et al.* (2010) have pointed out that various components of institutional quality have differential effects on growth, depending on a country's history, stages of development, and the length of time horizon being investigated. Following Zhuang, *et al.* (2010) we have investigated the impact of various components of institutional quality on economic growth. Table 3 reports the results.[5]

The disaggregated analysis has shown that control over corruption (CC), government effectiveness (GE) and rule of law (RL) are more important as compared to political stability (PS), regulatory quality (RQ) and voice and accountability (VA) in the full sample of Asian countries. Further, we have found that different institutions perform differently for developed and developing Asia. For Asian developing economies, the government effectiveness and rule of law play significant role in promoting economic growth. On the other hand, all most all measures of institutional quality contribute significantly to economic growth. These findings support the Zhuang, *et al.* (2010) view that different institutions perform differently at different stages of development.

[5]We have also used other control variables in the estimation, but for presentation purposes we have omitted these variables from the Table. The detailed estimation Tables are available upon the request from authors.

Table 3

Impact of Institutions on Economic Growth (Components of Institutional Quality)

Variable	CC	GE	PS	RL	RQ	VA
Full Sample	0.762	1.497	0.245	0.832	0.779	0.411
	(0.41)*	(0.49)***	(0.25)	(0.48)*	(0.43)*	(0.44)
Developing	0.620	1.194	0.292	0.682	-0.699	0.920
	(0.56)	(0.68)*	(0.31)	(0.41)*	(0.57)	(0.57)
Developed	1.095	2.099	0.140	1.428	3.041	0.173
	(0.63)*	(0.78)***	(0.42)	(0.74)*	(0.72)***	(0.66)

Standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1.

4.2. Sensitivity Analysis

To examine the issue of reverse causality between institutions quality and economic growth, we re-estimate the model after controlling the possibility of reverse causality and endogeneity using dynamic system GMM (SYS-GMM). The SYS-GMM uses lag of dependent variables to introduce dynamics in the model. The inclusion of lagged dependent variable allows for path dependency in the model and works as a partial adjustment mechanism. Lagged level of per capita GDP is taken to test the neo-classical hypothesis of convergence to a long run steady state. The results are presented in the Table 4. A battery of diagnostic tests have been applied to check the accuracy of the specification and to ensure that the models are adequately specified. Chi-square statistic confirms the adequacy of the estimated models. Diagnostic statistics based on AR1 and AR2 are consistent with the validity of instruments used in SYS-GMM.

The results show that institutions have a positive impact on economic growth in a sample of 35 Asian countries as well as for developed and developing Asian countries. We found that institutions perform relatively better in developed Asian countries as compared to developing Asian countries as indicated by the size of the coefficient. The estimated impact of institutions is high in developed Asian countries than developing Asia. The impact of control variables remains the same as we found in case of fixed effects estimation.

As shown in Table 4 the negative coefficient of the lagged level of GDP per capita (GDPPC(-1)) together with positive coefficient of the lagged growth rates (GDPPCG(-1)), support the neoclassical hypothesis of convergence to a long run steady state in the case of full sample. The impact of individual indicators of institutions on economic growth is also estimated using the SYS-GMM method (Table 5). The results suggest that different institutions perform differently at different stages of development. The results are similar to those found in case of fixed effects estimation. The results suggest that control of corruption, government effectiveness and regulatory quality have relatively greater effect on economic growth in developed Asia as compared to developing Asia. On the other hand, rule of law and voice and accountability perform better in developing Asia than in developed Asian nations.

Table 4

SYS-GMM (Results of Institutional and Economic Growth)

Variables	Asia	Developing Asia	Developed Asia
INS Index	1.304	1.568	1.992
	(0.36)***	(0.51)***	(0.36)***
EXP	–0.259	–0.210	–0.225
	(0.10)**	(0.14)	(0.11)**
INV	0.024	0.244	–0.096
	(0.04)	(0.06)***	(0.06)*
INF	–0.109	–0.065	–0.207
	(0.03)***	(0.03)**	(0.05)***
GDPPC(–1)	–2.870	–2.748	–5.050
	(0.58)***	(1.00)***	(0.89)***
GDPPCG(–1)	0.096	**-0.104**	0.226
	(0.03)***	**(0.05)****	(0.04)***
Constant	24.047	15.183	49.023
	(4.07)***	(5.48)***	(8.10)***
Observations	560	256	304
Number of Countries	35	16	19
Wald Chi2 Value	60.72	36.16	83.60
AR1 Test	0.0018	0.0396	0.0042
AR2 Test	0.1729	0.1140	0.1645

Standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1.

Table 5

SYS-GMM (Components of Institutional Quality)

Variable	CC	GE	PS	RL	RQ	VA
Full Sample	1.570	2.728	0.142	2.465	2.308	1.239
	(0.46)***	(0.55)***	(0.38)	(0.57)***	(0.55)***	(0.51)**
Developing	2.287	2.336	0.446	3.645	0.144	2.310
	(0.68)***	(0.79)***	(0.42)	(0.88)***	(0.67)	(0.74)***
Developed	2.932	2.370	–0.134	2.406	2.832	0.875
	(0.52)***	(0.62)***	(0.43)	(0.59)***	(0.66)***	(0.51)*

Standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1.

5. CONCLUDING REMARKS

This study develops a theoretical model and assesses the role of institutions on economic growth for a panel of 35 Asian countries over the period 1996-2012. We have used the fixed effects and SYS-GMM estimation techniques to examine the impact of different institutions including: control over corruption, government effectiveness, political stability, rule of law, regulatory quality and voice and accountability on economic growth. We have constructed institutional quality index using six component

institutions by employing principle component method. The theoretical model reveals that as institutional quality improves, the rent seeking activities decrease and hence income increases and vice versa. The empirical results support the hypothesis that institutions exert positive impact on economic growth. Our findings suggest that control of corruption and maintenance of rule of law are the key determinants of long term economic growth for sampled Asian countries. Furthermore, results reveal that the impact of institutions on economic growth varies across Asian countries depending on the stages of economic development. The estimated impact of institutions on economic growth is relatively higher in the developed Asia than in the developing Asian countries. This result highlights the role of institutions and level of economic development in determining the long run economic growth. Therefore, different countries require different set of institutions and policies to promote long run economic growth.

Appendix Table 1A

Descriptive Statistics

Variable	Observations	Mean	Std. Dev.	Min.	Max.
		Full Sample			
GDP Per Capita Growth Rate	595	3.70	4.84	–14.39	38.06
Investment (INV)	595	24.14	8.33	8.01	64.43
Government size (EXP)	595	13.59	5.62	3.46	30.50
Inflation (INF)	595	7.15	11.33	–8.53	128.42
Openness (OPN)	595	101.95	75.89	18.76	448.31
Institutions (INS Index)	595	–0.14	0.70	–1.45	1.44
Control of Corruption (CC)	595	–0.10	0.86	–1.49	2.42
Government Effectiveness (GE)	595	0.09	0.80	–1.28	2.43
Political Stability (PS)	595	–0.35	0.92	–2.50	1.40
Rule of Law (RL)	595	–0.05	0.79	–1.52	1.77
Regulatory Quality (RQ)	595	0.06	0.82	–1.73	2.25
Voice and Accountability (VA)	595	–0.44	0.72	–1.86	1.14
		Low Income/Developing Countries			
GDP Per Capita Growth Rate	272	4.38	4.26	–14.39	38.06
Investment (INV)	272	24.59	9.18	8.01	64.43
Government Size (EXP)	272	11.21	4.68	3.46	25.88
Inflation (INF)	272	9.29	11.43	–1.71	128.42
Openness (OPN)	272	76.66	31.42	21.55	162.91
Institutions (INS Index)	272	–0.57	0.38	–1.45	0.29
Control of Corruption (CC)	272	–0.62	0.47	–1.49	0.82
Government Effectiveness (GE)	272	–0.42	0.40	–1.28	0.78
Political Stability (PS)	272	–0.79	0.87	–2.50	1.31
Rule of Law (RL)	272	–0.57	0.48	–1.52	0.37
Regulatory Quality (RQ)	272	–0.44	0.40	–1.50	0.68
Voice and Accountability (VA)	272	–0.59	0.56	–1.82	0.50
		High Income/Developed Countries			
GDP Per Capita Growth Rate	323	3.12	5.21	–11.53	33.03
Investment (INV)	323	23.76	7.54	9.66	57.71
Government Size (EXP)	323	15.59	5.57	6.77	30.50
Inflation (INF)	323	5.35	10.93	–8.53	85.73
Openness (OPN)	323	123.25	93.80	18.76	448.31
Institutions (INS Index)	323	0.22	0.71	–1.24	1.44
Control of Corruption (CC)	323	0.33	0.88	–1.25	2.42
Government Effectiveness (GE)	323	0.53	0.80	–1.07	2.43
Political Stability (PS)	323	0.03	0.78	–1.62	1.40
Rule of Law (RL)	323	0.38	0.73	–1.19	1.77
Regulatory Quality (RQ)	323	0.48	0.85	–1.73	2.25
Voice and Accountability (VA)	323	–0.31	0.82	-1.86	1.14

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Is Negative Profitability-Leverage Relation the only Support for the Pecking Order Theory in Case of Pakistani Firms?

ATTAULLAH SHAH and JASIR ILYAS

Previous studies on capital structure in Pakistan have reported evidence in support of the pecking order theory. However, this evidence is largely based on testing one dimensional relationship between leverage ratios and firms' profitability. The objective of this paper is to extensively test the pecking order theory in Pakistan with well-known pecking order testing models. Specifically, we use a sample of 321 firms listed on the Karachi Stock Exchange from 2000 to 2009 and test pecking order theory with models suggested by Shyam-Sunder and Myers, Frank and Goyal, Watson and Wilson, and Rajan and Zingales. Results of these models indicate that there exits only weak evidence in support of pecking order theory in Pakistan. However, strong support is found for pecking order theory when leverage ratios are regressed on profitability ratio, along with a set of control variables. This discrepancy in the results of the two sets of models needs further investigation, as well as care in interpreting the results of existing studies on capital structure in Pakistan. Our results show robustness even after controlling for possible profits understatements or weak corporate governance practices.

JEL Classification: G10, G21, G32
Keywords: Pecking Order Theory, Profitability-Leverage Relation, KSE

1. INTRODUCTION

Many theories have been presented and tested to explain corporate capital structure choices; however, none of these theories has been able to come up with a comprehensive explanation of the capital structure choices of firms in different industries and/or countries. Because of this reason, Brealey, Myers, and Marcus (1999) included corporate capital structure in seven unanswered subject issues of finance. Debate over capital structure decision started with the ground-breaking work of Modigliani and Miller (1958) who argued that corporate capital structure is inconsequential to the value of a firm and hence there exists no optimal capital structure. However, Modigliani and Miller reached this conclusion under the assumption of perfect capital markets. Once the assumption of perfect capital markets is relaxed and real-world market imperfections are allowed to play a role in firm-financing decisions, then optimal capital structure does exist.

Existing capital structure theories build their arguments around different market frictions such as taxes, information asymmetry, agency costs, and different types of

Attaullah Shah <attaullah.shah@imsciences.edu.pk> is a Faculty Member at the Institute of Management Sciences, Peshawar. Jasir Ilyas <jasirilyas@yahoo,com> is Faculty Member at City University of Sciences and Information Technology, Peshawar.

transaction costs. Among these theories, the most heavily discussed and empirically tested theories are the trade-off theory and the pecking order theory. The trade-off hypothesis was first proposed by Kraus and Litzenberger (1973); however, it was later modified and refined by a number of studies. The trade-off theory proposes that there exists a trade-off between the benefits and costs of debt financing. Debt financing benefits a firm because interest expense serves as tax-shield. And cost of debt financing arises from the increase in probability of bankruptcy as debt financing subjects a firm to fixed periodic interest and principal payments. An optimal capital structure is reached at a point when benefits and costs of debt financing from a one additional dollar of debt financing become equal. The pecking order theory states that financing behaviour of a firm follows a pecking order because information asymmetry costs are different for different sources of funds [Myers (1984)]. When funds are required by a firm, it first uses the internally-generated funds. Internally available funds can be employed to meet funding requirements without information costs and time constraints. When the funding requirements exceed internally available funds, only then the firm opts for external financing. While choosing between debt and external equity financing, a firm prefers a less costly source of financing over the costly one [Myers (1984)]. Equity has information asymmetry problem; therefore, debt financing is a less costly choice. Information asymmetry means that managers and potential investors do not have equal information regarding the firm's future cash flows. Potential investors know that corporate managers will work in the interest of existing shareholders and will issue equity only when shares are overpriced in the market. Therefore, when equity is issued, potential investors will discount it in view of possible overpricing. This makes issuance of equity costly for the existing equity holders. Consequently, a firm will prefer to use debt before issuing equity when external financing is required. This forms an order in financing behaviour of firms. Firms first pick internally available funds i.e. retained earnings as a financing source. If these internal finances are inadequate to meet the funding requirements then the firm will opt for external financing in order of preference from least risky debt (straight debt) to more risky debt (convertible debts), preferred stocks and lastly equity financing [Myers and Mujluf (1984) Myers, (2001)].

Empirical work has provided evidence, in favour of as well as against, both the theories. The relationship between profitability and leverage of a firm is considered as a focal point when it comes to testing these theories. Under the trade-off theory, it is predicted that profitable firms will try to use more debt financing. It is because these firms are less risky and hence they will try to gain maximum tax advantage provided by leverage [Barclay and Smith (2005)]. The tax advantage associated with debt financing increases after tax cash flow of the firm. This way the trade-off theory suggests a positive relationship between profitability and leverage of the firm. Contrary to the trade-off theory, the pecking order theory predicts a negative relationship between profitability and leverage because a profitable firm will have more retained earnings over a period of time. This reserve of funds could be used as first choice of financing when the firm is in need of funding for purchase of new assets or financing a project. Thus, there will be less need for external financing. In contrast, a less profitable firm will have less to retain and will be unable to meet its funding requirement with internally generated funds. Such a firm has to meet its funding requirements through external financing, which according to the

pecking order theory ought to be debt financing. This way, the pecking order theory predicts a negative relationship between leverage and profitability.

Many empirical studies have supported the pecking order theory primarily based on the negative profitability-leverage relationship. Booth, *et al*. (2001) studied firms in 10 developing countries and found a negative relationship between profitability and leverage. Similarly, [Tong and Green (2005)] reported significant inverse relationship between the current as well as past profits and leverage. [Qureshi (2009)] followed the work of Tong and Green (2005) and found support for the pecking order theory on the basis of a negative relation between the two variables. Moreover, studies such as Sinan (2010) and Ozkan (2001) from UK; Sheikh and Wang (2010), Qureshi (2009), Ilyas (2008) and Hijazi and Shah (2004) from Pakistan; and Gaud, *et al.* (2005) from Switzerland; and Serrasqueiro and Nunes (2010) from Portugal provided evidence in favour of a negative relation between the two variables.

A major twist in testing the pecking order theory came with the study by Shyam-Sunder and Myers (1999). They shifted the focus from profitability-leverage relationship to a more refined proxy for testing the pecking order hypothesis. They argued that external funding requirements of a firm should be matched dollar to dollar by changes in debt financing. Therefore, if pecking order theory holds, coefficient of funding deficit should be one in the regression of net debt issues. [Frank and Goyal (2003)] further modified the approach of Shyam-Sunder and Myers (1999) to use individual components of funding deficit in the regression of net changes in leverage levels, instead of using just one composite figure for funding deficit. Following the approach of these two studies, a large number of studies have reported mixed support for the pecking order theory.

Existing studies on this topic in Pakistan [see, e.g., Sheikh and Wang (2010) Qureshi (2009), Ilyas (2008), Khan and Shah (2007) Hijazi and Shah (2004) and Booth, *et al*. (2001)] use the profitability-leverage relation to explain the financing pattern of Pakistani firms. This provokes a natural question whether the negative profitability-leverage relationship is the only support for the pecking order theory in Pakistan? Review of literature suggests that there are several models such as models suggested by [Sunder and Myers (1999), Frank and Goyal (2003) and Watson and Wilson (2002)] to test the pecking order theory. These models use different assumptions and techniques to confirm the existence of the pecking order theory apart from just profitability-leverage relation. Therefore, a need for a comprehensive study is felt which can find evidence in support of or against the presence of the pecking order theory in financing pattern of Pakistani listed firms using a set of recently developed alternative models in this area. There is additional motivation for testing pecking order theory in Pakistan. Pecking order theory considers information asymmetry costs as the prime determinants of firms' financing choices. Since information asymmetry problems are expected to be higher in developing and emerging markets [see, e.g. Balasubramanian, *et al*. (2010), Jabeen and Shah (2011), Seifert and Gonenc (2008b), Stiglitz (1989)], Pakistan is a good candidate to test the pecking order theory.

Besides the above, our unique contribution to the literature lies in the fact that no previous study in Pakistan on the given topic has controlled for possible earning understatements or poor corporate governance practices. There is some evidence that corporate governance practices are weak in Pakistan where insider-controlling

shareholders try to expropriate outside minority shareholders or try to evade taxes through earning understatements. [See, e.g., Abdullah, *et al*. (2012)]. Earning understatements or poor corporate governance might contaminate our results. We have controlled for this possibility in two ways. First, we estimate all regression models on a full sample of 321 firms, and also on a sub-sample of 102 firms for which corporate governance compliance score was available. This score was obtained from Tariq and Abbas (2013) who measured compliance with the code of corporate governance of Securities and Exchange Commission of Pakistan on more than 50 dimensions. The sub-sample was further divided into two groups of firms i.e. firms with higher compliance score and firms with lower compliance score. Then all the regression models were estimated separately for each group to compare whether corporate governance practices drive our results. Our second approach to control for possible earning understatement is to divide firms into three groups based on 25th, 50th, and 75th percentiles of firms' profitability. If discretionary understatement of earnings have any effect on our analysis, that should be visible in the results of these three groups. Separate regressions were estimated to see whether explanatory variables of interest behave randomly across these groups.

In next section, we review the relevant literature. After that, we discuss the data sources, sample, and choice of models in Section 3. In Section 4, results and findings of the empirical analysis are presented and discussed. Section 5 concludes the paper.

2. REVIEW OF LITERATURE

This section reviews the relevant literature for developing a set of testable hypotheses. The review specifically focuses on models used to test pecking order theory of corporate capital structure.

Donaldson (1961) found that majority of firms used internally generated funds as a first choice of financing even with fairly high PE ratio. He formulated the pecking order hypothesis which was later on modified and refined by Myers (1984) and Myers and Majluf (1984) Myers (1984) proposed the pecking order in the context of asymmetric information and highlighted the shortcomings of the trade-off theory in the presence of correction costs to optimal leverage ratio. According to Myers, a firm adjusts its capital structure to maximise its value by changing the level of debt. Myers highlighted that trade-off theory holds only when costs of these corrections are zero. Myers and Majluf (1984) proposed that firms should issue equity only when balanced information exists between managers and potential investors. However, when the condition of balanced information does not hold, equity issuance can be harmful to the interest of its existing equity holders. This happens because potential investors know that managers will work in the interest of existing shareholders and will issue equity only when shares are overpriced in the market. Therefore, when equity is issued, potential investors will try to correct the share price downward. They do so because they feel they are exposed to adverse selection in the presence of information asymmetry. Thus, information asymmetry between managers and potential investor makes equity financing costlier. This led Myers and Majluf to propose that in the presence of information asymmetry, a firm should depend on past equity reserves or surplus profits retained over period of time along with savings through reduction in dividend pay-outs as a first choice of financing. If internal

funds are insufficient, firms would then choose debt financing before going for equity issuance because debt issuance has lower information asymmetry costs.

With the increasing focus on pecking order theory, researchers developed several different models to test this theory under different assumptions. These models focused primarily on how firms finance their funding deficits. Among the pioneering works in this area was the study by Shyam-Sunder and Myers (1999). Their model implies that for the pecking order theory to hold, a dollar of financing deficit should be funded by a dollar of debt financing. Thus, in the regression of net debt issue, funding deficit should return slope coefficient of one. The results of their study mostly favoured pecking order theory as compared to trade-off theory. Chirinko and Singha (2000) criticised Shyam-Sunder and Myers model (SSM) on the grounds that their model contained only financing deficit and debt financing while equity financing was missing. If equity, as a last resort, is accommodated in the model then slope coefficient won't be equal to one as suggested by SSM model. Furthermore, Chirinko and Singha marked other weaknesses of SSM model such as it does not speak of the situation in which equity is issued prior to debt or when debt and equity financing are used in fixed proportions. Moreover, Frank and Goyal (2003) challenged the generalisation of the empirical results in Shyam-Sunder and Myers (1999) on grounds that the sample of 157 firms used in their study was relatively small for publically traded US firms.

The SSM model argues that change in debt financing is purely a result of change in funding deficit. A challenge to this argument comes from target adjustment models which argue that changes in debt financing show attempts of a firm to adjust to its target capital structure with the passage of time. A number of studies used SSM model and target adjustment models to test the pecking order theory. These studies include [Dang (2005), Hovakimian and Vulanovic (2008), Seifert and Gonenc (2008b)]. A brief overview of these studies is presented. Dang (2005) tested the pecking order theory and the trade-off theory using a sample of UK firms for the period 1996-2003. He found that most of the tested firms adjust to their ideal leverage ratio with a substantial speed. This study also tested both theories together in one model and found that the trade-off theory did well in contrast to the pecking order theory. Hovakimian and Vulanovic (2008) tested funding of the long term retiring debt instead of funding deficit in SSM model. Conventional SSM model regresses financing deficit on new debt financing. The study argued that doing so was in line with pecking order theory as maturing debts were financed by new debt after exhausting inside funds. This fact was evident from negative intercept term which shows employment of inside funds before new debt funding. The pecking order theory failed when retiring debt was regressed on outside funding, i.e. debt and equity together, where the regression produced a positive intercept term. The study argued this failure is in line with the finding of Leary and Roberts (2007). And finally, Seifert and Gonenc (2008b) argued that emerging economies have more information asymmetry problems; therefore, they should mostly follow pecking order theory. They tested pecking order theory in 23 emerging economies. Results of their study revealed that equity financing is preferred over debt financing in these emerging economies which was inconsistent with pecking order theory. In a more recent study, Komera and Lukose (2014) tested the role of pecking order theory in Indian market and found that pecking order theory cannot explain capital structure of the firms used in the sample.

Frank and Goyal (2003) argued that SSM model uses an aggregated value for funding deficit, which is less informative. They suggested that the funding deficit should be disaggregated into its individual components and then be tested in conventional leverage regressions. Using this modified model, Frank and Goyal (2003) studied US public firms over a period 1971-1998 to know how these firm finance their funding deficits. They found that the sample firms used equity financing to meet funding deficit. Frank and Goyal also found that support for pecking order theory declines over a period of time. This declining support was found in case of both large and small firms. Large firms somewhat tend to follow pecking order theory in comparison to small firms. Theoretically, as highlighted by Berger and Udell (1995), small firms should follow pecking order theory more than large firms as small firms are more susceptible to information asymmetry problems. Frank and Goyal argued that small firms did not follow pecking order theory because most of them went public during 1980s and 90s. Later on, several studies including Flannery and Rangan (2006) and Huang and Ritter (2007) reported findings similar to that of Frank and Goyal. Seifert and Gonenc (2008a) extended the work of Frank and Goyal (2003) to British, German and Japanese firms along with American firms using OLS and fixed effect models. They found results similar to Frank and Goyal study with exception of Japanese firms. Overall results from US, Britain and Germany do not support the presence of pecking order theory. However, large sized US and German firms followed pecking order theory. Importantly large sized US firms with higher profitability were following pecking order theory but surprisingly in case of large sized Japanese firms, even firms with low profitability were following pecking order theory.

Several other studies have used quite different methodologies to test pecking order theory. For example, [Bharath, *et al*. (2009)] tested information asymmetry as a key driver of pecking order theory. They found that with an increase in information asymmetry, firms avoid their financing through equity which is in line with pecking order theory. However, they argued that it does not completely determine the financing source selection of the firms. In case of highest information symmetry, only 30 percent of the funding requirements are fulfilled with debt instead of 100 percent as implied by pecking order theory. They concluded that information asymmetry is significant but not the sole determinant of leverage. Another study that used a different approach to test the pecking order theory was [Autore and Kovacs (2004)] who investigated the pecking order theory in relation with changing adverse selection cost over time. The study took dispersion in analysts' earnings estimates as a measure of adverse selection cost. The study used pooled and fixed-effect regression models and found that with the lower adverse selection cost, firms tend to finance themselves via outside sources, preferably with equity. However, in case of a firm with higher adverse selection costs, traces of the pecking order theory were found. The study further found that firm profitability is negatively associated to adverse selection costs, outside financing and changes in debt. And finally, [Ghosh and Cai (2004)] used different tests and found that typically firms which have debt level greater than industrial average ultimately move towards the industry mean debt ratio. This fact shows that firms that have debt ratio above the industry average, they trace the trade-off theory. Such firms try to readjust their debt level towards the target industrial debt level by lowering it. Whereas those firms which have a lower level of debt, do not show the same tendency as they are not bothered by their existing debt level.

Fama and French (2005) argued that the pecking order theory is not complete capital structure model as information asymmetry problem is not a prime driver of financing choices. They argued that information asymmetry problem can be avoided by changing the ways of issuing equity, for example mergers can be financed with stock, repurchased plans, employee's stock options and rights offering. Thus equity issuance is not a last choice of financing as predicted by the pecking order theory. In their empirical tests, they found that firms do issue equity generally and retire equity even when firms have funding deficits which is against the pecking order theory implications. In times of financing surplus, firms do retire debts. Similar to [Lemmon and Zander (2004)], Fama and French pointed out that usually firms with funds deficit, low profitability and good growth opportunities issue equity.

In conclusion, the review reveals that testing pecking order theory goes beyond using just profitability-leverage relationship. Second, only mixed support exists for pecking order and that too is declining in the recent times.

2.1. Hypotheses of the Study

In light of the literature cited above, we develop and test the following hypotheses regarding the relevance of pecking order theory to Pakistani corporate financing behaviour.

H_1: Funding deficit determines the debt level of the firm.
H_2: Internally available retained earnings are preferred over debt financing.
H_3: Aggregation of funding deficit components is less informative.
H_4: Funding deficit contributes more as a determinant of leverage as compared to other conventional determinants of leverage.
H_5: Retained earnings are preferred over debt financing whereas debt financing is preferred over equity financing.

3. METHODOLOGY

3.1. Data of Study

Data for the study are taken from State Bank of Pakistan's publication "*Balance Sheet Analysis of Joint Stock Companies Listed on the Karachi Stock Exchange*". Sample period for the study covers the years 2000 to 2009. Total number of non-financial firms listed in 2000 were 520; however, the number of listed firms decreased to 414 in (2009). This study selected all firms which had complete data available during the sample period. After exclusion of outliers and incomplete data, we were left with a final sample of 321 firms.

3.2. Models to Test Pecking Order Theory

3.2.1. *SSM Model*

We start with the model developed by [Shyam-Sunder and Mayer (SSM) (1999)]. This model has also been used by many empirical studies like [Dang (2005), Hovakimian and Vulanovic (2008), and Seifert and Gonenc (2008b), and Komera and Lukose (2014)].

These studies used the model with slight amendments to test the pecking order theory. This model is not considered a perfect model in general, which was accepted by Shyam-Sunder and Myers. This model has been heavily criticised in empirical studies such as [Chirinko and Singha (2000) etc.]. Still due to its simplicity and good first order approximation this model has been used in many studies around the globe in testing the pecking order theory. The pecking order theory suggests that external equity financing is used only as a last resort; whereas as a first option, firms will use debt financing when their funding needs exceed the internally available funds. So every dollar of a firm's deficit is met by each dollar of debt financing of the firm, which will result in slope coefficient equal to 1. Thus, this formulation can be expressed in the following form;

$$\Delta D_{it} = \alpha + \beta_P DEF_{it} + e_{it} \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (1)$$

Whereas $DEF_t = DIV_t + X_t + \Delta W_t + R_t - C_t$

In Equation (1), ΔD_{it} shows the change in debt level of a firm *i* between time *t* and *t*–1. This value is expected to be positive if a firm faces funding deficit i.e. the firm will obtain external financing. In case the funding deficit is negative, the firm will retire its debt in that year. β_P is the pecking order coefficient. *DEF* represents the internal funds deficit. Funding deficit is a combination of dividend payment (*DIV*), capital expenditure (*X*), net increase in working capital *(*ΔW) and current portion of long term debt at the beginning of time *t* (*R*) minus operating cash flow after interest and tax (*C*). All these components are expected to have a positive relationship with funding deficit except operating cash flow which should be negatively related to funding deficit. To control for scale differences, all the variables are scaled by total assets.

Typical definition of funding deficit in SSM also includes current portion of long term debt (*R*) as a component. However, Frank and Goyal (2003) found that, contrary to pecking order theory, this component showed negative relation with net debt issued. They also argued that this component already exists in change in working capital component so it does not need to be repeated. The fact that the funding from internal sources is preferred over debt financing is represented by term "α" in Equation (1) which is expected to have zero value.

3.2.2. *Frank and Goyal Disaggregation Model*

In contrast to SSM model, Frank and Goyal (2003) argued that aggregation of funding deficit in one value is not very informative. These components can reveal more information about debt financing behaviour when studied independently. Therefore, they suggested that funding deficit as in Equation (2) is more appropriate. Our second model is adopted from Frank and Goyal (2003)

$$\Delta D_{it} = \alpha + \beta_{Div} DIV_t + \beta_X X_t + \beta_W \Delta W_t + - \beta_C C_t + e_{it} \quad \ldots \quad \ldots \quad \ldots \quad (2)$$

Theoretically, unit change in each of these components of funding deficit must lead to unit change in debt financing i.e. $\beta_{Div} = \beta_X = \beta_W$ a $= \beta_C = 1$ to confirm the pecking order theory.

3.2.3. *Frank and Goyal Conventional Leverage Model*

In order to address the omitted variable bias, Frank and Goyal estimated another equation that incorporates all previously identified explanatory variables in the leverage

regression. In view of this, we adopt the following model from Frank and Goyal. This model allows us to find relevant contribution made by the variable of interest (i.e. funding deficit), in the presence of other conventional variables. The model is given below:

$$\Delta D_{it} = \alpha + \beta_T \Delta T_{it} + \beta_G G_t + \beta_{LS} \Delta LS_{it} + \beta_P \Delta P_{it} + \beta_{DEF} DEF_{it} + e_{it} \quad \ldots \quad (3)$$

In Equation (3) ΔD, ΔT, ΔLS, ΔP, and DEF show the changes in debt level, tangibility, size, and profitability from previous period to the current period, and funding deficit of the firm, respectively. All variables are scaled by total assets, except growth and size which is the natural log of total assets.

A firm with higher tangibility ratio (i.e. proportion of fixed asset to total assets) can borrow at a relatively lower rate of interest by using fixed assets of the firm as collateral. A firm with a higher percentage of fixed assets is expected to borrow more as compared to a firm whose cost of borrowing is higher because of less fixed assets [Bradley, *et al.* (1984); Rajan and Zingales (1995); Kremp, *et al.* (1999) etc.]. From a different perspective, Harris and Raviv (1990) argued that a firm with lower tangibility has more information asymmetry problem. Therefore, under the pecking order theory, such a firm will go for more debt financing in comparison to equity financing after utilisation of internal funds. It is due to the fact that information asymmetry makes equity financing as an expensive option. Thus, we expect a negative relation between funding deficit and debt level of firms that have lower tangibility ratios. In this study tangibility is measured as a ratio of fixed assets to total assets.

According to the pecking order theory, a firm will use first internally generated funds which may not be sufficient for a growing firm. So next option for such growing firms is to use debt financing which implies that a growing firm will have a high debt [Drobetz and Fix (2003)]. Some studies suggest that firms with higher growth are expected to have lower leverage. This is based on the fact that debt is supported by assets-in-place rather than growth opportunities [Titman and Wessels (1988)]. Previous empirical studies have used various proxies for growth opportunities of a firm such as market-to-book ratio and yearly percentage changes in capital expenditure and total assets. Firms with high market-to-book value will opt more for equity financing. It is so to take advantage of high market value than book value. Later two proxies are component of funding deficit under SSM model and are expected to be positively related to debt. This study measures growth as a geometric mean of percentage increase of total assets of the firm with respect to the previous year. In this study, it is expected that firms with higher growth are expected to have higher leverage.

Size of the firm is closely related to risk and bankruptcy costs of a firm. Large sized firms tend to be more diversified and as a consequence they have a lower probability of bankruptcy. Thus creditors will be more willing to lend their funds to larger firms. Examining the effect of size in the determination of capital structure, Marsh (1982) and Bennett and Donnelly (1993) found that larger and more capital intensive companies are likely to employ more debt. On the other hand, as highlighted by Berger and Udell (1995), small firms should follow pecking order theory more than large firms as small firms confront information asymmetry problem more than large firms. The study measures the size as the natural logarithm of total assets.

About the profitability of the firm, trade-off theory predicts a positive relationship between leverage and profitability of the firm by arguing that highly profitable corporations in order to benefit from debt tax advantages would employ more debt. Finding of many studies, such as Titman and Wessels (1988), Baskin (1989), Allen (1993), Michaelas, *et al*. (1999), Fama and French (2002) and Tong and Green (2005) challenged this prediction. However, the pecking order theory predicts that if a firm is profitable then it is more likely that financing would be from internal sources rather than external sources to finance their operations and investments. Debt typically grows when investment exceeds retained earnings and falls when investment is less than internal funds. Hence a negative relationship between leverage and profitability is expected. This study measures profitability as net income of the firm divided by total assets.

Similarly, when funding requirements are in excess of internal funds, , there is a need for external funding. External funding includes both debt and equity. The pecking order theory predicts that increase in funding requirement, i.e. funding deficit, results in more debt financing along with equity. However, the pecking order theory suggests a preference of debt over equity in the presence of information asymmetry. This study expects positive relationship between funding deficit and debt financing. Funding deficit is a sum of dividend payment, capital expenditure, net increase in working capital minus operating cash flow after interest and tax.

3.2.4. *Watson and Wilson Model*

We also use Watson and Wilson (2002) model. This model allows us to test whether firm prefers debt over equity in situations when internal funds have already been utilised. The model is given below;

$$(TA_{it}-TA_{it-1})/TA_{it-1} = \sum\alpha_i + \beta_1 (P_{it} - Div_{it})/TA_{it-1} + \beta_2 (EI_{it})/TA_{it-1} + \beta_3 (D_{it} - D_{it-1})/TA_{it-1} + v_{it} \quad \ldots \quad (4)$$

Whereas $\sum\alpha_i$ shows vector of firm fixed effects, *TA* shows total assets of the firm, *P* shows profits, *Div* shows dividends, *EI* shows changes in equity and finally *D* shows debts of the firm. In this model, internally available funds are represented as a remainder of profit after dividend payment. The equation tries to capture changes in total assets in relation to changes in equity and liabilities.

3.2.5. *Rajan and Zingales Model*

Lastly we use Rajan and Zingales (1995) model to know whether negative leverage-profitability relationship responds differently to different levels of profitability of Pakistani firms. Firms are categorised into three groups based on their profit levels by using 25th, 50th and 75th percentiles. These three groups are named as low profitable firms, average profitable firms and high profitable firms. The following model is tested for this purpose;

$$D_{it} = \alpha + \beta_1(T_{it}) + \beta_2 G_{it} + \beta_3 LS_{it} + \beta_4 P_{it} + e_{it} \quad \ldots \quad (5)$$

Where D_{it} is the total debt of firm *i* at time *t*, scaled by total assets, T_{it} is the ratio of tangible assets to total assets, *G* is the geometric mean of annual percentage increase in total assets, and *P* is the ratio of net income to total assets.

Under the pecking order theory, profitability of a firm should be negatively related to the debt financing of the firms as internal funds are preferred over external funding. Using Rajan and Zingales model for the above stated groups our interest lies in knowing whether the negative relation between profitability and debt financing remains the same for each level of profit or not. If it so, it would mean that the negative profitability-leverage relation holds true regardless of the level of profitability of the firm. If not so, it would mean the profitability-leverage relation is determined by the level of profits firms generate.

3.3. Panel Data Analysis

Since we use data on both cross-sectional and time-series dimensions, we employ different variants of panel data models for analysis. One might argue that many of the models are in difference form and hence fixed effects might not be an issue, still for comparison purpose we report results from random effects and fixed effects models. For formal selection between these two models, we employed the Hausman (1978) specification test. We also estimated pooled OLS for all models, but we do not report results as results from pooled OLS and random effects models were virtually similar.

3.4. Robustness Checks

There is an anecdotal evidence of weak corporate governance in Pakistan. For example, there is large scale tax evasion, firms are closely held and controlled, banks rather than markets dominate corporate finance, and accounting statements may not reflect the true state of affairs. In such an environment while it is quite legitimate to study financing patterns and behaviour of corporations, simple tests of the theories are not likely to be productive exercises.

In view of the above, we conduct our analysis on full sample of firms and use several robustness checks to see whether results change substantially once we account for weak corporate governance or potential profit understatements in Pakistani firms. For this purpose, we have borrowed corporate governance compliance index (CGCI) for 102 firms from Tariq and Abbas (2013). They have developed this index to measure the extent to which companies follow the Code of Corporate Governance of the Securities and Exchange Commission of Pakistan. We divided the 102 companies into two groups based on the median value of CGCI. These groups are named as 'High CG and 'Low CG. Our interest lies in the comparison of the results from different models estimated on the data of all firms, Higher CG firms, and Lower CG firms. We want to see whether our results are driven by weak or good corporate governance practices.

Our second robustness check to control for the understatement of profits problem is to estimate Rajan and Zingles (1995) model (see Section 3.2.5) for three groups of firms which are formed on the basis of 25th, 50th, and 75th, percentiles of firms' profitability. For each group of firms, we estimate the model and want to see whether the key variables change their signs or significances. If profits understatements drive the results, then the coefficients of the explanatory variables will behave randomly across these groups of firms. In unreported work, we also estimated all models for high- and low-profit groups of firms (low group included firms in 25th percentile of profitability, and high group included firms in the 75th percentile of profitability) to compare results

across different profitability groups. The results of these regressions show that profits level do change the basic results. To save space, we do not report these results, however, they can be supplied upon request from the authors.

4. ANALYSIS AND FINDINGS

In this section, we present and discuss results of the empirical models. Since we are dealing with panel data, we have to choose between fixed and random effects models. Almost in all models, the Hausman (1978) specification test indicated to use fixed effects model. However, for comparison purpose, we report results from both fixed and random effects models. In all of the regression tables from Table 4.1 to 4.4, first column shows names of the variables, second and third columns report results from the random and fixed effects models, respectively. As discussed in Section 3.4, we also report results from a subset of firms for which corporate governance compliance data were obtained from Tariq and Zaheer (2013). A total of 102 firms are included in this sub-sample. Fourth column of the regression tables report results for all these 102 firms whereas fifth and sixth columns report results for two groups of firms which are divided according to the median value of the compliance index. Firms with high corporate governance compliance index are named as 'High CG' whereas firms with low compliance index are named as 'Low CG'.

4.1. Results from SSM Model

Results of Shayam-Saunders and Myers (SSM) model are given in Table 1. Standard errors are reported in parentheses, whereas ***, **, and * show significance at 1 percent, 5 percent, and 10 percent, respectively.

Table 4.1

Results of the SSM Model

$\Delta D_{it} = \alpha + \beta DEF_{it} + e_{it} \ldots\ldots\ldots$ (1)

VARIABLES	(1) Random Eff.	(2) Fixed Eff.	(3) CG All	(4) High CG	(5) Low CG
DEF	0.0319***	0.0857***	–0.0045	–0.0005	–0.0046
	(0.0085)	(0.0155)	(0.0163)	(0.0262)	(0.0215)
Constant	0.0559***	0.0582***	0.0557***	0.0528***	0.0582***
	(0.0029)	(0.0029)	(0.0046)	(0.0068)	(0.0066)
Observations	2,534	2,534	762	383	379
R-squared		0.0136	0.0001	0.0000	0.0001
Number of firms	321	321	102	56	56

Table 1: Change in debt level scaled by total assets is the dependent variable. Whereas funding deficit variable (DEF) is measured as a sum of dividend payment, capital expenditure, net increase in working capital minus operating cash flow after interest and tax. Both variables are scaled by total assets. Standard errors are reported in parentheses, whereas ***, **, and * show significance at 1 percent, 5 percent, and 10 percent, respectively.

Under the pecking order theory, SSM argue that the slope coefficient of funding deficit must be equal to one. A firm uses debt funding when their funding needs exceed the internally available funds. Every dollar increase in funding deficit after utilisation of internally available funds will be met by a dollar of debt financing. Whereas equity funding is used only as a last resort and is relatively rare. The results in Table 4.1 show that the slope coefficient of funding

deficit is 0.085 and R^2 has a value 0.0136 in fixed the effects model. These findings show only a weak support for the pecking order theory. The positive coefficient of funding deficit is in accordance with prediction of SSM model, but the coefficient value of funding deficit is too low against its expected value that should be near 1. In fact the coefficient of funding deficit was reported 0.76 by Shayam-Saunders and Myers (1999) and 0.75 by Frank and Goyal (2003) when they used a sample of firms that had no gaps in the data. However, when they relaxed the continuous data restriction and estimated the equation on full sample, the funding deficit coefficient declined to 0.28. Further, they noted that with the passage of time, SSM model showed declining support for the pecking order theory. Another important fact is that the pecking order theory predicts the preference of internal source of funding over debt financing. But our results show that intercept has significant positive value. This fact is against the pecking order theory. Therefore, the study rejects the hypothesis that internally available retained earnings are preferred over debt financing.

Comparing results in 'High CG' and 'Low CG' groups, we observe that results in these two groups are not different. In fact, financial deficit seems to have no influence on debt ratio in the full sample of 102 firms for which corporate governance data is available or in the high or low compliant groups. This shows that corporate governance practices do not alter the results.

4.1.2. *Results of Frank and Goyal Disaggregation Model*

Second model used in this study is the model of Frank and Goyal (2003) who proposed to disaggregate funding deficit factor in the SSM model. Table 4.2 presents results of Frank and Goyal disaggregation model. Standard errors are reported in parentheses, whereas ***, **, and * show significance at 1 percent, 5 percent, and 10 percent, respectively.

Table 4.2

Results of the Frank and Goyal Disaggregation Model

$$\Delta D_{it} = \alpha + \beta_{Div} DIV_{it} + \beta_X X_{it} + \beta_W \Delta W_{it} + - \beta_C C_{it} + e_{it} \ldots\ldots\ldots (2)$$

Variables	(1) Random Eff.	(2) Fixed Eff.	(3) CG All	(4) High CG	(5) Low CG
DIV	0.0001**	0.0000	0.0000	0.0000	–0.0000
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0001)
ΔW	–0.0181**	–0.0900***	–0.0338**	–0.0333	–0.0297
	(0.0089)	(0.0185)	(0.0158)	(0.0259)	(0.0205)
X	0.5661***	0.5141***	0.6292***	0.5884***	0.6581***
	(0.0271)	(0.0300)	(0.0497)	(0.0735)	(0.0679)
C	–0.1811***	–0.2905***	–0.1801***	–0.1490**	–0.2129***
	(0.0282)	(0.0387)	(0.0505)	(0.0714)	(0.0743)
Constant	0.0437***	0.0523***	0.0492***	0.0479***	0.0519***
	(0.0033)	(0.0041)	(0.0061)	(0.0096)	(0.0081)
Observations	2,534	2,534	762	383	379
R-squared	0.1349	0.1493	0.1966	0.1637	0.2314
No. of Firms	321	321	102	56	56

Table 4.2: Change in debt level is dependent variable of the model and is measured as the difference of total liabilities at time *t* with respect to time t_{-1}, scaled by total assets Independent variables are dividend payment (*DIV)*, capital expenditure (*X)*, net increase in working capital (ΔW) and operating cash flow (*C*). All these variables are scaled by total assets. Dividend payment is the amount of dividend paid by the firm for the year, capital expenditure is change in net fixed assets with respect to the previous year, working capital is the difference between current asset and current liabilities of the firm; and the operating cash flow after interest and tax is equal to net income plus depreciation for the year. Standard errors are reported in parentheses, whereas ***, **, and * show significance at 1 percent, 5 percent, and 10 percent, respectively.

Results in Table 4.2 suggest that the coefficients of each component of the funding deficit are significantly different from one. Under the pecking order theory, one unit change in any component of the funding deficit should lead to a unit change in debt level. The results do not support this prediction of the pecking order theory as proposed in SSM model. Results show that aggregation of the components of funding deficit term is less informative. Since aggregation of funding deficit is not justified, study of the individual components can reveal more information.

Further, we find that the coefficient of dividends (*DIV*) is positive and is statistically significant only in the random effects model. The positive coefficient implies that dividend paying firms use more debt financing. Since its coefficient is marginally significant, it supports the pecking order theory to some extent. The coefficient value of capital expenditure (*X*) ranges from 0.51 (in the fixed effect regression) to 0.65 (in the lower CG regression), and is positively related to debt financing. The positive relation between capital expenditure and debt financing is in accordance with both the pecking order theory and the trade-off theory. Under the pecking order theory, once internal funds are employed, increase in capital expenditure will increase funding deficit of the firm which will in turn increase debt financing. Under the trade-off theory, capital expenditures create tangible assets which can be used by the firm as collateral against debt financing.

Internally available operating cash flows (*C*) show a negative relation with changes in debt in all models. This finding is in line with the financing behaviour pattern laid down in the pecking order theory. However, if one considers profitability as a proxy of future growth opportunities, the trade-off theory would then also predict a negative relationship between profitability and debt financing. Working capital (ΔW) shows negative relation with the changes in debt. Pecking order theory predicts that after we control for internally generated funds, working capital needs should be financed dollar for dollar from debt financing. Thus, pecking order theory fails here.

In conclusion, we find only weak support for the pecking order theory using the Frank and Goyal model. This is evident not only from fairly small coefficients of the individual components of funding deficit, but also some of the components of the funding deficit yielded unexpected signs.

Results for firms that have corporate governance data are reported under column headings (3), (4) and (5) in Table 4.2. It is interesting to see that the results of the sub-sample are almost similar in statistical significance and coefficient signs as the full sample. Further, there is no significant difference in the results of firms that score high on corporate governance compliance index (High CG) and firms that score low on this index (Low CG).

4.1.3. *Results of Frank and Goyal Conventional Leverage Model*

In order to avoid omitted variable bias and to know the contribution made by each funding deficit variable, we follow the work of Frank and Goyal (2003) to modify Equation 1 into Equation 3 by adding previously identified explanatory variables. Table 4.3 presents results of Frank and Goyal model using conventional leverage regression.

Table 4.3

Results of the Frank and Goyal Model Using Conventional Leverage Regression

$$\Delta D_{it} = \alpha + \beta_T \Delta T_{it} + \beta_G G_t + \beta_{LS} \Delta LS_{it} + \beta_P \Delta P_{it} + \beta_{DEF} DEF_{it} + e_{it}$$

Variables	(1) Random Eff.	(2) Fixed Eff.	(3) CG All	(4) High CG	(5) Low CG
ΔT	–0.0533***	–0.2828***	–0.0452*	–0.0577	–0.0373
	(0.0154)	(0.0355)	(0.0244)	(0.0362)	(0.0338)
G	0.3416***	.2581***	0.3520***	0.2843***	0.4291***
	(0.0307)	(.03145)	(0.0500)	(0.0732)	(0.0709)
ΔLS	0.0081***	0.0347***	0.0053	0.0018	0.0098*
	(0.0025)	(0.0066)	(0.0038)	(0.0055)	(0.0055)
ΔP	–0.3476***	–0.3568***	–0.2509***	–0.1797***	–0.3584***
	(0.0335)	(0.0453)	(0.0515)	(0.0682)	(0.0856)
DEF	0.0192*	0.0747***	–0.0071	–0.0137	0.0054
	(0.0098)	(0.0151)	(0.0193)	(0.0295)	(0.0264)
Constant	–0.0056	–0.0323	0.0007	0.0340	–0.0390
	(0.0183)	(0.0498)	(0.0298)	(0.0465)	(0.0410)
Observations	2,534	2,534	762	383	379
R-squared	.0832	0.0740	0.0785	0.0533	0.1156
Number of Firms	321	321	102	56	56

Table 4.3: Change in debt level is dependent variable of the model and is measured as the difference of total liabilities at time *t* with respect to time t_{-1}, scaled by total assets. Independent variables are the tangibility, growth, size, profitability and funding deficit of the firm. These variables are denoted as *ΔT*, *G*, *ΔLS*, *ΔP*, and *DEF* respectively. This study measures tangibility as a ratio of change in fixed assets to total assets with respect to the previous year, growth as a geometric mean of percentage change in total asset of the firm with respect to the previous year, size as the change in natural logarithm of total assets with respect to the previous year, profitability as change in ratio of net income to total assets of the firm with respect to the previous year and funding deficit variable as a sum of dividend payment, capital expenditure, net increase in working capital minus operating cash flow after interest and tax. Standard errors are reported in parentheses, whereas ***, **, and * show significance at 1 percent, 5 percent, and 10 percent, respectively.

Result in Table 4.4 shows that tangibility is negatively related to changes in debt levels of the Pakistani firms. Negative sign of the coefficient of tangibility is in accordance with the pecking order theory as highlighted by Harris and Raviv (1990). Rationale of this negative relation is that firms with low tangibility have more information asymmetry problems. This makes equity financing more expensive for them, which in turn makes debt financing attractive after utilisation of internal finds. However, it is noted that this negative relation is in contrast to the findings of Hijazi and Shah (2004) and Ilyas (2008) who also studied the factors determining the leverage of Pakistani firms.

As expected under pecking order theory, slope coefficient of growth variable has a positive sign and is statistically significant. The observed relation between growth and change in debt level shows that growing Pakistani firms funding requirements exceed the internally available funds. Thus, these firms go for debt financing [Drobets and Fix (2003)]. Hence such firms behave in a pecking order. This finding is similar to the finding of Hijazi and Shah (2004).

The variable *LS* (a proxy for firm size) did not show the predicted sign under the pecking order theory. Its coefficient is positive and significant. Under the pecking order theory, smaller firms tend to use more debt financing as they have more asymmetric information problems [Berger and Udell (1995), Rajan and Zingales (1995), Frank and Goyal (2003)]. In contrast, the trade-off theory predicts a positive relation between firm size and debt financing as larger firms have more assets. Larger size increases the firm's ability to obtain more debt. Similarly, if size is taken as inverse proxy of probability of bankruptcy then larger size firms have a lower probability of bankruptcy that allows them to use more debt financing [Rajan and Zingales (1995)].

Negative slope of profitability (ΔP) is in accordance with the pecking order theory but in contrast to the trade-off theory. This shows that Pakistani firms employ their internal funds generated by profits before debt financing. Another possible explanation for this negative relation is that Pakistani firms may use profits to pay their debts. This negative relation was also found by Hijasiand Shah (2004) and Ilyas (2008).

The funding deficit variable (*DEF*) showed predicted relation with changes in debt i.e. it is positive and significant. However, its coefficient remains very low. Positive slope of funding deficit shows that with increasing funding deficit, internally available funds become inadequate and hence firms choose debt financing.

Overall the coefficients of the explanatory variables show predicted signs under the pecking order theory except size of the firm. Importantly, funding deficit explained less of the variation in debt level of the sample firms in the presence of other variables. Profitability and growth seem to be important determinants of debt level of Pakistani firms. Thus, this study rejects the hypothesis that funding deficit contributes more as a determinant of leverage as compared to other conventional determinants of leverage.

Comparing results of firms that are grouped on the basis of lower and higher compliance with code of corporate governance of SECP, one can see not much of a difference. Majority of the variables have their statistical significances and coefficient signs similar in both the groups, with the exception of size, which is marginally significant in 'Low CG' group and insignificant in the 'High CG' group.

4.1.4. *Results of Watson and Wilson Model*

We use Watson and Wilson (2002) model to investigate a firm's choice between debt and equity funding once internal funds are utilised. Table 4.4 presents the results of the Watson and Wilson model.

Results from the fixed effects model show that the coefficient of profitability has value of 0.4610 which is greater than the coefficient of equity financing which has a value of 0.4151but less than the coefficient of debt financing having value of 1.0032. These estimates are significant at 1 percent level of significance. Under the pecking order theory, the coefficients of debt must be greater than equity funding but lesser than internally available funds. The pecking order theory suggests that debt financing is utilised before equity financing which is used only in extreme circumstances when funding needs exceed internally available funds. Contrary to the prediction of pecking order theory, results of Watson and Wilson model suggest that external debt financing is preferred over other sources of funding. Second preference is given to internal source of financing i.e. profits and as a last resort equity financing is picked by Pakistani firms at

Table 4.4

Results of the Watson and Wilson Model

$$(TA_{it}\text{-}TA_{it-1})/TA_{it-1} = \sum\alpha_i + \beta_1 (P_{it} - Div_{it})/TA_{it-1} + \beta_2 (EI_{it})/TA_{it-1} + \beta_3 (D_{it}\text{-} D_{it-1})/TA_{it-1} + v_{it} \ldots (4)$$

	(1)	(2)	(3)	(4)	(5)
Variables	Random Eff.	Fixed Eff.	CG All	High CG	Low CG
$(P_{it} - Div_{it})/TA_{it-1}$	0.4014***	0.4610***	0.2968***	0.1904***	0.4958***
	(0.0364)	(0.0424)	(0.0559)	(0.0670)	(0.1011)
$(EI_{it})/TA_{it-1}$	0.1492***	0.4151***	0.1226***	0.1543***	0.0893***
	(0.0101)	(0.0155)	(0.0172)	(0.0233)	(0.0253)
$(D_{it}\text{-} D_{it-1})/TA_{it-1}$	1.0286***	1.0032***	1.1265***	1.0299***	1.2154***
	(0.0190)	(0.0183)	(0.0334)	(0.0433)	(0.0501)
Constant	–0.0011	–0.1009***	–0.0040	–0.0104	0.0034
	(0.0047)	(0.0061)	(0.0081)	(0.0116)	(0.0115)
Observations	2,534	2,534	762	383	379
R-squared	.5999	0.6476	0.6266	0.6331	0.6332
Number of firms	321	321	102	56	56

Table 4.4: Dependent variable of the model is changes in total asset at time *t* with respect to time t_{-1} measured as a proportion of total assets and denoted as $(TA_{it}\text{-}TA_{it-1})/TA_{it-1}$. Independent variables include internally available funds ($(P_{it} - Div_{it})/TA_{it-1}$), equity funding ($(EI_{it})/TA_{it-1}$) and debt funding ($(D_{it}\text{-} D_{it-1})/TA_{it-1}$). Internally available fund is measured as a reminder of profits after paying dividends. Equity funding is measured as shareholders equity and debt funding as change in total liabilities. All of the variables are calculated as a proportion of total assets. Standard errors are reported in parentheses, whereas ***, **, and * show significance at 1 percent, 5 percent, and 10 percent, respectively.

times of funding deficit. Results lead to rejection of the hypothesis that retained earnings are preferred over debt financing but accept that debt financing is preferred over equity financing. Thus, the results of Watson and Wilson model show only partial support for the pecking order theory in case of Pakistani firms.

4.1.5. *Results of Rajan and Zingales Model*

In view of poor corporate governance practices which might lead to understatement of profits to avoid taxes or expropriate minority shareholders in Pakistan [see, e.g., Abdullah, *et al*. (2012)], we are concerned that our results might be contaminated by reported earning understatements. As a robustness check, we categorise firms into three groups based on 25th, 50th, and 75th percentiles of the firms' profitability to see whether our results behave randomly across different reported profitability levels. These groups are named as low profit, medium profit, and high profit firms. Then we estimate Rajan and Zingales (1995) conventional leverage regression for each group separately. Table 4.5 presents results of Rajan and Zingales model.

Under the pecking order theory, firms having low profits and funding requirements will consider debt financing before they consider equity financing. Whereas firms with high profits will cover funding requirements with internal funds i.e. retained earnings. However, average profitable firms will have moderate external financing mostly from debt financing. So in each case, profitability of the firm must be negatively related to debt financing of the firm. Low profitable firms have highest slope coefficient value of –2.1296 for *P*. Then, average profitable firms have slope coefficient value of –1.8278.

Table 4.5

Results of Rajan and Zingales Model

$D_{it} = \alpha_t + \beta_1(T_{it}) + \beta_2 G_{it} + \beta_3 LS_{it} + \beta_4 P_{it} + e_{it}$

Variables	(1) Low Profits	(2) Average Profits	(1) High Profits
T	0.2685***	0.0408	0.0808*
	(0.0694)	(0.0560)	(0.0440)
LS	–0.0388**	–0.0124	0.0282***
	(0.0168)	(0.0126)	(0.0100)
G	–0.7248***	–0.6341***	0.0005
	(0.1587)	(0.1227)	(0.0929)
P	–2.1296***	–1.8278***	–0.5837***
	(0.2214)	(0.3991)	(0.1269)
Constant	0.8777***	0.8380***	0.2834***
	(0.1565)	(0.1064)	(0.1062)
Observations	633	633	633
R-squared	0.3131	0.1700	0.1737

Table 4.5: Debt (D_{it}) is the dependent variable of the model and is measured as the ratio of total liabilities at time *t* of *i*, scaled by total assets. Independent variables include tangibility (*T*), growth (*G*), size (*LS*) and profitability (*P*) of the firm. We measure tangibility as a ratio of fixed assets to total assets, growth as a geometric mean of percentage changes in total assets, size as the natural logarithm of total assets, profitability as net income divided by total assets. Standard errors are reported in parentheses, whereas ***, **, and * show significance at 1 percent, 5 percent, and 10 percent, respectively

High profitable firms have lowest slope coefficient value of –0.5837. Results of Rajan and Zingales model show that for each level of profitability of firms, profitability is negatively related to debt financing. This negative relationship between profitability of the firm and its leverage is statistically significant in each category of profitability of the Pakistani firms. Thus, we can conclude that level of profitability of Pakistani firms does not affect negative profitability-leverage relationship. This finding is in line with the previous studies on capital structure in Pakistan [see, e.g., Shah and Hijazi (2004), Shah and Khan (2007)].

5. CONCLUSION

Previous studies in Pakistan on corporate capital structure used only a single dimension to test pecking order theory where they presented negative profitability-leverage relationship as an evidence in support of the pecking order theory. The objective of this study was to test whether or not empirical support exists for the pecking order theory in Pakistani firms when we employ a wide range of models that use different assumptions and hence employ different econometric techniques. For this purpose, we used financial data of 321 non-financial Pakistani firms listed on the KSE over the period 2000-2009. Results of Shayam-Sunder and Myers model showed that funding deficit is not matched dollar for dollar by changes in debt financing. However, results showed that there was a positive relationship between funding deficits and debt levels of the sampled firms. Moreover, SSM model yielded positive intercept term which is expected to have a

zero value under the pecking order theory. Positive intercept term means that internal funds were not preferred over other sources of financing at times of funding deficit. Our conclusion based on the above findings is that funding deficit has less explanatory power in determining the debt level of the Pakistani firms.

We also used the disaggregated model of Frank and Goyal (2003). Results revealed that the aggregation of funding deficit term is not justified. When studied individually, all of the components of funding deficit showed expected signs with change in debt level of firms, except changes in working capital. Capital expenditure showed statistically significant and positive relationship with changes in debt level of the firms. Whereas, operating cash flows and changes in working capital showed negative relationships with changes in debt ratios. The negative sign for working capital is in contradiction to the pecking order theory. Dividend payout showed insignificant negative relation with leverage, which is also contrary to the pecking order theory. Overall results from this model were mixed. Thirdly, we tested the impact of funding deficit in the presence of other determinants such as tangibility, size, growth and profitability of the firms on their debt ratios. We found that the contribution of funding deficit was negligible in explaining changes in debt ratios in the presence of other variables. Profitability and growth seem to be the most important determinants of changes in debt levels of Pakistani firms. Profitability was negatively related to debt ratio and was statistically significant. Firm size showed positive relation with debt ratio which indicates that larger firms can take more debt. This finding is also contrary to the prediction of the pecking order theory. Coefficient signs and significances of tangibility, growth, and profitability variables support the pecking order theory. Lastly we found that level of profitability of Pakistani firms does not affect the negative profitability-leverage relation. Whether the firms are less profitable or more profitable, a consistent negative relationship between profitability and leverage was observed. As a further robustness check, we used data on compliance with the SECP code of corporate governance to see whether our results behave differently among firms that show high and low compliance with the code. We found that our results do not change with the level of compliance.

Overall, we found very weak evidence in support of the pecking order theory using funding deficit regressions. However, strong support is found for pecking order theory when leverage ratios are regressed on profitability ratio, along with a set of control variables. This discrepancy in the results of the two sets of models needs further investigation, as well as care in interpreting the results of existing studies on capital structure in Pakistan.

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Trade Liberalisation, Health Care and International Fragmentation: The Role of Health Capital Mobility

TONMOY CHATTERJEE and KAUSIK GUPTA

This paper delves into the complex relationship between health trade through international fragmentation and health trade through commercial presence. A neo-classical full employment four sector static general equilibrium model has been developed, where the three sectors produce final products except the health intermediate goods producing sector. The paper shows that expansion of health trade through commercial presence implies, under some reasonable conditions, enhancement of the volume of health trade through international fragmentation. It also shows that the composite volume of trade in health services through international fragmentation and commercial presence increases the size of the health care in our stylised small open economy.

JEL Classification: I10, F11, F21, D58
Keywords: Health Sector, Health Intermediate Sector, International Fragmentation and International Health Capital Mobility

1. INTRODUCTION

It has been specifically pointed out in General Agreement on Trade in Services (GATS) that trade in health services occur through four modes. These are namely, (1) *cross-border supply:* where the service is provided remotely from one country to another, such as telemedicine via Internet or satellite, or international health insurance policies; (2) *consumption abroad:* where individuals use a service in another country, such as patients travelling to take advantage of foreign health care facilities; (3) *commercial presence:* where a foreign company sets up operations within another country in order to deliver the service, such as hospitals, health clinics or insurance offices, and (4) *presence of natural persons:* where individuals such as doctors, nurses or midwives travel to another country to supply a service there on a temporary basis. In this paper we have considered only trade in health

Tonmoy Chatterjee <tonmoychatterjee.economics@gmail.com> is affiliated with the Department of Economics, Rabindra Bharati University, Kolkata, India. Kausik Gupta <kausik2k1@rediffmail.com> is affiliated with the Department of Economics, Rabindra Bharati University, Kolkata, India.

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services via the mode of commercial presence. The consideration of this mode of health trade becomes important mainly due to the massive presence of foreign direct investment (FDI) in health care in the post globalisation era of any developing economy.[1] However, there is dearth of theoretical works which have considered health trade in the context of international trade. In particular, there is almost no study (empirical as well as theoretical) that has considered health trade through international fragmentation. This issue has also not been considered in any one of the four modes of GATS.

It is to be mentioned in this context that the term international fragmentation is widely used in the literature on international trade. For instance, Jones and Kierzkowski (2005), Deardoff (2001), Jones and Marjit (2001), Marjit (2008), Marjit (2009) and Marjit, Beladi, and Chakraborty (2004) etc.[2] have nicely defined international fragmentation and have discussed its various implications. The term international fragmentation implies that the production process is dependent on intermediate inputs from abroad. In India, over 65 percent of the medical equipments are still being imported from abroad in a very fast growing domestic market, which was 80 percent—90 percent in the pre liberalisation period. This implies health service sector is internationally fragmented. Not only for India this is also relevant for many other developing economies. However, neither of the modes of GATS has captured this issue in spite of its relevance in a globalised world. The present paper is an attempt to analyse theoretically the consequences of incorporating the issue of international fragmentation in the context of the health sector. In fact this paper is probably the first attempt to examine theoretically the interrelation between different patterns of health trade like commercial presence and international fragmentation. The present study thus not only focuses on an aspect that is not mentioned in any one of the modes of GATS but also tries to link mode 3 of GATS with international fragmentation. In other words the paper shows how mode 3 of GATS can be broadly interpreted to incorporate international fragmentation.

In the literature all the authors, as mentioned earlier, have discussed either the causes behind the term international fragmentation or have related fragmentation with the pattern of trade. Unlike others, in this paper we are interested to identify FDI as a source of international fragmentation. This is something new in the context of the literature on international fragmentation. Given the fact that trade through international fragmentation is possible due to inflow of FDI, there is enough scope to analyse the impact of trade through international fragmentation, in the presence of health capital mobility, on the size of the

[1]Feedback ventures expect private equity funds to invest at least US$ 1 billion during 2009-2013. 12 percent of the US$ 77 million venture capital investments in July-September 2009 were in the healthcare sector. GE plans to invest over US$ 3 billion on R&D, US$ 2 billion to drive healthcare information technology and health in rural and underserved areas, US$ 1 billion in partnerships, content and services, over the next six years. International clinic chain Asklepios International plans to invest US$ 100-200 million in the Indian healthcare market. Gulf-based group Dr Moopen is planning to invest US$ 200 million for setting up hospitals and eye-care centres across India. Fortis is planning to invest US$ 55 million to expand its pan-India operations. In the recent decade the medical devices and equipments industry has been successful in attracting foreign direct investment too though this sector is importing 50 percent–60 percent till now. From merely US$2.3 million in 2000 it reached US$ 147.69 million in 2009. Some of big foreign firms in the sector invested in India either directly or through collaborations and joint ventures. Some to mention are GE (USA), Isoft (Australia), Proton Healthcare (USA) and Seimens (Germany) etc.

[2]Jones and Marjit (2008) have considered a general equilibrium framework and from which they have argued that trade may lead to more fragmented activities relative to autarky even if one observes specialisation. Again Marjit, Beladi, and Chakraborty (2004) have shown that reduction in the price of intermediate product may lead to a zone which is more fragmented. They have also examined the impact of fragmentation on skilled-unskilled wage gap.

health care. This is consistent with GATS view that commercial presence (inflow of FDI) is a major source of health trade for any developing economy. Moreover, this issue becomes more relevant for the policy-makers in the context of mobile health capital regime.

In this paper we have tried to examine the impact of trade in health services via commercial presence and international fragmentation on the output levels of a health care of a small open developing economy. Moreover, we have found in our study that finite changes in trade policy through commercial presence in a health care may enhance the volume of health trade due to international fragmentation. It also shows that the composite volume of trade in health services through international fragmentation and commercial presence increases the size of the health care in our small open economy.

The paper is organised in the following manner. Section 2 considers the model. It has one subsection. Subsection 2.1 considers the drive towards fragmentation and health sector. Finally, the concluding remarks are made in Section 3.

2. MODEL

We consider a small open economy consisting of four sectors in a Heckscher-Ohlin-Samuelson framework. Out of the four sectors, one is an export sector (*A*), which produces an exportable composite good (X_A) (other than health) using unskilled labour (*L*) and capital (*K*). The second sector is an import competing sector (*M*), which produces importable good (X_M) using skilled labour (*S*) and capital. The third and fourth sectors of our economy are the domestic intermediate health good producing sector (*I*) and the health sector (*H*) respectively. Sector I uses skilled labour along with health capital (*N*) for production of the intermediate health product (X_I) of our economy and the health sector uses health capital,[3] skilled labour and intermediate health input (X_I) to produce another exportable product (X_H). Here we assume that the requirement of intermediate goods for the production of one unit of output of the health sector is fixed. Competitive markets, CRS technology, diminishing marginal productivity and full employment of factors of production are also assumed.

The notations used in the model are stated as follows:

X_i = product produced by the *i*th sector,
i = A, M, I, H;
P^f_A = world price of commodity *A*;
P_A = domestic price of commodity X_A, we assume
$P_A = P^f_A = 1$;
P_M = world price of good X_M;
P_I = domestically determined price of X_I;
P^f_I = price of the foreign intermediate commodity;
P_H = world price of X_H;
a_{ji} = quantity of the *j*th factor for producing one unit of output in the *i*th sector, j=L,K,S,N and i=A,M,I,H;
W = competitive unskilled wage rate;
W_S = skilled wage rate;

[3]By the term health intermediate goods we actually mean those commodities which are exhausted in the course of production in the health service sector (H), e.g. injectable goods and its associated products, several chemicals, equipments used in pathology and different forms of medicines. Again by health capital we mean those equipments and products which are not exhausted in the production process, e.g. ECG machine, X-ray machine etc.

r = rate of return to capital;

R = rate of return to health capital;

ζ = nutritional efficiency of unskilled labour and $\zeta' > 0$;

γ = nutritional efficiency of skilled labour and $\gamma' > 0$;

$\wedge$ = proportional change, d = domestic and f = foreign.

The structure of equations of the model is as follows.

The competitive equilibrium conditions in the product market for the four sectors give us the following equations.

$$a_{LA}W + a_{KA}r = 1 \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (1)$$

$$a_{SM}W_S + a_{KM}r = P_M \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (2)$$

$$a_{SI}W_S + a_{NI}R = P_I \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (3)$$

$$a_{SH}\ W_S^f + a_{NH}R + a_{IH}\,P_I = P_H \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (4)$$

For simplicity we assume that a_{SH} and a_{IH} are given to us and we have also assumed that $W^f_S > W_S$.

Equilibrium condition for the health intermediate sector is given by

$$a_{IH}\,X_H = X_I = X_I^d + X_I^f \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (5)$$

Sector specificity of unskilled labour is given by the following equation

$$a_{LA}X_A = L\,\zeta(X_H) \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (6)$$

Perfect mobility of capital between sectors A and M can be expressed as

$$a_{KA}X_A + a_{KM}X_M = K^d + K^f = K \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (7)$$

Full employment of skilled labour implies the following equation

$$a_{SM}X_M + a_{SI}X_I + a_{SH}X_H = S\,\gamma(X_H) \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (8)$$

Perfect mobility of health capital between sectors H and I can be expressed as

$$a_{NH}X_H + a_{NI}X_I = N^d + N^f = N \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (9)$$

This completes the specification of our model. We have nine unknown variables—W, W_S, r, R, P_I, X_A, X_M, X_I, and X_H —that are solved by nine Equations, (1)–(9), for the given parameters, P_A, P_M, P_H, L, K, S and N.

Here we are eager to find out the cause and implications of international fragmentation (IF) in the presence of a health care. In this model sector I has been considered as a domestic intermediate health good producing sector. This intermediate good can be imported by the health sector from foreign but in this case it has to incur an intermediate cost (Φ) mainly due to transaction or communication factors.[4] Thus whether the health service sector is going with IF or no IF, that depends upon the following conditions,

[4]Interested readers may look at Marjit, Beladi, and Chakraborty (2004) for the definition of international fragmentation that we have used in this paper. The RHS of both (10.1) and (10.2) are implying the gap between cost of domestic intermediate health service provider at W_S^f, R^f and cost of domestic intermediate health service provider at W_S, R. Now IF is preferable if this gap is greater than the fixed cost associated with import of intermediate health services and IF is not preferable if this gap is less than the fixed cost associated with import of intermediate health services. For details one can go through the above mentioned paper.

(i) IF is preferable if $(W_S^f - W_S)a_{SI} + (R^f - R)\, a_{NI} > \Phi(N)$, … … (10.1)

(ii) IF is not preferable if $(W_S^f - W_S)a_{SI} + (R^f - R)\, a_{NI} < \Phi(N)$ … … (10.2)

So far we have considered that internationally health capital is immobile and hence N has been treated as exogenous. Now we want to take into account the case of international health capital mobility, implying N is to be treated as an endogenous variable. This is very crucial in the context of the present paper. In most of the studies related to fragmentation the authors have considered the change in the gap between price of domestic intermediate and price of foreign intermediate as main cause of trade through IF, whereas in this paper we want to show that mobility of health capital causes trade through IF. In the regime of international health capital mobility the equation structure remains similar to that of earlier. The only change that we have to note is that N becomes endogenous and R is fixed at R^f. Thus the number of unknowns and number of independent equations remain same and hence the system can be solved.

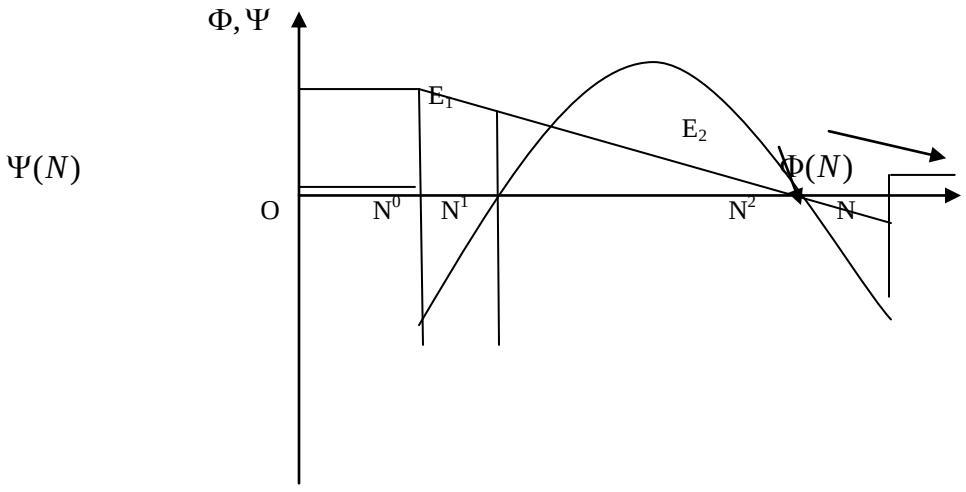
Let us start with a movement from regime of international health capital immobility to regime of international health capital mobility and hence R will go down. From Equation (4) we can say that a fall in R leads to an increase in P_I, since P_H and W^f_S are exogenously given. By using similar type of arguments from Equations (1), (2) and (3) we can infer that finite increase of N causes rise in W, W_S and fall in r.[5] Thus above mentioned inequalities can be rewritten as

(i) $\Psi(N) > \Phi(N)$, … … … … … … (10.1)

(ii) $\Psi(N) < \Phi(N)$ … … … … … … (10.1)

The above analysis can be explained with the help of Figure 1.[6]

Fig. 1.



[5]See Appendix 2 for details.

[6]Shapes of Φ and Ψ schedule have been explained in Appendix 1.

In this paper we find that there exist two critical values of N such that for all $N \in [N^1, N^2]$ there will be IF. Here N^2 is the international health capital market clearing level of health capital. It is to be noted for $N \in [0, N^1]$ there will be no fragmentation. Actually by using this interval we want to explain the initial stage of economic growth of any developing economy, since here we assume N^f is zero up to N^0. As we move towards N^1 it implies the economy needs more of N, it also implies the need for foreign intermediate health product. At N^1 (point E_1) we can arrive at a situation, where health service sector will be indifferent between *IF* and no *IF*. Hence to fill up the demand for health care, sector *H* has to import more foreign health intermediate products. Thus it is clear from the above figure that movement from lower level of N (say N^1) to a higher level of it (say towards N^2) causes further increase in *IF* in health care. Here point N^2 (point E_2) implies a threshold level of health capital where we will reach again to a situation where sector *H* will be indifferent between *IF* and no *IF*. The only difference between E_1 and E_2 is that, at E_1 the economy has low level of health capital resulting in *IF*, whereas at E_2 the economy has very high level of health capital implying that sector *H* has made its own infrastructure for intermediate health product. It implies after E_2 the economy will be indifferent between *IF* and no *IF*.

We state the results in the form of following proposition.

Proposition 1: *If* $[\Psi(N) - \Phi(N)] > 0$ *for* $N \in [N^1, N^2]$, *trade due to international fragmentation in health service sector will rise through trade liberalisation and foreign health capital mobility.*

2.1. The Drive towards Fragmentation and the Health Sector

An increase in N implies a fall in R. To examine the impact of an increase in N on X_H, we are modifying the Equation (9) as follows. Using Equation (5) in Equation (9) we get

$$(a_{NH} + a_{NI}\, a_{IH})\, X_H = N \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (9.1)$$

From Equation (9.1) we can argue that a reduction in R implies an increase in unit health capital demand of sectors *H* and *I*. Again a rise in N causes a rise in supply of health capital. Thus X_H will go up if change in supply of health capital dominates the change in demand for health capital. This is usual in case of a small open developing economy, because purchasing power of consumers of health capital in these economies is very low. From Equation (5) we can infer that an expansion of health care leads to an increase in X_I^f. From Equation (6) we can say that a rise in X_H causes an increase in X_A due to both—*Nutritional Efficiency Effect* (NEE) and *Factor Price Effect* (FPE). A fall in R will lead to a reduction in per unit labour demand in sector A. Thus from Equation (6) we can infer that, given nutritional efficiency factor, a movement towards health capital mobility will enhance the output level of sector A. We call it FPE. Again a rise in X_H implies a rise in nutritional efficiency of labour and hence it will cause an expansion of sector A. We call it NEE. Using these arguments from Equation (8) one can observe that there is another rise in X_H. The first rise in X_H as already mentioned, is mainly due to infrastructure developmental aspect of health capital mobility. However, the second rise

in X_H is due to two different aspects, first, because of nutritional efficiency aspect of health capital mobility on both types of labour and second because of the impact of international fragmentation. Regarding the first effect it is to be noted that an increase in X_H due to a rise in N leads to an increase in $\zeta(X_H)$ and $\gamma(X_H)$. From Equations (6) and (7) we can argue that a rise in $L\zeta(X_H)$ leads to an expansion of sector A and a contraction of sector M. A fall in X_M implies sector M releases some amount of skilled labour on one hand and on the other hand a rise in $S\gamma(X_H)$, due to rise in X_H, implies productivity of skilled labour will go up. Thus combining these nutritional efficiency effects one can say that sector H will definitely improve. Regarding the second effect we find that an increase in X_H due to rise in N leads to fall in X_I^d and rise in X_I^f. This is mainly due to the presence of international fragmentation. Thus contraction of domestic health intermediate goods producing sector implies availability of S and N to sector H will increase and hence output levels of health care will go up.

Proposition 2: *A movement from a regime of no fragmentation towards a regime of fragmentation (or towards a regime of international health capital mobility) leads to an increase in the levels of output of health care and a reduction in the level of output of the domestic intermediate health goods producing sector.*

3. CONCLUDING REMARKS

The present paper considers a four sector general equilibrium structure where the third and fourth sectors are intermediate health goods producing sector and health service sector respectively. In this model we have captured the positive production externality of health service sector for both types of labour through nutritional efficiency factors. In such a setup we have shown that a movement towards health capital mobility may increase the possibilities of health trade through international fragmentation. Thus policy makers can use the mobility of health capital as an instrument for controlling the volume of health trade through international fragmentation. Apart from this here we have examined the impact of trade liberalisation in the form of regime change on the output levels of different sectors, in the presence of a private health care. In this part we have shown that a change in regime from international health capital immobility to international health capital mobility, leads to an expansion of health service sector and hence it increases the demand of imported health intermediate product. Thus an improvement of health trade through commercial presence may uplift trade of health services due to international fragmentation.

Appendices

APPENDIX 1

1. Shape of $\Phi(N)$ Schedule

Initially we have assumed a very high and fixed intermediate cost for $N \in [0, N^0]$, it implies $\Phi(N)$ schedule is horizontal up to foreign health capital immobility. As we

have entered into the region of health capital mobility it implies the cost related to transaction and communication factors will decline because technology will be transferred from north to south and medium of communications and transactions will become more cheap compared to the situation of no health capital mobility. Thus it will be downward sloping for $N \in [N^0, N^2]$. Cost related to communication and transaction factors are declining is a fact but it will decline up to N^2 and after that $\Phi(N)$ schedule will become horizontal, as Φ will be fixed at its minimum value.

2. Shape of $\Psi(N)$ Schedule

Since R is fixed in the region of health capital immobility, it implies the left hand side of inequality (10.1) will also remain fixed and hence $\Psi(N)$ becomes horizontal for $N \in [0, N^0]$. As we move towards health capital mobility, we may have different situations and that will affect the shape of $\Psi(N)$ schedule. If initially we assume that fall in R dominates the increase in W_S and $\Psi(N)$ becomes upward rising and after a large amount of inflow of foreign health capital, the $\Psi(N)$ becomes downward sloping due to the assumption that an increase in W_S dominates the decline in R. Thus $\Psi(N)$ schedule will be of inverted U shape for $N \in [N^0, N^2]$. After N^2 it will be horizontal as R is fixed at R^f.

APPENDIX 2

Here we consider the following,

θ_{ji} = distributive share of the jth input in the ith sector and
σ_i = elasticity of factor substitution in sector i, i = A, M, I, H.

Differentiation of equation (4) gives us

$$\theta_{NH}\ \hat{R} + \theta_{NH}\ \hat{a}_{NH} + \theta_{IH}\ \hat{P}_I = 0$$

Now $\sigma_H = (\hat{a}_{NH} - \hat{a}_{IH} / \hat{P}_I - \hat{R})$

$$\hat{a}_{NH} = (\hat{P}_I - \hat{R})\sigma_H$$

Using it we get

$$\theta_{NH}(1- \sigma_H)\ \hat{R} + (\theta_{NH}\sigma_H + \theta_{IH})\ \hat{P}_I = 0$$

$$\hat{R} = -(A_2/A_1)\ \hat{P}_I \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (A.1)$$

Where, $A_1, A_2 > 0$.

Differentiation of Equation (3) gives us,

$$a_{SI}\, dW_S + W_S\, da_{SI} + a_{NI}\, dR + R\, da_{NI} = dP_I$$

From the envelop condition we get

$$W_S\, da_{SI} + R\, da_{NI} = 0$$

Using envelop condition we get

$$\theta_{SI}\ \hat{W}_S + \theta_{NI}\ \hat{R} = \hat{P}_I$$

Using (A.1) we get

$$\hat{W}_S = \{(1/\theta_{SI}) + (\theta_{NI}/\theta_{SI})(A_2/A_1)\}\ \hat{P}_I$$

$$\hat{W}_S = A_3\ \hat{P}_I \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \text{(A.2)}$$

Where, $A_3 > 0$.

Differentiating Equation (2) we get

$$\hat{r} = -(\theta_{SM}/\theta_{KM})\hat{W}_S \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \text{(A.3)}$$

Similarly from Equation (1) one obtains

$$\hat{W} = -(\theta_{KA}/\theta_{LA})\hat{r} \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \text{(A.4)}$$

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