ISSN 1811-5438

THE LAHORE JOURNAL OF ECONOMICS

Lahore School of Economics

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Volume 23, No.2 **July-Dec, 2018**

THE LAHORE JOURNAL OF ECONOMICS

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Publisher: Lahore School of Economics, Lahore, Pakistan.

Correspondence relating to subscriptions and changes of address should be sent to *The Lahore Journal of Economics*, 104 -C-2, Gulberg-III, Lahore - 54660 – Pakistan.

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23 2018

THE LAHORE JOURNAL OF ECONOMICS

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Inventory, Marketing and Markups of Exporters: The Case of Spinning, Weaving and Finishing Textile Sector of Pakistan

Imtiaz Ahmad* **and Zafar Mahmood****

Abstract

This paper studies the impact of inventory-intensity, marketing-intensity and firm size on the markups of exporting firms. We used audited financial statement data of publicly listed companies in the spinning, weaving and finishing industry within the textiles sector of Pakistan. We document five observations: 1) average markup of exporters is relatively higher than non-exporters; 2) there is higher dispersion in markups of non-exporters relative to exporters; 3) large firms have relatively higher markup and marketing-intensity; 4) firms which have higher marketing- and inventory-intensity also have higher markups; and 5) exporters have relatively higher markup elasticity with respect to marketing-intensity, inventory-intensity and growth in inventory-intensity.

Keywords: Markups, inventory intensity, marketing intensity, firm size, Pakistan.

JEL classification: F14, L11, L25.

1. Introduction

The analysis of markup determinants has a long tradition in international trade and industrial organization. The changes in firms' market power are typically measured by firms' markups. Previous studies within the international trade literature that incorporate features of monopolistic competition (e.g., increasing returns and heterogeneous firms) has recently included variable markups to create a clearer picture of international trade (Melitz and Ottaviano, 2008; Edmond, Midrigan & Xu, 2015; Melitz, 2018). The models which have utilized constant markup[1] are useful for explaining trade at extensive margins (i.e., which products are exported where), whereas, models that use variable markups are helpful in explaining trade at intensive margins (i.e., relative market shares of

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[1] See Melitz and Redding (2014) for a survey.

exported products). Therefore, models that include both factors are relatively better in explaining margins, as international trade fluctuates to adjust to a number of factors such as competition, trade liberalization and other policy interventions.

Most theoretical and empirical studies focus on market size and trade liberalization as the two key factors that increase productivity and decrease markups via increase in competition. However, firm-specific factors are not given appropriate share of attention in the international trade literature on markups. In this study, rather than focusing on demand-side factors directly, we analyse firm-specific factors that reflect the uncertainties of demand and demand creation features of a monopolistic firm to explain markup variations.

The literature providing explanations of firms' heterogeneity and international trade has evolved into three key parts: 1) a strand that primarily considers productivity and size (Melitz, 2003; Bernard & Jensen, 2004; Jean, 2002; Bernard, Eaton, Jensen & Kortum, 2003); 2) a strand that incorporates variables markups (Melitz & Ottaviano, 2008; Feenstra & Weinstein, 2010; Edmond, Midrigan & Xu, 2015); and 3) a strand that focuses on the impact of uncertainties (Feng, Li & Swenson, 2017; Handley, 2014; Lewis, 2014).

The first strand of literature primarily emphasizes firms' heterogeneity in productivity and size, which is symmetrically related to export participation, with exporters being larger and more productive relative to non-exporters within an industry. The theoretical approach of this strand of literature considers firms' price as constant markup over marginal cost (Melitz, 2003). Markups are considered as constant, though prices are tied to marginal cost of production, but the markup variations caused by factors such as demand creation, differentiation and uncertainties are ignored.

The second strand of literature incorporates variable markups in explaining firms' heterogeneity and international trade. The early empirical literature combined variable markups with differentiated products to estimate aggregated demand and supply for products (Berry, Levinsohn & Pakes, 1995; Goldberg, 1995). Feenstra and Weinstein (2010) estimated the impact of globalization on welfare via variations in markups that arise because of globalization.

The theoretical literature in international trade incorporates variable markups by combining the standard Constant Elasticity of Substitution (CES) demand system and imperfect competition, such as monopolistic competition with a small number of firms (Atkeson & Burstein, 2008) and large number of firms (Edmond et al., 2015). Melitz and Ottaviano (2008), an extension of Melitz (2003), have formally modelled variable markups along with productivity that respond to trade liberalization. All three frameworks predict that more productive firms have a larger market share and higher markups, and international trade increases competition and reduce markups. These pro-competitive gains from trade, caused by variable markups, whether under CES or non-CES demand systems, have increasingly become the focus of the recent literature in international trade.

The existing empirical literature that incorporates variable markups supports the pro-competitive effects of trade, as demonstrated in the first strand of literature mentioned above (i.e., trade has twofold impact on a particular industry). At the firm level, trade liberalization increases competition and decreases the market power of non-exporters, compelling firms to reduce markups. At the industry level, trade liberalization affects the markup distribution and reduces dispersion (Restuccia & Rogerson, 2008; Hsieh & Klenow, 2009; Lu & Yu, 2015). Contrary to these studies, there is also the possibility of negative pro-competitive effects causing labor reallocation towards more productive exporting firms, which internalizes the lower trade cost and increases markup (Edmond et al., 2015; Arkolakis, Costinot, Donaldson & Rodríguez-Clare, 2015).

The third strand of literature increases the focus on the impact of uncertainties on trade (Feng et al., 2017; Handley, 2014; Handley & Limao, 2015; Lewis, 2014; Nguyen, 2012; Novy & Taylor, 2014). These studies suggest that uncertainties decrease firm entry into the export market and decrease firm level exports, with the exception of Lewis (2014), who found that firms export more when they face inflation uncertainties.

Firms keep the finished output or intermediates as inventory to mitigate demand and supply-side uncertainties. The higher the stock of finished and intermediate goods, the better the firm is able to mitigate demand and supply-side uncertainties. Inventories are particularly important for exporting firms since they have to face more uncertainties relative to domestic firms. Exporting firms must deal with multiple factors affecting demand for their products in the destination markets. There is also cost attached to output and price adjustments that a firm makes to

account for cases in which their substantial growth in inventories occur in times of low demand, and also the greater opportunity costs of being out of stock. Although there is much literature on the issue of inventory adjustment under uncertainties (Novy and Taylor 2014; Alessandria, Kaboski & Midrigan, 2013; Tamegawa 2014), the literature on variable markups have little to say about the role of inventories in affecting a firm's markup and exports.

Firms under monopolistic competition, always and everywhere, are more interested in marginal revenue product than the value of marginal product from the inputs they employ. In simple words, firms are more concerned about generating additional revenue from the input they employ than they are about additional physical output in money terms. In this setting, firms are interested in the most profitable adjustments in overall expenditures, and therefore are bound to consider selling, distribution and marketing expenditure, the purpose of which is not to increase production but to get maximum sales revenue. Such expenditures are particularly relevant under monopolistic competition and serve as a tool of demand creation. However, the demand creation feature of monopolistic firms has remained completely disregarded in the literature on international trade and markups. Consequently, pricing and output decisions of firms have been studied in isolation from factors that can potentially affect the position or alter the shape of demand curve.

Our paper adds to the recent literature on variable markups and uncertainties. Our goal is to provide new empirical facts about the role of inventories and demand creation activities in explaining the variable markups of exporting firms. We choose a narrow industry within the textiles sector (spinning, weaving and finishing), which is a key exporting industry of Pakistan, and use audited financial statements of publicly listed companies for the period 2010 to 2015. The data is published in the form of annual financial statements by the State Bank of Pakistan. Our sample contains 91 firms, of which 25 are non-exporters and 66 are exporting firms. Our key findings, as we discuss in more detail below, are: 1) even in this narrowly defined industry the dispersion in markups of non-exporters is relatively higher than exporters, but mean markups of exporst are higher for exporters; 2) larger firms have higher markups and they market their products extensively; 3) firms which have higher inventory-intensity have higher markups but growth in inventor-intensity decreases markup; and 4) the magnitude of the impact of marketing-intensity and growth in inventory-intensity is higher in the case of exporters.

2. Markup Dispersion across Exporting and Non-Exporting Firms

We define markup as a percentage difference between selling price and cost per unit[2]. We start by reporting the distribution of markup of firms by their exporting status. The markups reported in Table 1 are averaged over a five-year period (2010-2015) and the mean markup for the whole sample is 11.78 percent. The exporting firms have a higher markup (12.31 percent) compared to non-exporters (9.11 percent). The dispersion in markups is as follows: 90-10 percentile ratio and 75-25 percentile ratio is less for exporters compared to non-exporters. The coefficient of variation of markups is 45.47 for exporters and 62.82 for non-exporters. We have considered relatively higher average markup and lower dispersion of exporters as our first key finding.

The relatively higher markups of exporting firms can be associated with higher quality and lower average cost of production. However, it is uncertain whether exporters charge different prices for export sales relative to local shares. On the other hand, Figure 1 shows the positive correlation between markups and export orientation, measured as ratio of exports in total sales. Even within exporters, markups marginally increase with the level of export orientation.

The relatively lower dispersion in average markups of exporters, as the literature suggests, indicates that they are more competitive relative to non-exporting firms (Melitz & Ottaviano, 2008). On the other hand, the higher average markup is associated with larger size, inventory- and marketing-intensity of exporters, as we discuss in more detail below.

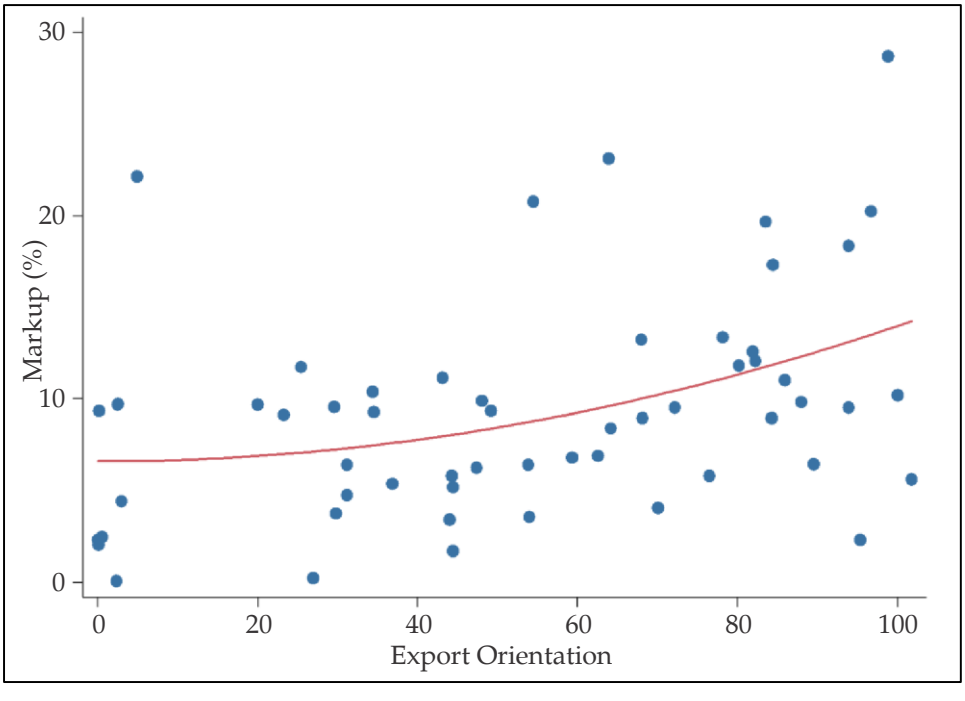
[2] Unlike most of the studies that use survey data, the issues of overstatement or understatement are negligible in the case of data based on audited financial statements. Therefore, instead of indirectly estimating the markups based on production data under a number of assumptions, as in De Loecker and Warzynski (2012) and other studies, we measure markups directly based on data from audited financial statements. For details on the measure of markup, see appendix.

Table 1. Dispersion in Average Markup* by Exporters and Non-Exporters

	Whole Sample	Non-Exporters	Exporters
Min	0.62	0.62	0.66
P5	2.09	0.79	2.37
P10	2.84	1.78	4.33
P25	6.83	3.23	8.23
P50	12.45	8.80	12.94
P75	15.72	14.74	16.25
P90	20.06	15.95	20.40
Max	29.78	20.15	29.78
Mean	11.78	9.11	12.31
Std. dev	6.55	5.72	5.59
P90/P10	7.07	9.47	4.72
P75-/P25	2.30	4.19	1.97
Coef. Var.	55.59	62.82	45.47
Observations	91	25	66

*Markups are averaged over 5 year
Source: Author calculations.

Figure 1. Markups and Export Orientation

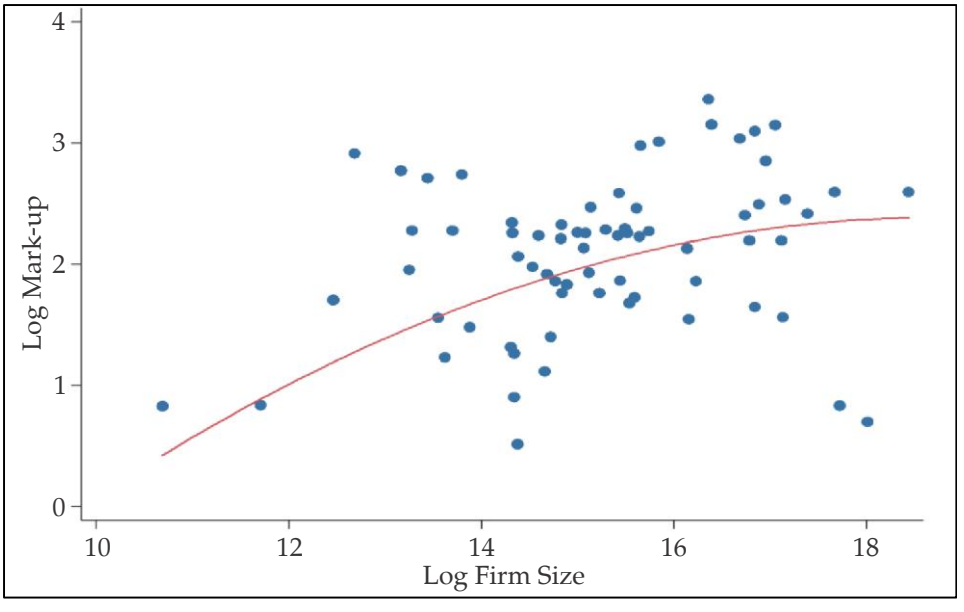


Source: Author calculations.

3. Markups, Firm Size and Marketing-Intensity

The literature also documents how markups are related to key firm characteristics. One of the key predictions in these models is that more productive firms have higher market share and are larger in size (Melitz, 2003; Bernard & Jensen, 2004; Melitz & Ottaviano, 2008). Motivated by these arguments, we focus on the relationship between markups and firm size. We take total assets, including total current and fixed assets, and use them as a proxy for firm size.

Figure 2. Markups and Firm Size



Source: Author calculations.

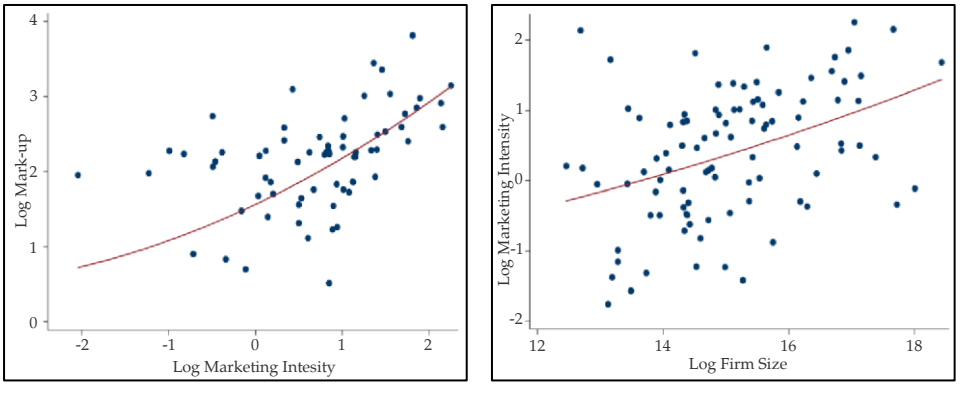
Figure 2 shows the relationship between markups and firm size. Overlaid on the scatter plot is a curve of quadratic fit. The markups are positively correlated with firm size. The elasticity of markups with respect to firm size is 0.14 (see Table 2, between effects), which is statistically significant. Atkin, Chaudhry, Chaudhry, Khandelwal & Verhoogen (2015) have also analysed markups in Pakistan's soccer-ball producers and have observed positive correlation between markup and firm size with an elasticity of 0.31. The theoretical literature that models firms as heterogeneous along a single dimension (e.g., productivity) predicts that more productive firms are larger in equilibrium—thus firm size is a proxy for a firm's entrepreneurial ability and productivity.

There must be fine line drawn between cost incurred for distribution, advertisement or marketing of products and production costs, especially under monopolistic competition. The former is completely ignored in the existing literature on international trade, firm heterogeneity and on variable markups. Attention has been confined only to price and quantity adjustments. Consequently, the firms' cost curve only comprises outlays for producing products to meet demand, and not to create demand.

Selling cost includes outlays for the marketing of varieties, margins granted to dealers/retailers, shelf costs, demonstrations of new goods, etc. There is no need for such costs if we assume that wants are constant and buyers have perfect knowledge. Otherwise, these costs can potentially affect the demand and, therefore, prices and profits. Firms which have different varieties, continue upgrading quality or possess other characteristics with respect to their products are likely to have higher costs of distribution and advertisement, due to higher salaries of salesmen, higher margins of dealers, window displays, or simply increased efforts to sell new products. Intensive marketing of products also indicates differentiation and demand creation on the part of firms. Moreover, quality competition is stimulated by informing a large number of potential consumers about the quality changes in the product, or even of existing qualities of which they may not be aware. Demand is satisfied more effectively if consumers are aware of the characteristics of the product. Secondly, marketing affects demand by altering the desires of consumers. We measure marketing intensity as expenditures on distribution, advertisement and marketing expenses related to sales as a ratio of costs of sales.

Figure 3.

Markups and Marketing-Intensity **Marketing-Intensity and Firm Size**



Source: Authors calculations.

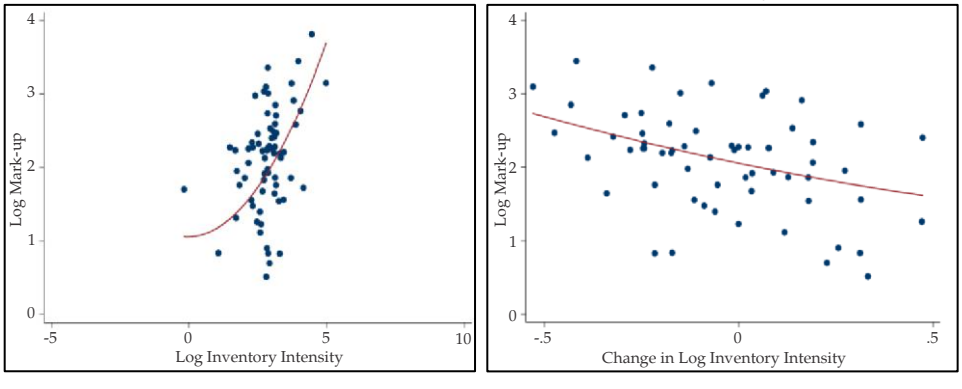
The left panel of figure 3 shows the relationship between markups and marketing intensity of firms. Firms which have higher marketing intensity have relatively higher markups. As discussed ealier, firms which spend more on marketing activity have higher markups. Such firms are likely to have higher quality, rapid changes and upgrades of products, or advanced and costly distribution channels. Marketing intensity is also correlated with firm size (see right panel of Figure 3) which indicates that large firms are better positioned to market their products.

4. Markups and Inventories

Inventories are an inevitable consequence of demand and supply-side uncertainties. It follows from the distinction between marginal revenue product and the value of marginal product that a firm's output decisions are more influenced by the marginal revenue product. The inventories are kept either in anticipation of higher marginal revenue product, via mitigating uncertainties, or they simply demonstrate the gap between demand and supply, which includes: 1) unsold output that becomes part of inventory, 2) output that is produced for later sales, or 3) the work-in-progress output and inputs, like materials and overheads.

Figure 4

Markups and Inventory-Intensity **Markups and Growth in Inventor-Intensity**



Source: Authors calculations.

Keeping goods in inventory can affect markups in many ways. Firstly, keeping inventory is costly. Secondly, inventories, if kept at an appropriate amount, may increase marginal revenue product via reducing losses in case of demand- and supply-side uncertainties. The literature linking markups, inventories and trade is scant and says little regarding the direction of the relationship. However, inventories really become

important in terms of their impact on a firm's markups and exports when they compel firms to make output and price adjustments.

The right panel of Figure 4 shows the ratio inventories measured at cost to the total cost of sales, which indicates the amount of output remaining unsold or kept for sales in a later time period relative to output which is sold. We call this the inventory-intensity of the firm. The positive relationship between inventory-intensity and markups shows that higher inventories put firms in a better position to respond to demand- and supply-side uncertainties. The left panel of Figure 4 shows the relationship between markups and growth in inventory-intensity. Positive growth in inventory-intensity relative to sales is associated with lower markups and decrease in growth is associated with higher markups.

What causes the negative relationship between markups and growth in inventory-intensity? Growth in inventory-intensity can be a result of an increase in output that is unsold and/or an increase in unused material or unfinished output relative to sales. There are costs involved in maintaining these inventories and firms incur these costs to avoid losses in the case of demand- and supply-side uncertainties. However, significant growth in the inventory-intensity is an indicator of deeper issues, such as an increase in competition, demand, or supply-side shocks. The negative relationship between markups and inventory-intensity also points to the presence of adjustment costs (Kryvtsov & Midrigan, 2012). In other words, a substantial increase in inventories relative to sales compels firms to adjust output or prices and these adjustments are not costless.

5. Markup Elasticities across Times and Firms

We estimate the within-effects and between-effects model to measure the markup elasticities with respect to size, marketing-intensity, inventory-intensity and growth in inventory-intensity.

$$Markup_{it} = \beta_0 + \beta_1 Size_{it} + \beta_2 Inv_{it} + \beta_3 \Delta Inv_{it} + \beta_4 Mrkt_{it} + e_{it} \quad (1)$$

We report different specifications of both within-effects and between-effects in order to keep in check the effect of possible relationships between size, inventory-intensity and marketing-intensity. Equations (1)-(4) in Table 2 estimate the markup elasticities over time with respect to a firm's size, inventory-intensity and marketing-intensity. The increase in size of a firm over time is negatively correlated with markups which may indicate the impact of an increase in the average cost of a firm as its size

increases. The elasticity of markup and a firm's size is strongly negative for exporters relative to the whole sample.

Firstly, an increase in marketing- or inventory-intensity over time does not affect the markups of exporters, but the relationship is positive and significant in the whole sample. Secondly, the impact of increase in size over time is higher in the case of exporters and size is not strongly correlated with marketing- and inventory-intensity as firm size does not change much and remains significant after including inventory-intensity and marketing-intensity variables. On the other hand, for the overall sample, inventory-intensity and marketing-intensities correlate with firm size.

Equations (5)-(10) in Table 2 estimate the markup elasticities with respect to size across firms. It is reassuring that larger firms have higher markups and the elasticity coefficients are also significant both for the whole sample and exporters. Furthermore, the markup elasticity with respect to size is relatively higher for exporters. The elasticity coefficients of markups with respect to inventory-intensity and marketing-intensity are also positive and highly significant. However, the positive correlation between size, inventory-intensity and marketing-intensity decreases the elasticity coefficient with respect to firm size in both whole sample and exporter equation.

Table 2. Markup Elasticities

	Within Effects				**Between Effects***					
	Whole Sample		**Exporters**		**Whole Sample**			**Exporters**		
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**	**(10)**
Log Size	- 0.34*	- 0.42**	- 0.51***	-0.50**	0.21***	0.04	0.14*	0.19***	0.06	0.21***
	(0.17)	(0.20)	(0.16)	(0.21)	(0.04)	(0.05)	(0.07)	(0.05)	(.05)	(.08)
Log Inv. Intensity		0.21***		0.11		0.33***			0.24**	
		(0.08)		(0.07)		(.09)			(.10)	
Δ Log Inv. Intensity							-0.61**			-0.67**
							(0.27)			(.32)
Log Mrkt. Intensity		0.23**		0.11		0.17***	0.33***		0.33***	0.57***
		(0.10)		(0.19)		(0.06)	(0.09)		(0.08)	(.13)
Constant	7.33***	7.81***	10.04***	9.47***	- 0.92	0.65	- 0.32	- 0.61	0.58	- 1.8
	(2.56)	(2.94)	(2.49)	(3.10)	(0.66)	(0.07)	(1.13)	(0.75)	(0.69)	(1.17)
R-squared	0.04	0.07	0.07	0.03	0.17	0.34	0.27	0.13	0.38	0.40
Observations	558	552	425	429	570	552	91	433	499	58

Notes: Table report elasticities of markups separately for whole sample and exporters. The between effects equations with change in log of inventory intensity is estimated with 2015 data only because data on inventories are available only for 2014 and 2015. Robust standard errors are reported. Significance *.10 **.05 ***.01.
Source: Authors calculations.

The coefficient of firm size in equation (9) is biased downwards because of positive correlation between firm size and growth in inventories. Equation (10), with growth in inventory-intensity, significantly improves the results and removes the bias. When controlling for export-intensity, as measured by export sales as a ratio of total sales, it does not significantly alter the markup elasticities of firm size, inventory- or marketing-intensities (See Table 2A). The negative relationship between growth in inventory-intensity and markup shows the presence of cost adjustments which have a significant negative impact on markups. Also, the markup elasticity with respect to marketing-intensity and growth in inventory-intensity is relatively higher for exporters, indicating the higher costs of adjustments that exporters have to face because of production and demand-side uncertainties and the greater positive impact of marketing activities.

Table 2A. Markup Elasticities

Variables	Within Effects	Between Effects
Log Size	-0.496**	0.217***
	(0.205)	(0.0779)
Log Inv. Intensity	0.100	
	(0.0729)	
Log Mrkt. Intensity	0.145	0.509***
	(0.188)	(0.181)
Δ Log Inv. Intensity		-0.664**
		(0.325)
Log Export share	-0.0564	0.0382
	(0.0831)	(0.0858)
Constant	9.607***	-1.969
	(2.974)	(1.241)
Observations	429	58
R-squared	0.050	0.409
Number of orgen	95	58

Note: Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1.
Source: Authors calculations.

6. Conclusions

In this paper, we have documented the dispersion in markups of exporters and non-exporters in the spinning, weaving and finishing industry within the textiles sector of Pakistan. Our findings are based on audited financial statements of publicly listed companies. Although, focused in this specific setting, our findings have important implications for the ongoing debate on variable markups and how to model it.

In relation to the literature on firm heterogeneity and variable markups, our main findings are: 1) aside from firm size, demand creation activities of firms also affect markups; 2) exporting firms are more competitive and have higher average markups which slightly increase with the level of export orientation; 3) growth in inventory-intensity has a negative impact on markups, which is relatively higher in terms of magnitude in the case of exporters; and, 4) the elasticity of markup with respect to size, marketing-intensity and growth in inventory-intensity is relatively higher for exporting firms.

Our findings suggest an important link between markups, inventories, and the demand creation feature of firms. It would be interesting to investigate whether these patterns hold in other settings. Even without assuming that these patterns would generalize, there is significant literature on uncertainties that indicate that firms adjust to uncertainties in a number of ways and the immediate impact of uncertainties is on inventories and output decisions. However, this issue is not well-represented in the literature on variable markups. Our findings also suggest that theoretical literature should account for the positive relationship between markups and selling and advertising costs.

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Appendix

The firm's profit is defined as the difference between total revenues and total costs i.e.

$$\pi_i = TR_i - TC_i = p_i q_i - c_i q_i - f_i$$

where p_i is unit price, q_i is quantity, c_i is cost per unit and f_i is fixed cost. The markup of firm i is defined as

$$p_i = (1 + \mu_i)c_i$$

where μ_i represents firms markup over marginal cost

$$\mu_i = \frac{(p_i - c_i)}{c_i}$$

Markup can also be represented in terms of total revenues and variables costs

$$\mu_i = \frac{(p_i - c_i)q_i}{c_i q_i} = \frac{TR_i - VC_i}{VC_i}$$

The Lahore Journal of Economics
23 : 2 (Winter 2018): pp. 19–48

The China-Pakistan Economic Corridor (CPEC): Considering Contemporary Pakistan through Old-Fashioned Economics and Historical Case Studies

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Abstract

As part of the massive One Belt One Road (OBOR) project or 'New Silk Road' the governments of China and Pakistan have announced that a significant 'corridor' will be constructed in Pakistan. This paper looks in detail at the $46 billion China-Pakistan Economic Corridor (CPEC) package of transport, energy and manufacturing projects and asks how we can analyse the impact of a transformative expansion of infrastructure. This paper draws lessons from various old-fashioned economics including Rostow, Hirschman and others and the historical case studies of transformative infrastructure expansion in the nineteenth century United States, Mexico, Germany and India to explore the conditions under which CPEC could promote sustainable long-run economic growth in Pakistan.

Keywords: Pakistan, China, China-Pakistan Economic Corridor (CPEC), growth.

JEL classification: O10.

1. Introduction

Much has been written about the China-Pakistan Economic Corridor (CPEC)[1]. Many of these writings are brimming with optimism such as the definition of CPEC as given by the Government of Pakistan, "a growth axis and development belt featuring complementary advantage, collaboration, mutual benefits and common prosperity." (2017:4). The promised investment in CPEC (US$46 billion) is enormous relative to the cumulative Foreign Direct Investment (FDI) Pakistan received between 1970 and 2001 (around US$7 billion) (Atique et al., 2004). CPEC can represent more than just a boost to economic growth. The explicit long-term commitment of investment can assist Pakistan in making a decisive

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[1] Thanks to three anonymous reviewers who provided very useful feedback and also to the scholars and students of the Institute of International Area Studies (IIAS) at Tsinghua University in Beijing where the final revisions of this paper were completed.

break with the decades-long dependence on the fickle whims of U.S. policy (McCartney, 2011). There is need for more careful reflection. CPEC is not due for completion until 2030 and Pakistan has a dire record of implementing and benefiting from large-scale donor funded projects – the unsuccessful Social Action Program (SAP) in the 1990s being just one such example (Birdsall & Kinder, 2010).

It is not easy to make a rigorous assessment about whether CPEC is likely to be an economic success. Economics, particularly its neo-classical branch, is very well suited to examining the impact of marginal changes to the economic environment. When it comes to how a new road, bridge or railway track will impact various markets and economic outcomes, economics has a well-developed methodology for doing just this – Cost Benefit Analysis (CBA) (see Gunasekara et al (2008) for an example in the South Asian region). The academic problem stems from the promise of CPEC – that it will represent a transformational and wide-ranging change to existing economic relations. These changes cannot be captured by a methodology geared to economic shifts at the margin.

This article offers a contribution to this theoretical and empirical dilemma. Often forgotten amidst the excitement surrounding CPEC is that, while it is unprecedented for contemporary Pakistan, there are many historical examples of transformational infrastructural change – among those discussed in this paper are the massive (much greater than CPEC) expansions of the railway systems in nineteenth century India, Mexico, the U.S. and Germany. This paper tries to draw out lessons from these historical case studies to inform our understanding of contemporary Pakistan. This paper will also make the case that there is a neglected body of economic theory more suitable to engage with such a question than CBA. This theory derives from the writings of the early development economists – like Rostow, Rosenstein-Rodan and Hirschman – whose starting point was not marginal interventions and consequent shifts in equilibrium, but was that of transformational change in the entire structure of an economy. While they were writing about the shift from a rural-agricultural to an urban-industrial economy we can profitably draw from their discussion to consider the possible impact of a transformational change in infrastructure.

This paper is organised as follows: section 2 examines the economics of geography to explain why transport infrastructure is important, section 3 introduces CPEC, section 4 examines the work of the early development economists, section 5 considers problems with existing

studies and proposes a possible methodology, section 6 considers the possible impact of CPEC on making markets more efficient, and section 7 on whether CPEC will more likely promote industrialization or deindustrialization in contemporary Pakistan. Section 8 concludes and draws together the lessons from this paper into a research agenda.

2. Why Transport Infrastructure is Important

The deep determinants of economic growth are those underlying factors that influence the ability of firms, households and the government to acquire land, labor, capital and technology. These factors are utilized to increase output and to do so productively. Other deep determinants of economic growth include institutions, history, culture and openness (McCartney, 2015).

The geography hypothesis argues that the geographical endowments of a country or state are the most important influence on long term growth and productivity. There are five major mechanisms through which geography can influence economic growth. These are proximity to or ownership of natural resources (Collier, 2007), state formation (Diamond, 1999), human health (Sachs et al., 2004), agricultural productivity (Bloom et al., 1998) and - of particular importance to this paper - transport costs. The economic analysis of infrastructure (and of CPEC in particular as discussed in this paper) is ultimately justified by the argument that geography has been shown to be a deep determinant of economic growth.

There is compelling evidence that geography has had an enduring and important economic impact. A global map showing GDP per capita in 1995 shows that tropical countries (those nearer the equator) tend to be poor, and also that landlocked countries are poorer than countries with access to the coast. Of the top thirty countries ranked by 1995 PPP-adjusted GDP per capita, only two are tropical (Hong Kong and Singapore), four are sub-tropical, and 23 are located in a temperate zone. This evidence uses single countries as data points such that India and the U.S. were considered coastal, despite having large portions of their land area located far from the coast. Nordhaus (2006) overcame the crudity of this early work by using gridded data. He divided the world into almost 20,000 data points, rather than the 150 country observations previously used. This approach allowed Nordhaus to use more finely tuned geographic data (including climate, location, distance from markets or seacoasts, and soils) which are organized by geography rather than political borders. Nordhaus confirms

the importance of geography and the significant positive link from temperate climates and costal location to economic outcomes.

Gallup and Sachs (1999) use data from 150 countries (with populations above 1 million) for the period 1960 to 1990 and control for the influence of economic and political institutions. They find four geographic variables (the prevalence of malaria, transport costs, the proportion of the country's population near the coastline, and endowment of hydrocarbons per capita) explain 69 percent of cross-country variation in per capita income. Bloom et al. (1998) examine data for 77 countries from 1965 to 1990 and find that the percentage of a country's land area in the tropics and the density of population within 100 km of the coast accounts for 73 percent of the income gap between Sub-Saharan Africa and East and Southeast Asia. The most important geographical variables Warner (2002) finds are tropical location, remoteness from the coast or a river, and mountainous terrain. In India the richest and fastest growing states in recent decades have tended to be coastal rather than landlocked (Kurian, 2000).

Transport costs are a product of geography and are those extra costs imposed by being a landlocked country, having population far from the coast or being far from domestic or large international markets. Transport costs are positively related to the distance of the country from core areas of the world economy and to the accessibility of the country to sea-based trade. Half of world trade takes place among countries located within a 3,000 km radius of each other (Gallup & Sachs, 1999). This is a particular problem for Sub-Saharan Africa. In 1990 the average distance of Sub-Saharan African countries from their trading partners was over 7,800 km and that Africa is also fragmented into nearly 50 countries each with an average four neighbours, many of which must be crossed to reach the coast. Coulibaly and Fontagne (2005) find that trade with the rest of the world is on average 60 percent lower for landlocked Sub-Saharan African countries. A specific example is the transport inefficiencies that impose significant cost on Ugandan exporters. These are most pronounced for railway connections through Kenya and the gross inefficiency at the Mombasa port. The route from Kampala to Mombasa should be one week although it is often as long as two months. This makes it difficult for exporters to book space on ships, departure times are often missed at high cost, and goods remain in port for long periods. Exporters rely on roads despite the high cost and increased risk of theft. The cost imposed on domestic producers by geography and inefficient transport was equivalent to an effective rate of protection of 48 percent on average in 1994 (Milner et al., 2000).

Any transport solution to the problems of geography will involve overcoming significant market failures. For a landlocked region in Pakistan (or another country), there are crucial external benefits to investment in transport infrastructure by regions or countries lying between them and the coast. Improving the railway line in the Punjab region, for example, would have little effect unless there was similar improvement to the line as it passed through Sindh or Balochistan on the way to ports in Gwadar or Karachi. Why should Sindh or Balochistan take into consideration those external benefits to investment for the Punjab region? This market failure relates to the external or spillover effects of transport infrastructure investment. There are also market failures related to the role of public investment in infrastructure creating profitable investment opportunities for the private sector. Crowding-in occurs when private sector investment is conditional or contingent on public investment. This is for various reasons, including the long-gestation of investments such as power-supply, the limited size of domestic capital markets, the risk of large investments without precedent in a developing country, and the fact that much of the benefit from such projects is external to the original investment. Investment in energy supply, for example, may not generate much return for the government but such investment may create profitable investment opportunities in private sector manufacturing (Hirschman, 1958). There has been some work on crowding-in of private investment in the Pakistani context. The general finding is that public investment has a positive impact on private investment (Khan, 1988; Hyder, 2001; Naqvi, 2002; Ahmed & Qayyam, 2007) though some argue the opposite (Ghani & Ud Din, 2006).

3. The China-Pakistan Economic Corridor

China and Pakistan have a long-established history of economic links. Bilateral trade and commercial ties were established in January 1963 with the signing of the first long-term trade agreement. In November 2006, China and Pakistan signed a free-trade agreement which was extended to services in 2009. China-Pakistan trade increased from a little over US$4 billion in 2006-07 to US$9.2 billion in 2012-13 (Sial, 2017). These trade policy agreements have recently been supplemented by a renewed emphasis on improving infrastructure. The construction of a nearly 3,000 km (1,800 mile) infrastructure link from Kashgar in Western China to the deep sea port of Gwadar in southern Pakistan was discussed during the visit to Pakistan of Chinese Premier Li Keqiang in 2013. The link became known as CPEC and includes oil and gas pipelines, railways, highways, special economic zones and fiber optic networks (Sial, 2017). CPEC is part of a huge infrastructure project that will involve more than sixty countries

known as the One Belt One Road (OBOR). OBOR has become an integral part of Chinese foreign policy under President Xi Jiping (Boyce, 2017).

There are deeper historical precedents for the construction of transport linkages in Pakistan motivated in part by the geopolitical-economic interests of external powers. The British constructed a railway to the Khunjerab Pass in Gilgit-Baltistan where it crosses into China. This renewed emphasis on railways linked up the border of Afghanistan in 1926. The Chinese constructed the 1300 km Karakoram Highway in the 1960s to connect Hasan Abdal in the Punjab region to the Khunjerab Pass in Gilgit-Baltistan where it crosses into China. The renewed emphasis on CPEC dates back to policy decisions in 2010 China to develop the western parts of China to close the gap in economic development with eastern and coastal China. The CPEC project has emphasized extending infrastructure and energy projects into Pakistan to link up western China with the rest of the world (Summers, 2016).

There is clear and widespread support for CPEC in Pakistan that was sustained through the change of government in Pakistan in the 2014 national election. The military have also confirmed their enthusiastic backing. To date the main exception has come from some minor regional nationalist parties in Balochistan (Sial, 2017). There is enormous and widespread optimism about CPEC; it "will be a harbinger of economic prosperity and well-being for Pakistan, China and the neighboring states" (Hali et al., 2015). CPEC is clearly in tune with the well-established government policy of giving priority to infrastructure, especially energy. There is good evidence that the provision of infrastructure in Pakistan is poor relative to large comparator developing countries and has become a significant constraint on economic growth (Loayza & Wada, 2012). CPEC is projected to cost US$46 billion, of which 71 percent is to be invested in energy, 4 percent in the Gwadar port, 8 percent in rail and 13 percent in road links (Boyce, 2017). The link to the port is likely to be highly significant, as in 2014-15 95 percent of Pakistan's foreign trade (US$46 billion of imports and US$23.7 billion of exports) transited through the three ports of Karachi, Qasim and Gwadar (Boyce, 2017).

4. How to Study the Economic Impact of Transformational Infrastructure

There is widespread agreement that CPEC will represent a transformational impact on Pakistan. "The CPEC is a growth axis and development belt featuring complementary advantage, collaboration, mutual benefits and common prosperity" (Government of Pakistan, 2017).

While conventional neoclassical economics offers a useful framework to analyze how marginal changes will push an economy towards a new equilibrium, it is a less suitable theoretical framework for examining transformational changes. There are various old-fashioned theoretical perspectives that can be called upon to analyze how a transformational change in the provision of infrastructure will likely impact economic growth. These theories date back to the early years of development economics when scholars were seeking to better understand the nature of the transformational shift represented by an agrarian economy undergoing industrialization.

There is a long-standing body of theoretical work, from those early years of development economics that emphasized the importance of a big push (something like CPEC) to launch a poor developing county into self-sustained economic growth. Rosenstein-Rodan (1943) argued for the simultaneous planning of several complementary industries on the basis that employment and income growth in each would create a corresponding demand for the output of the other industries and lead to broad-based sustained economic growth. Rostow (1956, 1960) places what he calls the take-off into a longer-term perspective and adds a discussion of complementary social changes to the focus on the economics. Rostow (1956) writes of a "take-off into self-sustained growth" when over two or three decades the economy and society transform themselves in such way that subsequent economic growth is more or less automatic. There is more to this than just policy change as these "[i]nitial changes in method require that some group in society have the will and the authority to install new production techniques" (Rostow, 1956,). Relevant for our study of CPEC is his argument that the "beginning of take-off can usually be traced to a particular sharp stimulus. The stimulus may take the form of a political revolution which affects the balance of social power and effective values, the character of economic institutions, the distribution of income, the pattern of investment outlays and the proportion of potential innovations actually applied" (Rostow 1960,). Could the unusually wide agreement in Pakistan encompassing both political and military elites be likened to such a Rostowian political revolution?

Rostow (1960) provides us with a useful framework in which we can analyze the success (or otherwise) of CPEC. A take-off, he argues, requires three related conditions. "Firstly, a rise in the rate of productive investment from 5 percent or less to 10 percent of national income. Secondly, the development of one or more substantial manufacturing sectors, with a high rate of growth. Thirdly, the existence or quick emergence of a political, social and institutional framework which exploits

the impulse to expansion in the modern sector and the potential external economy effects of the take-off and gives growth an on-going character." The relevance of this to contemporary Pakistan at first glance may appear a little tenuous. Pakistan boosted its investment from 5 to 10 percent of GDP and beyond in the early 1950s. Rapid manufacturing growth that created a modern industrial sector (textiles) can be dated back to the 1960s. The emergence of a pro-growth institutional framework has often been doubted, but it is nevertheless true that Pakistan has experienced an average of 5 percent GDP growth p.a. and, according to Word Bank data, not had a recession since at least 1960. This certainly can be considered growth with an on-going character. So perhaps here, we should modify Rostow: we should not be analyzing CPEC as potentially initiating a take-off, but as, at most, re-starting a stalled take-off.

Of more clearly obvious relevance from Rostow to Pakistan are his discussions of the wide variety of those leading sectors that can contribute to the take-off. Historically, Rostow noted this included, among others, the use of the steam-saw in the Swedish pulp industry (1890-1920), cotton textiles in Britain (1819-48), and the export of silk thread in Japan (1900-1920). Of more direct relevance to Pakistan is that Rostow argued that the 'growth and modernization of the armed forces' played a role as the leading sector in the take-off of Germany, Japan and Russia. Also of very clear relevance for CPEC is that Rostow (1960) argued that historically the introduction of the railroad has been "the most powerful single initiator of take-offs." He argues that railways were decisive in the U.S., France, Germany, Canada, Russia and played a very important part in Sweden and Japan. The railway had three major contributions to the take-off: firstly, lowering internal transport costs, bringing new regions and products to the market and widening the market for producers; secondly, generating large-scale exports; and thirdly, the expansion of the railway directly boosting the modern coal, iron and engineering industries. We must remember though, while the growth of the railway (think large scale infrastructure provision in CPEC) has generated self-sustaining economic growth, this has not always been the case. Rostow also argues that the expansion of railways was less successful in nineteenth century India and China, in Canada pre-1895, and in Argentina. This evidence indicates that there is nothing automatic about the benefits of CPEC and so we must be cautious regarding both the developmental benefits of big infrastructure projects and the widespread optimism surrounding CPEC in Pakistan and China. History offers many examples of otherwise productive investments failing to generate wider economic growth. The exemplar is the plantation or mechanized extractive sector. In such sectors the investment financing is often from overseas

developed countries, the output is entirely exported, much of the managerial expertise and capital equipment is imported, the consumption goods of senior managers are imported, and much of the profit from production is remitted back to shareholders in the home country. There are so few linkages with the domestic, host economy that such sectors can be likened to "domestic investment on the part of industrialized countries" (Weisskoff & Wolff, 1977).

Such thinking is not just a relic of colonial economic history (for example, it was much applied to the jute, tea and opium plantations of nineteenth century India). Even the software-IT sector in 1990s India bore many of these characteristics. Software was clearly a success in some ways. The IT sector in India experienced annual output growth of 30 percent p.a. for much of the 1990s. Total revenues of the IT services and software sector reached US$16.5 billion and exports US$12.2 billion in 2004-05, with the latter showing growth of 32.3 percent over the year. Such high rates of growth of output and exports had never been recorded by India's manufacturing sector (Balakrishnan, 2006). But during this decade the sector bore some uncanny resemblence to a nineteenth century tea plantation. Ninety percent of the output of the software sector was exported. This meant that production and resultant learning by software firms was geared to the needs of the high-technology economy of Silicon Valley in the U.S., so had little link with the needs of the developing country of India. Skills acquired by software engineers were more likely to lead to international migration and brain drain than those skills being transferred to other sectors in the domestic economy. The finished software and hardware used by the industry was largely imported meaning that net exports (of this very import-intensive sector) were actually much lower than the impressive headline figures (Chakraborty & Jayachandran, 2001; Balakrishnan, 2006; Kapur, 2007). However, there is increasing agreement that these enclave-like features declined in the 2000s, when software took on more of the characteristics of a leading sector (Kite, 2013).

The lesson from this particular concern is that we need to go beyond measures of the success of CPEC itself – freight volume at Gwadar or transit volumes on the new highways, for example. The expansion of one sector can promote wider economic growth through spillovers and these need to be carefully considered in any discussion of the CPEC. The theoretical literature identifies four channels through which spillovers may boost productivity in the host economy: imitation, skills acquisition, competition and exports. Imitation occurs when firms in the rest of the economy observe and copy production methods, and managerial and organizational techniques. Skills

spillovers occur when skills acquired through employment and participation in the leading sector are transferred elsewhere in the economy through the movement of labor. Competition spillovers occur when the lead sector compels other firms through competition to become more efficient and adopt new technology at an accelerated rate. Export spillovers may occur if the leading sector is able to export and so enjoy scale economies and increased exposure to global-leading technology (Gorg & Greenaway, 2004). There is a dearth of any work on spillovers and linkages from CPEC, which must be a research priority.

Theory reminds us that we should not forget politics. The intense debates among regional political leaders in Pakistan about re-routing CPEC to pass through their own political constituencies should be a timely reminder that support for CPEC is not just about its national benefits. We must not forget the local and the political considerations, as well. In their theory of white elephants, Robinson and Torvik (2005) demonstrate how infrastructure projects with negative social value may still be built. They see such unproductive investment as a means of inefficient redistribution that can only be credibly built by certain politicians who have a vested interest in a particular group or region. For such politicians these projects may be preferred to socially-efficient projects.

Our final lesson from old-fashioned theory is that transformational infrastructure is very different from marginal changes. Marginal infrastructure changes involve incremental gains such as alleviating bottlenecks, meeting obvious and immediate needs, cutting costs for producers and reducing travel time for commuters. The benefits from such changes should be quickly and clearly evident. The impact of a transformational change in infrastructure cannot be so easily measured or even anticipated. We are no longer considering just promoting a more efficient economy, but of "calling forth and enlisting for development purposes resources and abilities that are hidden, scattered, or badly utilized." (Hirschman, 1958). Economic growth then is not about the efficient allocation of resources, but if the "economy is to be kept moving ahead, the task of development policy is to maintain tensions, disproportions, and disequilibria" (Hirschman, 1958). In considering the success (or otherwise) of CPEC we should not expect to see only improvements but also considerable and often unexpected changes that may in turn be associated with significant adjustment costs, such as shortages of credit among firms desperate to expand, bankruptcy of firms no longer able to compete, and forced migration as workers move to growing areas.

5. Problems with Existing Studies and a Proposed Methodology

There are various existing studies of infrastructure, but they tend to be very narrow in their focus. Gulyani (2001) has studied the impact of the poor road system in India in the 1990s on the automobile firm Maruti. He found that poor roads directly raised the cost of freight, increased the cost of operations and maintenance (greater wear and tear and higher fuel consumption) and increased transit times making it longer to complete deliveries. As a result, Maruti was compelled to tie up large amounts of capital holding stocks and inventories. Gunasekara et al. (2008) examined the improvement of 350 km of roads in Sri Lanka in 1987 through the rehabilitation of two highways connecting Colombo and Kandy to the Northeast. This was not a transformative change but did lead to the number of vehicles on these roads increasing from 2000 to 8000 per day. After the renovation, firms near the highway were found to have more output, more employees, increased capital and reduced labor, more skilled employment and households living near the road experienced higher incomes.

Here, after examining old-fashioned economics, we can now turn to history which offers a wide range of case studies that bear a lot of similarity to CPEC. Recall that the route from Kashgar to Gwadar will be around 3,000 km (1,800 miles) and is scheduled to be completed over 15 years (2015 to 2030). The historical case studies have been chosen because they bear some important similarities to the CPEC in contemporary Pakistan. The infrastructure was built in then-developing economies largely through foreign investment, much of it mediated by a foreign government (typically the UK). Infrastructure in two cases led to rapid and sustained industrialization (Germany and the U.S.) and in the other two tended to boost agriculture or have a more muted impact on industry (Mexico and Russia). This distinction allows us to draw on contrasting experiences when thinking about possible lessons for contemporary Pakistan. Finally, the railways generated new economic opportunities, but in the context of the close presence to and competition with an industrially developed economy. For the case of India and Germany the leading industrial economy was the UK. The later constructions of railways in Mexico were overshadowed by both the UK and U.S., and in Russia by Germany, the UK and France.

In India the first railway tracks were laid in 1854 and the 4,711 miles of track in 1860 had expanded to 37,029 miles by 1920 (Hurd, 1975)[2]. In the U.S., railways were first laid in the 1820s and during the 1850s there was a boom in construction. The 1850s saw around 22,000 miles of track being laid (Haines & Margo, 2006). German railroad began later, in the early 1840s, and there were 14,518 miles by 1860 (Fremdling, 1977). In Russia the railway system grew from nothing in 1850 to 32,000 miles by around 1900 (Metzer, 1974). In Mexico the railway network expanded from 680 miles in 1880 to 12,400 miles in 1910 (Coatsworth, 1979; Dobado & Marrero, 2005). In each of these cases, there is ample evidence to suppose these changes did not represent marginal changes but were 'transformative'. Prior to the railroad era, goods transport within India took place on roads, rivers and coastal shipping routes. Bullocks were either employed as pack bullocks (goods strapped to backs) and travelled over pasture land or cart bullocks, which pulled a cart containing goods, and travelled along improved roads. Before the railways, the overland commodity transport was dominated by Banjaras who travelled with huge herds of bullocks that sometimes numbered 10-20,000. Such a herd could move 6-8 miles per day and could only travel for a few months a year when animals could find food and water and not during the monsoon. In a year, such a herd could move an amount equivalent to that which a railroad could carry over an equal distance in a single week. In 1860, grain sold 100 miles apart between Aligarh and Bareilly (a route dominated by Banjaras) showed a three-fold price difference (McAlpin, 1974). Water transport was superior to road transport though only feasible on the Brahamputra, Ganges and Indus river system. To travel between Ahmedabad and Calcutta, it took around 20 days downstream and two or three months upstream. Coastal shipping was perennially available along India's long coastline; ocean-going steamships were fast after 1840 and could cover over 100 km per day, but could only service major ports (Donaldson, 2010). From the outset, railroads proved far superior to road, river or coastal transport. Railroads were able to travel 600 km a day and offered superior speed, predictable timetables, through all months of the year and railroad freight rates were also much cheaper (Donaldson, 2010). In a sample of 188 districts, only 14 were served by railroads by 1860 and 99 by 1880. By 1867, 19 of the 20 largest cities had a railroad (Hurd, 1975). In nineteenth century Russia, pre-railway trade was conducted by river, canal and wagon. Waterways were

[2] Considerable debate remains about the motivation for this construction which has variously been explained by connecting cotton and rice producing regions to facilitate exports of these goods, to speed up troop movement between urban areas and to protect regions from crop failures (particularly after publication of the Famine Commission Report in 1880) (Andrabi & Kuehlwein, 2010).

frozen for six months a year. Transport had high cost and served only localized markets, and the volume of market output was relatively small, with much of it consumed or retained as a famine reserve (Metzer, 1974). In Mexico, there were no cheap alternatives to railway travel and the main population centers were far from the coast. As such, coastal shipping was not a realistic alternative (Coatsworth, 1979; Dobado & Marrero, 2005).

There have been various attempts to measure the impact of these transformative changes. Fogel (1966) pioneered a method called 'social saving' to measure the incremental contribution of U.S. railroads to the U.S. economy. He defines 'social saving' as "the difference between the actual cost of shipping goods in a year and the alternative cost of shipping exactly the same goods between exactly the same points without railroads" (Fogel, 1966). He argued that even by the later nineteenth century, the extensive system of existing and potentially expandable waterways in the U.S. offered a reasonable alternative to railway transport. Despite the enormous infrastructural costs, he argued, by 1890 the social saving of railways only amounted to less than 3 percent of GDP. He notes, for example, that the main wheat and cotton growing regions and bulk of iron ore deposits were all located close to natural waterways. Fogel (1966) also argued that (contrary to the ideas of the 'leading sector') the growth of the railways accounted for only around 17 percent of the output of total iron production, less than 1 percent of total lumber output and 6 percent of total machine production.

There are predictably many criticisms of Fogel and his pioneering method. Fogel makes strong assumptions about the feasibility and likely impact on the costs of transport by shifting from the actual railways to a counter-factual, the waterways. Fogel based his estimates on the actual market prices of waterway transport in the 1890s without accounting for the possibilities of rising costs if waterways were burdened with the extra traffic then carried by railways. Fogel makes no mention of the comfort and convenience of passenger travel. This activity generated 25 percent of operating revenues for the railroad companies in 1890. Fogel does not account for the importance to the U.S. of massive grain exports in the nineteenth century which provided the foreign exchange necessary to import the capital goods and technology needed for industrialization. The export of grain on a large scale would have been difficult without railways. While Fogel focused on the expansion of the cultivated area of grain he paid little attention to the greater ease of regional agricultural specialization and internal trade afforded by railways (as noted later in this article). Fogel also neglected to consider the impact of railways on risk and consumption patterns. The reduction of risk by reducing the vulnerability of previously self-sufficient regions and allowing

inter-regional and international trade is difficult to quantify. The more even flow of grain throughout the year via railways allowed consumers to move away from seasonal consumption patterns and to maintain consumption levels more evenly throughout the year (David, 1969; White 1976). The root of the methodological problem is that there are so many potential changes induced by a transformational change in infrastructure that it is impossible to convincingly account for all of them or more generally that there are "deficiencies of partial analyses, which accept the existing structure of prices and production" (David, 1969).

Another potential method which avoids many of these problems is a before and after comparison. Haines and Margo (2006), for example, measure rail access in the U.S. at the county level using information derived from maps to show whether a rail line passed through county boundaries in 1850 or 1860 (or both). They then link rail access data to county level information on economic outcomes in 1850 and 1860. They use a difference-in-difference approach comparing outcomes in the treated group (counties that gained rail access in the 1850s) with a control group before and after gaining rail access using 672 counties from 14 states. While more satisfying in some ways, this method couldn't be carried out in Pakistan until well after 2030 – when CPEC has been completed and we can begin thinking about comparing before and after. The method used in this paper is to draw from historical studies and think about their likely relevance for the case of CPEC in contemporary Pakistan.

6. Markets More Efficient

While this paper has drawn on old-fashioned economics, many of the historical case studies have also utilized very conventional economics and focused on how transformative infrastructure has influenced the efficiency of markets. The implication being drawn from neo-classical economic theory is that economic growth is best promoted with freely functioning and competitive markets. Such orthodox theory predicts that where a profit opportunity exists, somebody will take it. Where prices and profits are high, commodities will be moved until prices and profits decline to an average through arbitrage. Prior to railway construction in India and elsewhere, owing to prohibitive transport costs and absent information on arbitrage opportunities across much of the world, different regions and districts were not in the same market. Hence, prices differed widely across different climactic zones and the movement of these prices was unrelated. There is widespread evidence that transformative infrastructure led to price convergence.

In India, prior to the railways, some regions were perennially short of grain or had frequent famines, while others had a relative abundance of food. In the 1860s, the prices of grains in some districts were eight to ten times higher than the prices in others. In India the railways caused transportation costs to fall by approximately 80 percent per mile and trade in bulk goods was made possible. By 1910 almost 3 million tons of wheat were carried by rail amounting to around 30 percent of the wheat crop (and also 14 percent of the rice crop). Historical India has an abundance of food-grain price information that was collected by the British colonial state from 1861 onwards at a disaggregated level of detail. Price data reveals a decline in the coefficient of variation between districts from the mid-nineteenth to the early twentieth century, which coincides exactly with the era of railway construction (Hurd, 1975). Between 1876 and 1910, the coefficient of variation in the average prices of rice in around 70 sub-divisions of Bengal showed a secular decline and lower seasonal price variations (Mukherjee, 1980). Donaldson (2010) used seven million observations on district-level prices, output, daily rainfall and inter-regional and international trade in India. He found that railroads reduced trade costs, the responsiveness of prices to local weather shocks, inter-regional price gaps, real income volatility, and increased trade volumes and income levels. He found the timing of connection to a railway link was clearly correlated to rising real incomes in districts (by an average of 18 percent). Such links though had the effect of reducing income in neighboring districts by an average of 4 percent. The detail of this study was striking. Among other data, Donaldson (2010) used the all-India network of 3,614 meteorological stations that recorded the amount of rainfall at each station on every day of the year to link local rainfall to local crop output and combined these data with a newly created digital map of India's railroad network in which each 20 km segment was coded with its year of opening. One problem with such studies that purport to show railways were correlated with economic success is that they were often built in areas already experiencing economic growth. Haines and Margo (2006) for example found that gaining access to railways was correlated with existing access to water transport and that more densely populated areas were more likely to gain access to railways. Controlling for such factors reduces the effects significantly but preserves the impact of railways on market efficiency. Andrabi and Kuehlwein (2010) examine the effect of railway construction on price dispersion in annual retail wheat and rice prices in over 150 Indian districts between 1860 and 1920. They have found that railways can explain only 10 percent of the decline in the relative price gap that we observe over these 60 years. The bulk of the effect they suggest can be accounted for by other factors such as the spread of the

telegraphy and postal service which improved information flows, the construction of paved roads which improved road-based bullock transport, the greater peace and uniformity in the all-India legal system after the ending of the 1857 uprising, the spread of a single currency and the abolition of internal tolls which hindered inter-regional trade.

Elsewhere Dobado and Marrero (2005) have found that between 1885 and 1908 inter-state differences in corn prices declined in Mexico and that railways played a significant role. The speed of price convergence of those states with railroads in 1884 more than doubled those of the states without them. In Russia there was a clear decline in price differentials starting in the 1870s with the first surge in railway construction between wheat prices in Odessa and St Petersburg, as well as various other regional markets such as Odessa-Moscow and Riga-Moscow. There was a rapid commercialization of rye, previously a subsistence product, and a rise in the share of the harvest that was marketed. About 83 percent of the decline in price differentials could be attributed to railways, which induced a decline in transportation costs (Metzer, 1974).

The relevance of these studies for contemporary Pakistan is limited. Even before CPEC was launched, there is evidence that markets were already efficient in Pakistan. Price data show that there was rapid convergence of prices across ten major cities of Pakistan between 2000 and 2011 (Alam & Bhatti, 2014), 35 Pakistani cities between 2001 and 2008 (Mohsin & Gilbert, 2010), and of food commodities (but less so other commodities) between 35 Pakistani cities between 2001 and 2011 (Ghauri et al., 2013). Therefore, the benefits of CPEC infrastructure are not likely to emerge from more efficient price convergence and the creation of national markets.

A key result from this work is that some regions gain and some regions lose. In India by 1914, around 18 percent of agricultural production by value was marketed over long or medium distances. This generated a process of greater regional specialization in the cultivation of market-oriented cash crops such as cotton, sugarcane, indigo, and poppy. Across India cultivation shifted to high yield areas and away from areas close to rivers. Cotton cultivation came to an end in low yield areas in the United Provinces (which grew a low-quality, short-staple variety) and Central, Northern and Eastern Oudh. Cotton became increasingly concentrated in the Middle Doab where yields were highest and where the plant could be sown early as part of the double cropping mix (Derbyshire, 1987). The United Provinces became the great sugar-province of the sub-continent with a 30-50 percent increase in its sugarcane acreage being recorded between

1860 and 1895. During the same period, sugarcane acreage fell in Western and Central India (Derbyshire, 1987). All these changes generated winners and losers. In the United Provinces there is no reason to suppose cotton farmers who lost out could have transferred production to benefit from growing sugarcane. As noted above, Donaldson (2010) has found that districts adjacent to newly constructed railways experienced income increases and those further away experiences declines in income. This is not surprising as businesses may go bankrupt or seek to re-locate in areas further away from railway lines to participate in new growth opportunities. There is the danger of polarization in response to growing inequalities of opportunity created by transformative infrastructure. This is highly relevant for the case of contemporary Pakistan which has long experienced striking regional inequalities in economic growth (Zaidi, 1992).

Recent work has emphasized that patterns of specialization have different implications for long-run economic growth. Specialization in agriculture or low-technology production may lock-in a region or country to long-run patterns of slower economic growth (Deraniyagala & Fine, 1999). In this view the very efficiency of the railway system in nineteenth century India (or, as discussed below, Mexico) locked the economy into long-run slow economic growth.

A key safety valve for regional polarization has historically been the migration of people from the poor to the fast-growing areas of the economy. If a region or state has 'poor geography', the constraint to aggregate growth can be overcome by people moving to better endowed regions/states. Hundreds of millions of people in contemporary India remain stuck in the Gangetic heartland, in some of the poorest states - Madhya Pradesh, Rajasthan, and Bihar. There is no indication of mass migration to the more rapidly growing coastal states of Gujarat or Maharashtra, for example. India has long been handicapped in this regard by relatively low levels of migration. There was little migration and wage convergence in the nineteenth century (Collins, 1999) and this pattern continued into the period between 1960 and 1990 (Cashin & Sahay, 1996). A representative sample of rural Indian households found that the likelihood of male migration actually declined between 1982 and 1999 despite growing wage inequality between states and urban-rural areas (Munshi & Rosenzweig, 2005). In India "[t]he highest level of movement are recorded within the same district. The flow of migrants across state lines is a trickle. Since 2001 there has been a slowdown in permanent or long-term migration" (World Bank, 2009). By contrast, in the more mobile U.S., over the course of a decade a quarter of the population changes its

state of residence (World Bank, 2009). In China over the 1980s and 1990s perhaps 100 million people moved from inland to rapidly growing coastal China. This immobility in India has been ascribed to various reasons: the location-based welfare programs such as subsidized food and land reform, the restrictions on marriage outside the sub-caste/jati which restrict partner choice to a local pool, kinship- and caste-based insurance networks that would be undermined by migration, and the enormous linguistic, religious and caste diversity. Migration in India is also associated with constructed political constraints. The influential Shiv Sena party in Mumbai, for example, have a dedicated program to keep the city a preserve of the locally born. Pakistan, by contrast, was a country born of migration. Soon after independence, more than 50 percent of the populations of major urban areas - Karachi, Lahore, Hyderabad - were composed of migrants. There are no directly comparable studies with India, but evidence for Pakistan suggests migration has continued at a high level over the subsequent decades (Perveen, 1993). Tension and conflict have been prevalent, such as conflict over jobs and urban living space in Karachi during the 1990s, but this hasn't hindered long-term migration. By 2000, ethnic Sindhis were a tiny minority of the urban population of Sindh (Ahmar, 1996; Khan, 2002).

The other important lesson we can learn from this historical literature is that infrastructure, even if transformative, is not sufficient to create efficient markets and ensure the flexible allocation and re-allocation of commodities and factors of production. Estimates of the impact of railway infrastructure on price convergence ranged from 10 to 80 percent of the total convergence. In contemporary Pakistan there are well-documented constraints on economic growth that will not be tackled by transformative infrastructure. These include competition from other countries such as Vietnam, corruption (in 2013 Pakistan ranked 127 from 175 countries in the Corruption Perception Index produced by Transparency International, TI), regulatory burdens, the business climate, political instability, and the availability of skilled labor (Amjad et al., 2015).

7. Industrialization or De-Industrialization

To understand more fully the impact of transformative infrastructure in the historical settings discussed in the previous section, we need to go beyond the neo-classical assumption that efficient markets are necessarily good and ask instead, efficient at what?

Various authors have argued that the railways in colonial India were so efficient that they facilitated the import of British manufacturing goods and undermined domestic industrialization in India. The arrival of the Indian railways coincided with a significant change in the composition of exports, imports and domestic production. In the nineteenth century, new export commodities emerged such as indigo, opium and cotton. India's traditional cotton textile industry declined between 1820 and 1860. Initially, the export market for Indian cloth disappeared, and later, hand-spun cotton yarn and handwoven cloth declined in response to competition from imports of yarn and cloth produced in English mills (Roy, 2002). By 1880-81 British manufacturers were supplying more than half of total consumption (Habib, 2006). Other sectors to decline were the jute handloom weaving and silk of Bengal, Kashmir shawl manufacture in Srinagar, hand paper, glass, and iron (Habib, 2006).

More efficient markets did not prevent devastating famine. The estimated mortality from starvation and disease crossed 1 million in the Deccan in 1876-78, and North West Provinces in 1877-78. There were country-wide famines in 1896-97 (an estimated 4.5 million dead) and 1899-90. The Orissa famine in 1865-66 was clearly a pre-railway age famine, as crops failed in an area without roads and ports and the region could not receive supplies from outside. It was expected that as the railway network spread, supplies would move in from cheaper/surplus areas and famine would be alleviated. The famine in 1868-69 in the North West Frontier occurred in an area well-supplied by railways and so refuted this notion. The railways had instead facilitated a general shift to producing cash crops for trade rather than food crops for local consumption. The output of food crops per head stagnated in British India from 282.41 kg in 1885 to 287.95 kg in 1895 (Habib, 2006). The second effect of the railways was to connect inland areas to ports which facilitated the export of food-grains, especially rice and wheat. In 1875, British Indian ports exported 1.22 million tons of food-grains and in 1895 about 2.49 million tons, representing 2.3 percent and 3.9 percent of estimated food-grain production, respectively. In 1896-98 and 1899-90, exports would have been enough to avert famine (Habib, 2006). Others have emphasized the more positive efficiency impacts of the railways. The Indian National Congress met for the first time in Bombay 1885 and could not have done so with the railways which brought in delegates from the provinces. If railways contributed to colonial exploitation, then they also contributed to the growth of nationalism. The growing Indian press depended on railways for their circulation (Rothermund, 1993). The postal system was started in the 1850s and mail was carried by the railways. The number of letters and packets carried by post increased from 85 million in 1869 to 1,043 million in 1914 (Habib, 2006).

Another example is that of Mexico in the Porfirian era (1877-1910). Before the railroad, Mexico depended almost exclusively on overland transportation. Mexico, unlike Russia, the U.S. and Britain, had no river system suitable for use in transport. Most of the Mexican population and economic activity has traditionally been located far from the two coasts in plateaus and mountain valleys, so coastal shipping never played the role it did in Europe and the U.S. Unit savings on railway freight operations were enormous, with an estimated social saving of around 25 percent of GDP. Local entrepreneurs and foreign capitalists responded to changing market incentives with the result that modern mining and agricultural export industries boomed. Railroads promoted Mexican economic growth by reinforcing the country's comparative advantage in the production of minerals and, to a lesser extent, fibers for export. On the Mexican Central Railway (the longest in Mexico) minerals and fibers amounted to 1.3 percent of total freight tonnage in 1885 and 58.2 percent in 1908. It is likely that the export sector received at least 75 percent of the benefits of the operation of the railways in Mexico by 1910. The construction and operation of the railways was also heavily import-dependent. Imported inputs as a percentage of total operating costs increased from 29.3 percent in 1896, to 48.0 percent in 1900, 25.1 percent in 1905 and 32.3 percent in 1906. The extreme levels of export- and import-dependence of Mexico during these years meant that the railways generated very few backward linkages to stimulate domestic industry. Railroads were constructed and operated with rails, locomotives, rolling stock, spare parts, iron bridges and supervisory/engineering personnel imported from abroad. On occasion, even fuel (coal and wood), ties for laying tracks and unskilled labor were imported (Coatsworth, 1979).

In nineteenth century Germany, by comparison, the railways stimulated widespread backward linkages to local industry. When railway construction began in the mid-1830s, the German engineering and iron industries were backward and not capable of producing the main investment goods such as rails and locomotives. For example, in 1835 more than 90 percent of the pig iron was produced in small charcoal-using furnaces. In the first years of railroad construction, foreign, mainly British, suppliers dominated the market. By the beginning of the 1840s, the substitution for these imports by domestic production had begun. Many iron processing plants using modern British technology were established and existing ones enlarged their capacity. By the 1850s, most of the rails were produced in Germany. After 1854, all locomotives except a few from Austria were supplied by German producers (Fremdling, 1977). The sequence and speed of import substitution was promoted by a tariff policy that protected

the wrought-iron industry by levying heavy duties on all processed iron products. Catching up with British technology was possible through deliberate imitation and borrowing. Foreign technology was transferred through leading German manufacturers traveling and studying in France and Britain, through employment of French, Belgian and British engineers and skilled workers (for example, puddlers and roll-masters), and through foreign investors founding firms, especially French ironmasters in the Ruhr and Rhine area (Fremdling, 1977). This was a general process of the state taking on a more direct and guiding role in relation to domestic industry after 1840. The state promoted infant industry through tariff protection, state investment, public-private cooperation and various subsidies. The state also gave scholarships to promising innovators, subsidies to competent entrepreneurs, and directly facilitated the organization of new machinery and industrial processes (Chang, 2002).

There is a well-established body of literature that explores the criteria necessary for a state to be developmental in the style of nineteenth century Germany and so ensure that the benefits from a project like CPEC promote domestic economic growth rather than leak out overseas. These pre-conditions include: that leaders have a politically-driven desire to promote growth; that state institutions are autonomous; the bureaucracy is competent and insulated from politics; that civil society is weak; and that the state enjoy widespread legitimacy, whether of the democratic variety or other (Leftwich 1995, 2000). Unfortunately, there is good evidence that the capacity of the state in Pakistan is declining. The Global Competitiveness Reports compile indices, ranging from 1 to 7 (7 being the best) to measure various aspects of governance. Table 1 compares the reports from 2006-07 and 2014-15 which reveal a widespread deterioration in state capacity, across the quality of institutions, judicial independence excepted, favoritism in government decision-making, waste in government spending, and an improving if poor measure of the reliability of the police.

Table 1: Declining State Capacity in Pakistan

Measure of Governance	2006/07	2014/15
Quality of Institutions	3.5	3.2
Judicial Independence	3.3	3.8
Favoritism shown in decisions of government officials	3.1	2.6
Wastefulness of Government Spending	3.5	2.6
Reliability of Police	3.1	3.1

Source: World Economic Forum (2006). *The Global Competitiveness Report, 2006-07*, Geneva, Switzerland and World Economic Forum (2014). *The Global Competitiveness Report, 2014-15*, Geneva, Switzerland.

One practical example is the Medium-Term Development Framework for 2005 to 2010, launched by the Government of Pakistan with the aim to provide basic infrastructure to promote sustained economic growth. The effort was evaluated by the Asian Development Bank (2013). The evaluation found that efforts at inter-departmental cooperation and coordination were a failure and the work was eventually implemented separately by line ministries. A significant lack of government capacity to identify projects through feasibility studies and to bring them to the bidding stage was also noted, and the government was unable to ensure contract and licensing enforcement. The absence of a long-term debt market and no long-term financing was identified as an enduring constraint on infrastructure financing. Not surprisingly, almost none of the targeted outcomes were achieved in practice.

As noted, the developmental state theorists argue that a key criterion for a state to be developmental is a bureaucracy that is autonomous and therefore empowered to take a long-run growth-promoting view of the economy that is not side-tracked by the populist and short-term demands of politicians. The reality is very different in contemporary Pakistan. State capacity is declining and the state has become increasingly subordinate to the demands of civil society. The relationship between state and society in Pakistan is one of patronage between politicians and supporters or dependents, such that "people gain access to patronage by using their position within a kinship network to mobilize support for a politician who then repays them in various ways in office, or by using kinship links to some policeman or official to obtain favors for relatives or allies" (Lieven, 2011). The process can be likened to state fiscal resources being "nibbled by a plague of mice" (Lieven, 2011). The state fails to provide public services such as water, education and power, because it is too weak to raise tax revenue and to control corruption among state officials. Corruption is not just about individual gain but is also for patronage, whereby state resources are recycled by politicians to win, retain and reward supporters and kinship groups.

8. Conclusion and a Research Agenda

There is widespread agreement that CPEC is a transformative infrastructure project and will be a success. It has become a key part of the discourse surrounding the contemporary debate on the economics of Pakistan. It is worth pausing here, as while there is much research on the geopolitical implications of CPEC, there is very little existing research on the likely economic outcome of the CPEC.

Old-fashioned economics has given us some key theoretical ideas from scholars who thought in terms of transformational changes – usually the shift away from a rural-agricultural economy to an urban-industrial one. Such theory gives us the means to think about the likely impacts of CPEC and of some of the preconditions for it to be a success. A key idea is that of leading sectors, where one sector expands and pulls up the wider economy through positive spillovers. While the CPEC could become a leading sector there are plenty of historical examples of expensive infrastructure projects than ended up in costly and splendid isolation from the rest of the economy. The decaying and underused Olympic Games projects in many countries are perhaps the most notorious such examples. The current and likely spillovers need to be studied further, focusing on those relating to imitation, skills, competition and exports. We must also give careful consideration to the politics of CPEC. Does the wide support for CPEC represent a Rostowian elite commitment that will help ensure it works successfully? Does CPEC represent a new national idea or consensus that has eluded so many other reformist efforts in the past? Are its many supporters genuinely anticipating that it will contribute to the national economic revival of Pakistan or hoping that some of the resources associated with its construction and operation will benefit them and their constituents? History offers us much evidence of the impacts of transformational infrastructure, their successes and failures. We can draw from these studies and their various methodologies of counter-factual history and before-after approaches to think carefully about whether CPEC is likely to be successful in contemporary Pakistan.

There is widespread evidence that transformational infrastructure does tend to make markets more efficient in the sense of reducing time and spatial price divergences. This is of little relevance for contemporary Pakistan where spatial price differences have already tended to converge before the launch of the CPEC. The potential transformational impact of CPEC needs to look for changing patterns of regional specialization in production and its impact on changing patterns of migration.

Further we need to ask the question of efficient to accomplish what? Improved markets and transport links between China and Pakistan could lead to the growth of manufacturing production in Pakistan, to Pakistan being bypassed and becoming merely a transit route for Chinese exports travelling to the rest of the world, or for Pakistani manufacturing production to be displaced by imports from China. Each of these outcomes could represent the working of efficient markets. A brief consideration of Pakistan offers little cause to be optimistic. Existing studies looking at the

constraints to manufacturing growth need to be reviewed. Just how important is infrastructure as a constraint relative to absent long-term credit, education, political instability, governance and difficulties in accessing land for industrial development. The Pakistani state has no vision to utilize the construction of CPEC to promote domestic industrialization. There is no indication that a domestic industrial policy will be utilized to ensure that the opportunities of CPEC are manifested in domestic industrial growth rather than in more industrial imports. The Pakistani state lacks the capacity to be developmental even if it did seek to acquire and utilize just such an industrial policy. Recent evaluations of efforts to promote infrastructural growth have been negative. There is a need for more research certainly, but perhaps also for a dash of realism about the prospects for CPEC.

There is much of importance that this article does not cover that could also be considered in future studies. Firstly, the focus of this paper is narrowly on economic growth rather than issues of wider development. The likely impact of CPEC on livelihoods would represent an important extension of this research. While CPEC is promising the creation (or diversion) of at least 30,000 security posts to protect its investments (Boyce, 2017), others will inevitably have to surrender their lands and associated livelihoods for the construction of the new infrastructure. Secondly, this article does not consider the financing of CPEC. Will it lead to excess profits among outside investors supported by government guarantees and subsidies? This was one mechanism by which the economic advantages of railways in colonial India were argued to have benefited the British rather than the domestic Indian economy (Habib, 2006). Will CPEC lead to an excessive level of external debt creation and so to long-term debt dependence? Here there are grounds for some optimism. The US$12 billion financing of infrastructure has been undertaken at interest rates of around 1.6 percent (Boyce, 2017). This is more generous lending than, for example, the high interest rates used to finance massive developing country infrastructure investments in the 1970s that collapsed in the global debt crisis of the 1980s. Finally, this article focuses on the infrastructure side of CPEC rather than the energy investments – the latter has already been widely researched and the benefits of better electricity supply seem much more clearly apparent (Siddiqui et al., 2011).

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The Lahore Journal of Economics
23 : 2 (Winter 2018): pp. 49–68

Variance Persistence in the Greater China Region: A Multivariate GARCH Approach

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Abstract

This paper utilizes three Multivariate General Autoregressive Conditional Heteroscedasticity (MGARCH) models to determine variance persistence in the Greater China region from 2009 to 2014. The first approach applies the Baba, Engle, Kraft and Kroner (BEKK) model and shows that the Shanghai Stock Exchange Composite Index (SSEI), Taiwan Capitalization Weighted Stock Index (TAEIX) and the Hang Seng Stock Index (HSEI) stock returns are all functions of their lagged covariances and lagged cross-product innovations. The second MGARCH approach applies two methodologies, namely, dynamic conditional correlation (DCC), and constant conditional correlation (CCC) estimations. The DCC model concludes both short- and long-run persistencies between Taiwan's TAIEX and Hong Kong's HSEI. Alternatively, the CCC model confirms the initial findings of the BEKK model, and adds that the relationships among these three strong economies are stable in the long-run. The log-likelihood values determine that the DCC model is better in judging volatility dynamics in the Greater China region, because of economic clauses brought by the Closer Economic Partnership Arrangement (CEPA), the Economic Co-operation Framework Agreement (ECFA) and the Hong Kong - Taiwan Business Cooperation Committee (BCC).

Keywords: Greater China Region, stock market returns, volatility dynamics, MGARCH models.

JEL classification: C30, P45.

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1. Introduction

The Greater China Region is a label generally used to refer to the economic and cultural ties among the relevant territories of China, Taiwan and Hong Kong. With the implementation of free market reforms and subsequent opening to global trade in 1978, the economy of mainland China has become one of the world's top economic performers. Hong Kong is one of the Asian region's main economic hubs, having an economy that has become a center of financial and high-technology industries. Taiwan is consistently one of the fastest growing economies in East Asia with its strong reliance on electronics and semi-conductor industries.

The growing integration within the Greater China Region has become more evident with signed trade agreements among these economies. The return of Hong Kong's sovereignty to mainland China in 1997 led to stronger integration between these two economies, paving the way to the signing of the Closer Economic Partnership Arrangement (CEPA) on 29 June 2003. The CEPA aimed to decrease restrictions like tariffs and quotas to ensure a smoother flow of goods and services between China and Hong Kong. The arrangement also agreed to follow the international rules mandated by the World Trade Organization (WTO). Mainland China is currently the largest trading partner of Hong Kong with a total trade of US$73.34 billion of exports, which accounts for 42% of Hong Kong's total exports; and US$38.87 billion of imports, or 16% of total imports (WTO, 2014). CEPA is an agreement that brings benefit to both China and Hong Kong by providing greater access for Hong Kong's businesspeople to invest in Mainland China, while the latter could use the former's economy as a springboard to reach out to the global market (Trade and Industry Department, 2012).

Taiwan's economic relationship with China was also strengthened with the signing of the Economic Co-operation Framework Agreement (ECFA) in June 2010. The agreement further expanded their bilateral trading relationship, as well as their commercial linkage with the rest of the world (Morrison, 2003). The ECFA boosted the current total exports of China to Taiwan by approximately US$7.88 billion (4.5 per cent), while the total imports account for 2.5 per cent, which is valued at US$5.91 billion (WTO, 2014). This has made Taiwan one of Mainland China's top ten main trading partners. The economic transaction between China and Taiwan is expected to grow further with the signing of the Cross-strait Service Trade Agreement (CSST) on 21 June 2013.

Taiwan's close economic relationship with Hong Kong was cemented in April 2010 with the establishment of the Hong Kong-Taiwan Business Cooperation Committee (BCC). Each of the two economies is the other's fourth largest trading partner. This trading relationship is also expected to expand with the Taiwan-Hong Kong Economic and Cultural Co-operation Council (THEC) serving as the discussion platform from which economic and public policies can be coordinated between the two economies. This will also serve the interests of Mainland China. In 2013, a total bilateral trade of US$34.6 billion was routed from Taiwan to Hong Kong to China (Hong Kong Economic, Trade and Cultural Office, 2014).

The economic integration in the Greater China region has become an important topic for Asian economists, as the region, particularly China in recent decades, has been experiencing noteworthy growth. This is the primary motivating factor of our study and, to the best of our knowledge, studies on the volatility correlations among the region's major stock markets are still unchartered. This research explores the application of multivariate GARCH models to the stock markets of Shanghai Stock Exchange (SSEI), Taiwan Stock Exchange Index (TAIEX) and Hong Kong Stock Exchange (HSEI). The paper is motivated by the absence of empirical studies looking at the volatility linkages of the Greater China Region using MGARCH models.

MGARCH models are formulated to model conditional covariance matrices of multiple time-series, which offer relevant information on risk measures and spillover related to a set of financial instruments. The first MGARCH model was introduced by Bollerslev (1990), through the constant conditional correlation (CCC) model. The CCC model improves the estimates by using non-parametric models, and by extending the correlation to a more adaptive model. The second MGARCH model was proposed by Engle and Kroner (1995), through the synthesized Baba, Engle, Kraft and Kroner (BEKK) model, which allows cross dynamics of conditional covariances. Engle (2002) augmented a constrained dynamism in the correlations through the dynamic conditional correlation (DCC) model, in which the dynamics are limited to be equal for all correlations.

This paper analyzes the volatility dynamics among SSEI, TWSE and HKSE using three multivariate volatility models, namely diagonal BEKK, CCC and DCC. The paper also compares the performances of these models to identify which of the multivariate methods considered is best to model the stock markets of the Greater China Region. This paper contributes to

the literature by revisiting the volatility relationship of the major stock markets in the Great China Region. The objectives of this study are:

- to identify the presence of long- and short-run persistence in the relationships among SSEI, TAEIX and HSEI returns;
- to determine if the volatility of Greater China's major stock returns is transmitted within the markets through their own conditional variances or even conditional covariances;
- to examine if returns related relationships are constant over time or vary over time; and
- to identify which multivariate model can best determine the relationship among the stock markets of SSEI, TAEIX and HSEI.

The paper is written as follows: Section 2 reviews related studies, Section 3 describes the data and methodology of diagonal BEKK, CCC and DCC models; Section 4 interprets the empirical findings; and Section 5 presents the conclusion.

2. Related Literature

This section provides an overview of studies determining the relationships between the volatilities and co-volatilities of the major stock markets in the Greater China Region. The papers cited are taken from two groups of literature: (1) literature that has established return and volatility connections between financial market instruments, and (2) studies that have shown the suitability of GARCH models in modeling markets in the Greater China Region.

The globalization of financial markets created a tendency for volatilities to move across financial markets without any regard for boundaries, as shown by the studies of Hafner and Herwartz (2006) and Bubak, Kocenda and Ikes (2011) using exchange rates, and Karolyi (1995) and Zhu (2009) in stock markets. Studies also have shown that financial asset returns volatility, correlations and covariances changed from time to time with persistent dynamics as concluded by Fleming, Kirby and Ostdiek (1998). Moreover, Li, Su and Qiao (2016) observed that the co-movement between the stock market was a result of the economic policies of various countries, the co-movement of international markets, and the impact of national financial regulations.

It has also been shown that financial asset returns volatility, covariances and correlations changed over time with persistent dynamics, as seen by Fleming et al. (1998) in the bond and stock markets and Du, Yu and Hayes (2011) in the commodities markets. According to Bauwens, Laurent and Rombouts (2006), modeling these financial data characteristics through a multivariate framework can result in more relevant empirical models than working with separate univariate models. Jiang, Nie and Monginsidi (2017) observed the co-movement between the yields and volatility of the stock market indices in the ASEAN region. The study found that the co-movement was stronger in the short-term and the impact of economic fluctuations on the stock market was temporary.

Regarding the Asian market, particularly the Greater China region, So and Tse (2009) have found that the Asian region is becoming increasingly integrated, using an MGARCH model with tail dependence coefficient. The authors also have argued that there is strong evidence that integration during periods of financial distress are becoming stronger. The study of Yi, Heng and Wong (2009), on the other hand, by using a fractionally integrated vector error correction model combined with an MGARCH model, found that China's stock market has a strong linkage with Hong Kong. Moreover, Moon and Yu (2010) studied the linkages between the US and Chinese stock markets using a univariate GARCH model. The paper found that China's stock market has more information influence on the international stock market transmission because of more liquidity and expanding influence. Dynamic correlations using the MGARCH approach were observed earlier by Barari, Lucey and Voronkova (2006) using iShares ETFs to investigate diversification opportunities. The findings of the study showed the presence of time-varying conditional correlations in both the short- and long-run dynamics of ETFs. The power of the MGARCH models was also observed by Ho, Tsui and Zhang (2009), Zhu (2009) and Chang, McAleer and Tansuchat (2011) who have examined the US business cycle, Chinese stock returns and crude oil spot and futures returns, respectively. Zhang (2017) studied the interaction of the global stock market co-movements and found that the Chinese stock market's yield and volatility co-movement with the international market were strengthened during a crisis period, and that it maintained closer co-movement with other stock markets after the crisis.

The study of Yilmaz (2010), using the forecast error variance decomposition from a vector autoregression model, has discovered that China's stock market has deepening significance in international markets, particularly in Asia. This was confirmed by the paper of Allen, Amram and

McAleer (2013) which used multivariate VARMA and univariate GARCH. The authors studied volatility spillovers of China into some advanced countries (i.e., Australia, Hong Kong, Singapore, Japan and USA). Findings show the growing presence of China, and the existence of volatility spillovers across these markets. The authors also showed evidence of non-constant correlations and a period of negative correlations during the subprime mortgage crisis.

3. Data and Methodology

In determining the evidence of volatility dynamics in the Greater China Region, this section uses daily closing prices of SSEI, TAEIX and HSEI from the Taiwan Economic Journal Database beginning from 10 June 2009 to 5 September 2014. The data coverage was chosen right after the subprime mortgage crisis in order to eliminate the high volatility regime previously experienced, which may cause some biases in the analysis of the time-series data. As of October 2014, the total market capitalization of SSEI was approximately US$2.96 trillion; HSEI was approximately US$3.26 trillion; and TAIEX was approximately US$849.45 billion. This part of the paper expounds upon the three MGARCH models, namely the BEKK, CCC and DCC models.

3.1 Baba, Engle, Kraft and Kroner Model

The BEKK model was proposed by Engle and Kroner (1995) to adapt to the presence of dynamic conditional correlations. The model has the characteristic that the conditional covariance matrices can only be positive. The BEKK model for multivariate GARCH (1,1) is shown below:

$$H_t = C'C + A'\varepsilon_{t-1}\varepsilon'_{t-1}A + BH_{t-1}B\,, \tag{1}$$

The individual elements of matrices C, A and B are represented as:

$$A = \begin{bmatrix} a_{11}a_{12} \\ a_{21}a_{22} \end{bmatrix},\ B = \begin{bmatrix} b_{11}b_{12} \\ b_{21}b_{22} \end{bmatrix},\ C = \begin{bmatrix} c_{11}0 \\ c_{21}c_{22} \end{bmatrix}. \tag{2}$$

Given $\sum_{j=1}^{q}\sum_{k=1}^{K}(A_{kj}\otimes A_{kj}) + \sum_{j=1}^{q}\sum_{k=1}^{K}(B_{kj}\otimes B_{kj})$, $\otimes$ denotes the Kronecker product of two matrices, which are less than one in the modulus for covariance stationary (Silvennoinen & Terasvirta, 2008; Chang et al., 2011). The conditional variances are functions of their lagged values and lagged squared stock value shocks, while the conditional covariances are

functions of the lagged covariances and lagged cross-country of the corresponding stock value shocks from the diagonal formulation. This demonstration ensures that H_t is positive definite for all *t*.

The BEKK (1,1) model has *N(5N+1)/2* parameters (Caporin & McAleer, 2008, 2009). Given the equation *B=AD* where *D* is a diagonal matrix, the number of estimated parameters is decreased, and above equation will be changed to:

$$H_t = C'C + A'\varepsilon_{t-1}\varepsilon'_{t-1}A + D'E\left[A'\varepsilon_{t-1}\varepsilon'_{t-1}A\right]D, \quad (3)$$

Where

$\alpha_{ii}^2 + b_{ii}^2 < 1$, *i=1,2* represents a stationary series. The parameters of the covariance equation $(h_{ij,t}, i \neq j)$ are results of the subsequent parameters of the two variance equations ($h_{ij,t}$).

3.2 Constant Conditional Correlations Model

The CCC multivariate GARCH model was proposed by Bollerslev (1990) and provides better estimates by using non-parametric models and by having a more suitable model for the constant conditional correlation. CCC can be demonstrated below:

$$y_t = E(y_t|F_{t-1}) + \varepsilon_t, \varepsilon_t = D_t\eta_t, \quad (4)$$

$$\text{var}(\varepsilon_t|F_{t-1}) = D_t\Gamma D_t,$$

where

$y_t = (y_{1t,\ldots,} y_{mt})', \eta_t = (\eta_{1t,\ldots,} \eta_{mt})'$ denotes a series of independently and identically distributed (*iid*) random vectors;

F_{t-1} represents the previous available information at particular time t; $D_t = diag(h_1^{1/2},\ldots,h_m^{1/2})$, *m* are the number of returns, and $t = 1,\ldots,n.$

McAleer (2005) and Bauwens et al. (2006) further expanded the model by setting the constant conditional correlation matrix of the

unconditional shocks, η_t, equal to the constant conditional covariance matrix of the conditional shocks, ε_t, from Eq. (4). Note that, $\varepsilon_t\varepsilon_t' = D_t\eta_t\eta_t'D_t, D_t = (diagQ_t)^{1/2}$, and $E(\varepsilon_t\varepsilon_t'|F_{t-1}) = Q_t = D_t\Gamma D_t$, with $\Gamma = E(\eta_t\eta_t'|F_{t-1}) = E(\eta_t\eta')$, where $\Gamma = \{\rho_{ij}\}$ for *i, j=1,…,m*. Q_t stand for the conditional covariance matrix, which is a positive definite if all the conditional variances are positive and Γ is positive.

The assumption of a constant conditional variance for each return, $h_{it}, i = 1,...,m$, is a univariate GARCH process, and is represented as:

$$h_{it} = \omega_i + \sum_{j=1}^{r}\alpha_{ij}\varepsilon_{i,t-j}^2 + \sum_{j=1}^{s}\beta_{ij}h_{i,t-j}^2, \tag{5}$$

where

α_{ij} represents the ARCH effect, or the short run persistence of shocks to return *i*,

β_{ij} denotes the GARCH effect, and

$\sum_{j=1}^{r}\alpha_{ij} + \sum_{j=1}^{s}\beta_{ij}$ stands for long run persistence.

3.3 Dynamic Conditional Correlation Models

The DCC model was formulated by Engle (2002) and proposed to generate a time-dependent conditional correlation matrix. The model suggests the following form:

$$y_t|F_{t-1} + \varepsilon_t, \varepsilon_t = D_t\eta_t \sim N(0, Q_t), t = 1,2,...,n, \tag{6}$$

$$Q_t = D_t\Gamma D_t, \tag{7}$$

where

$D_t = diag(h_1^{1/2},...,h_m^{1/2})$ denotes a diagonal matrix of conditional variances, and

F_t represents the information set at time *t*.

The conditional variance, h_{it}, follows a univariate GARCH model, given as

$$h_{it} = \omega_i + \sum_{k=1}^{p} \alpha_{ik} \varepsilon_{i,t-k}^2 + \sum_{l=1}^{q} \beta_{ij} h_{i,t-l}^2 , \tag{8}$$

Given η_t as a vector of *iid* random variables, with zero mean and unit variance, Q_t in Eq. (7) stands for conditional covariance matrix (after standardization, $\eta_{it} = y_{it} / \sqrt{h_{it}}$). The η_{it} is used to estimate the DCC as below:

$$\Gamma_t = \left\{ diag(Q_t)^{-1/2} \right\} Q_t \left\{ diag(Q_t)^{-1/2} \right\}, \tag{9}$$

where the *k x k* symmetric positive definite matrix Q_t is calculated as:

$$Q_t = (1 - \theta_1 - \theta_2)\overline{Q} + \theta_1 \eta_{t-1} \eta_{t-1}' + \theta_2 Q_{t-1}, \tag{10}$$

where

θ_1 and θ_2 express the scalar parameters that stands for the effects of past shocks and past dynamic conditional correlations on the present dynamic conditional correlation.

These are also non-negative scalar parameters that fulfill the condition $\theta_1 + \theta_2 < 1$, which also means that $Q_t > 0$. Q_t in Eq. (7) is a conditional covariance matrix, given $\theta_1 = \theta_2 = 0$, and $\overline{Q}$ is the *k x k* unconditional variance matrix of η_t.

The DCC model is non-linear, but may be estimated by using a two-step method: (1) utilizing a series of univariate GARCH estimates, and (2) adapting a correlation estimates, all based on the likelihood function (Caporin and McAleer, 2009).

4. Empirical Results

The study initially filtered the data using univariate filters and showed that the alternative of no unit roots is not rejected in all stock market returns through the Augmented Dickey-Fuller (ADF) unit-root test, meaning the data are stationary. The minimum value of the Akaike Information Criterion (AIC) was applied to determine the lag 1,1 orders of the ARMA and GARCH models. Also, according to the results, the null hypothesis of no serial correlation cannot be rejected for all the stock indices through the Breush-Godfrey Lagrange Multiplier test. In testing for the ARCH effect, the Lagrange Multiplier Test (ARCH-LM) was used (Engle, 1982). The relevant statistics of the ARMA model with the null hypothesis of no ARCH effect for all samples were rejected. The results of the test showed that there is no autoregressive conditional heteroscedasticity for all the univariate samples.

4.1. Baba, Engle, Kraft and Kroner model results

Table 1 illustrates the results of the diagonal BEKK model. The test proposed by Hosking (1980) and Li and McLeod (1981) was also utilized to determine if multivariate ARCH effects are present. All data samples showed that the MGARCH model can be applied to the time-series, and presented statistically significant elements of the parameter matrices, A and B of the diagonal BEKK model. This means that for the values of alpha (A matrix), conditional variances depend only on their own lags, wherein the return volatilities can be determined by their lagged values. For the values of beta (B matrix), the conditional covariances of the Greater China stock returns are also a function of their lagged covariances or the lagged cross-products of the shocks. This means that volatilities are not only determined by their lagged values, but cross volatility spillovers are also present for the whole data set.

The significant results of the C matrix have also shown that the diagonal BEKK model has proved that volatilities of the three major stock indices in the Greater China Region have an impact on each other. The findings of this study with regard to the power of the diagonal BEKK model are consistent with the papers of Worthington, Kay-Spratley and Higgs (2005), studying Australian spot electricity prices, and Chang et al. (2011), studying Brent and WTI crude oil spot and futures returns.

Table 1: Diagonal BEKK estimates

Stock Index	Model	AIC	Multivariate ARCH test		c_{11}	c_{12}	c_{22}	a_{11}	a_{22}	b_{11}	b_{22}	Log likelihood
			Hosking (1980)	L & M (1981)								
SSEI & TAEIX	(1,1)	5.838	30.717** (0.031)	30.709** (0.031)	0.153*** (0.003)	0.028* (0.051)	0.084*** (0.007)	0.176*** (0.000)	0.196*** (0.000)	0.976*** (0.000)	0.976*** (0.000)	-3600.420
SSEI & HSEI	(1,1)	6.013	39.793*** (0.002)	39.754*** (0.002)	0.223*** (0.000)	0.282*** (0.002)	0.000 (0.303)	0.104*** (0.000)	0.155*** (0.000)	0.978*** (0.000)	0.956*** (0.000)	-3675.874
TAEIX & HSEI	(1,1)	5.381	77.992*** (0.000)	77.903*** (0.000)	0.088*** (0.003)	0.077*** (0.002)	0.115*** (0.000)	0.166*** (0.000)	0.195*** (0.000)	0.981*** (0.000)	0.973*** (0.000)	-3336.588

Notes: (1) *, ** and *** are significance at 10, 5 and 1% levels, respectively; p-values are in parentheses.

(2) $C = \begin{bmatrix} c_{11} & c_{12} \\ & c_{22} \end{bmatrix}$, $A = \begin{bmatrix} \alpha_{11} & \\ & \alpha_{22} \end{bmatrix}$, $B = \begin{bmatrix} b_{11} & \\ & b_{22} \end{bmatrix}$ are the coefficient matrices.

Source: Authors calculations.

4.2 Dynamic Conditional Correlation Model Results

Table 2 shows the results of the DCC model. The test proposed by Hosking (1980) and Li and McLeod (1981) was utilized to determine the presence of multivariate ARCH effects and all data samples again showed the applicability of the MGARCH model. Consistent with the earlier findings, this paper also observed that all the ARCH (α) and GARCH (β) estimates in the Greater China Region are significant. Our results show that a long-run persistence is evident for the stock returns time-series of China, Taiwan and Hong Kong. In looking at the DCC estimates, only China-Taiwan and Taiwan-Hong Kong supported a short-run persistence of shocks based on the 1st DCC parameter of 0.068 and 0.015, respectively. However, only with Taiwan-Hong Kong has the 2nd DCC parameter confirmed the presence of a long-run persistence of shocks in their conditional correlations with 0.978. This means that the volatility relationship of Taiwan and Hong Kong is dynamic.

The results of $\alpha + \beta < 1$ satisfies the second moment and log moment requisites that are sufficient conditions for the Quasi Maximum Likelihood Estimator (QMLE) to be consistent and asymptotically normal (McAleer, Chan & Marinova, 2007). The hypothesis of time-varying conditional correlations was proven when the higher values of log-likelihood pointed to the DCC estimates as a better model compared to the CCC. However, we can only conclude this finding for Taiwan and Hong Kong, which again corroborates the initial findings of Johansson and Ljungwall (2009). Dynamic correlations between investment instruments were also observed in the studies of Ho et al. (2009), Zhu (2009) and Chang et al. (2011) that examined the US business cycle, China stock returns and crude oil spot and futures returns, respectively. In comparing the log-likelihood values, results show that the CCC model is better for China and Taiwan; and Taiwan and Hong Kong. This demonstrates a significant economic relationship among these countries with increasing economic integration likely to occur in the future.

Table 2: Dynamic Conditional correlation estimates of Engle (2002)

Stock Index	Model	AIC	Multivariate ARCH test		alpha		beta	$a + b$	$DCC_E 1$	$DCC_E 2$	Log likelihood
			Hosking (1980)	L & M (1981)							
1. SSEI	(1,1)	5.827	31.406**	31.395**	a_1 0.030**	b_1	0.960***	0.990			
			(0.026)	(0.026)	(0.030)		(0.000)				
									0.068**	0.394	-3592.038
									(0.023)	(0.179)	
TAEIX					a_1 0.047***	b_1	0.946***	0.992			
					(0.004)		(0.000)				
2. SSEI	(1,1)	5.939	29.600**	29.585**	a_1 0.030**	b_1	0.960***	0.990			
			(0.042)	(0.042)	(0.027)		(0.000)				
									0.000	0.841	-3628.640
									(0.999)	(0.521)	
HSEI					a_1 0.054***	b_1	0.930***	0.984			
					(0.000)		(0.000)				
3. TAEIX	(1,1)	5.387	36.312***	36.283***	a_1 0.049***	b_1	0.942***	0.991			
			(0.006)	(0.006)	(0.008)		(0.000)				
									0.015**	0.978***	-3338.413
									(0.039)	(0.000)	
HSEI					a_1 0.051***	b_1	0.933***	0.984			
					(0.000)		(0.000)				

Note: *, ** and *** are significance at 10, 5 and 1% levels, respectively; p-values are in parentheses.
Source: Authors calculations.

4.3 Constant Conditional Correlation Model Results

Table 3 illustrates the estimates of the CCC model. The test proposed by Tse (2000) and Engle and Sheppard (2001) was used to check the multivariate ARCH effects for constant correlations. The former identified the applicability of the MGARCH model, while the former confirmed the results for the Shanghai Stock Exchange and the Taiwan Stock Index. All ARCH (α) and GARCH (β) estimates are significant for the Greater China Region. We conclude that a long-run persistence is present, wherein changes and shocks in the volatility series of the stock returns of China, Taiwan and Hong Kong have impacts on each other's' stock markets into the future.

The findings for $\alpha + \beta < 1$ satisfies the second moment and log moment requisites that are sufficient conditions for the QMLE to be consistent and asymptotically normal (McAleer et al., 2007). These necessary conditions are also used in the study of Chang et al. (2011) on crude oil spot and futures returns. The CCC estimates among the volatility of the Greater China Region's stock index returns are significant, which confirms that there are constant return volatility relationships among the stock exchanges of these economies, and they may not change over time. The highest CCC estimate is 0.582 between Taiwan and Hong Kong, which supports the initial findings of Johansson and Ljungwall (2009) that Taiwan and Hong Kong have a strong bilateral relationship. The lowest CCC estimate is 0.367 between China and Taiwan, which is expected according to Yi et al. (2009) that found China and Hong Kong have a stronger volatility linkage. Our findings of a constant conditional volatility are also consistent with the findings of Malliaropulos (1997) who used MGARCH models to discover that the seven major currencies against the US dollar behaved uniformly over time.

Table 3: Constant Conditional Correlation Estimates

Stock Index	model	AIC	Multivariate ARCH test								Log likelihood
			Tse (2000)	E & S (2001)		alpha		beta	$a + b$	CCC	
1. SSEI	(1,1)	5.830	4.830**	4.575*	a_1	0.029**	b_1	0.960***	0.990		
			(0.028)	(0.060)		(0.028)		(0.000)			
										0.367***	-3595.712
										(0.000)	
TAEIX					a_1	0.046***	b_1	0.946***	0.992		
						(0.004)		(0.000)			
2. SSEI	(1,1)	5.936	3.326*	5.569	a_1	0.030**	b_1	0.960***	0.990		
			(0.068)	(0.473)		(0.027)		(0.000)			
										0.565***	-3628.640
										(0.000)	
HSEI					a_1	0.054***	b_1	0.930***	0.984		
						(0.000)		(0.000)			
3. TAEIX	(1,1)	5.397	13.059***	3.171	a_1	0.049***	b_1	0.942***	0.991		
			(0.000)	(0.787)		(0.008)		(0.000)			
										0.582***	-3346.369
										(0.000)	
HSEI					a_1	0.051***	b_1	0.933***	0.984		
						(0.000)		(0.000)			

Source: Authors calculations.

5. Conclusions

This research utilizes three MGARCH models to analyze volatility dynamics in the Greater China Region from 1 July 2009 to 5 September 2014. The first methodology applies the BEKK model, which is a general methodology to identify volatility relationships between two data series. The BEKK model found that China's SSEI, Taiwan's TAEIX, and Hong Kong's HSEI stock returns are all functions of their lagged covariances and lagged cross-product innovations. These findings mean that financial market integration in the Greater China Region is increasing as a result of the growing commercial integrations of the three economies, namely the CEPA, ECFA and BCC. The second MGARCH approach applies two methodologies: the DCC model and the CCC model. The DCC model concludes both the short- and long-run persistencies between Taiwan's TAIEX and Hong Kong's HSEI. This implies that short-term co-movements in the volatility may increase in the long run. However, the model only finds short-run persistence between China's SSEI and Taiwan's TAEIX, which may be attributed in the political uncertainties plaguing these two economies. On the other hand, the CCC model confirms the initial findings of the BEKK model, and adds that the relationships among these three economies are stable in the long-run. The log-likelihood values, which measure the best fitting model, favor the DCC model over the CCC estimation indicating that the DCC model is indeed the better tool in judging volatility dynamics in the Greater China Region, particularly in the Taiwan and Hong Kong stock markets. This may be because of economic clauses brought by the BCC, which can maintain current relationship strength and remain stable in the long-term.

The study, given its contribution, is not without its limits. First, the paper did not control for some country-specific variables (e.g., China's more prominent political dominance compared to Hong Kong and Taiwan) that may also affect financial market movements. Second, the study did not consider structural changes in the financial markets, or structural changes in the time-series data.

However, these results can provide important direction for the investing community, particularly hedgers and speculators as a possible basis for investing strategies in the Greater China Region. The knowledge of their volatility dynamics will result in more accurate investment decisions and provide better market perspectives. The general public, as well as the government, can also gain a working knowledge of the patterns of volatility in Greater China Region; and the academic community can gain new insights into the transmission mechanisms in the region, thereby providing future avenues for research.

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The Lahore Journal of Economics
23 : 2 (Winter 2018): pp. 69–108

Role of Financial Services in Economic Growth: Policy Implications for Pakistan

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Abstract

In the last two decades, the financial services sector in Pakistan has seen remarkable growth and structural development. However, it is debatable whether the financial markets and institutions have contributed meaningfully towards promoting growth in the real economy. This paper provides a brief background of the theoretical and empirical literature on the linkage between the financial services sector and economic growth. It evaluates the development of Pakistan's financial markets and institutions in comparison to a cohort of developing countries. The country's governance and regulatory environment in light of these theories and the empirical evidence is compared with other countries. The weaknesses in the linkages between finance and economic growth are identified within the framework of the theoretical models and relevant empirical evidence. The final section discusses the challenges Pakistan faces in making its financial services sector become an effective driver of economic growth.

Keywords: Financial services, economic growth, Pakistan.

JEL classification: O16.

1. Background

Notwithstanding the earlier dismissal by neo-classical economists of the role of finance in economic development (Lucas, 1988; Robinson, 1952), the nexus between the development of financial sectors and economic growth is now so widely accepted that "[the idea] that financial markets contribute to economic growth is a proposition too obvious for serious discussion" (Miller, 1998). Pioneering studies by Gurley and Shaw (1955) and McKinnon (1973) firmly established the finance-growth link, which is well-stated in the following: "The preponderance of theoretical reasoning and empirical evidence suggests a positive, first-order

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relationship between financial development and economic growth" (Levine, 1997, p. x).

The theoretical underpinning and the empirical evidence are summarized in review studies such as those by Thiel (2001) and Levine (2005). The economic theory and extant empirical evidence also suggest plausible rationales for why well-functioning financial systems matter for growth: by reducing information costs and allocating capital; monitoring firm behavior and exerting corporate governance; facilitating the hedging, trading, and pooling of risk; mobilizing savings for investment; and reducing the transactions costs of economic exchange and activity.

The key message for economic policy-makers which emerges from the understanding of the finance-growth nexus is that financial development should be a crucial piece in any country's strategy for economic growth. In particular, developing countries need to strengthen institutional infrastructure by building effective legal and regulatory frameworks, and adopting best accounting and auditing standards and practices. The Global Financial Crisis (2008-09) has underscored the havoc that financial instability can wreak on the real economy and the critical importance of financial stability for growth. A resilient financial sector bolstered by prudential regulation will better equip developing countries to deal with the speed and scope of financial innovation, and new financial products, services and technologies in a globalized world.

In the last couple of decades, the financial services sector in Pakistan has seen remarkable growth and structural development. However, it is debatable if its financial markets and institutions have contributed meaningfully towards promoting growth in the real economy. This paper provides a brief background of the theoretical and empirical literature on the linkage between the financial services sector and economic growth. Next, it evaluates the development of Pakistan's financial markets and institutions in comparison to a cohort of developing countries. The country's governance and regulatory environment in light of these theories and the empirical evidence is compared with other countries. The weaknesses in the linkages between finance, economic growth and governance are identified within the framework of the theoretical models and the relevant empirical evidence. The final section discusses the challenges Pakistan faces in its financial services sector becoming an effective driver of economic growth and proposes policy recommendations.

2. Finance and Growth

Among development economists, a consensus has emerged that a well-functioning financial sector is a precondition for the efficient allocation of resources and for achieving an economy's full potential for growth. Levine (2005, 2004) has presented a comprehensive review of the theory and evidence on the connections between the operation of the financial system and economic growth. The study concluded that "the preponderance of evidence suggests that both financial intermediaries and markets matter for growth and that reverse causality alone is not driving this relationship." This implies that "better developed financial systems ease external financing constraints facing firms, which illuminates one mechanism through which financial development influences economic growth." Thiel (2001) showed that "financial development is related to economic growth even in industrial countries."

Among the more recent studies, Durusu-Ciftci, Ispir and Yetkiner (2017) have shown that debt from credit markets and equity from stock markets are two long-run determinants of GDP per capita. Their empirical study of 40 countries over the period 1989–2011 revealed that "both channels have positive long-run effects on steady-state level of GDP per capita, and the contribution of the credit markets is substantially greater." With reference to the developing and Asian countries, Estrada, Park and Ramayandi (2010) argued that sound and efficient financial systems are especially important for sustaining growth "because efficiency of investment will overshadow quantity of investment as the driver of growth in the region." Their panel data study of 125 countries has confirmed that financial development has a significant positive effect on growth, especially in developing countries, supporting the notion that further development of the financial sector matters for sustaining growth. Zhang, Wang and Wang (2012) used data from 286 Chinese cities over the period 2001–06 to investigate the relationship between financial development and economic growth. Their results suggest that most traditional indicators of financial development are positively associated with economic growth and that finance-growth linkages are present even in countries where the banking sector is state-ruled (e.g., China). Masoud and Hardaker (2012) presented an empirical analysis of the relationship between financial development and economic growth for 42 emerging markets. Their results indicated that "stock market development has a significant effect on economic growth, and this effect remains strong even after the influence of banking sector and other control variables." Their findings suggest that the stock market and the banking sector play a complementary role in the economy.

In the wake of the 2008 Global Financial Crisis (GFC), serious concerns have been raised about the disruptive potential of finance for economic growth. Such issues have been detailed in a number of studies. For example, Yongseok (2013) has argued that developed financial markets are still an essential ingredient of long-run economic growth. Cournède and Denk (2015) have shown that while finance has been a key ingredient of long-term economic growth in the Organisation for Economic Co-operation and Development (OECD) and G20 countries over the past half-century, there can be too much finance, that is, at some levels of household and business credit, "further expansion slows rather than boosts growth." Cecchetti and Kharroubi (2015) have explored the possible crowding out of real economic growth by the financial sector, suggesting that the growth of a country's financial system can be a drag on productivity growth, since "financial booms are not, in general, growth-enhancing, likely because the financial sector competes with the rest of the economy for resources." Further, they have concluded that credit booms harm what we normally think of as the engines for growth – those that are more R&D intensive. The contagion effects of the GFC were amplified by the globalized nature of the financial industry and led to economic disruptions and crisis across the globe. According to a report by the Group of Thirty (2013), "Globally, cross-border capital flows increased from US$4.9 trillion in 2000 to US$11.7 trillion in 2007. Nearly 60 percent of this growth was driven by cross-border lending, but most of this was short-term in nature." The implications are that developing countries need to prioritize enabling more stable flows of long-term capital.

The recent experience during the GFC suggests that the relationship of finance and real economic growth needs to be reexamined to identify both the growth-enhancing and the growth-retarding roles of finance. Economic growth strategies attach considerable weight to the development of efficiently functioning and complete financial markets. By fostering the development of the financial services sector, a country's economic growth would be accelerated. Emphasis is placed on policy measures that lead to the deepening of financial markets that include, in particular, institutional and legal measures to strengthen creditor rights, investor rights and contract enforcement.

However, there is still a wide divergence of opinions as to how and to what extent finance affects economic growth. Outstanding questions are pertinent for implementing strategies for the development of the financial sector as an engine for economic growth. Three questions require particular attention: (1) How does financial sector development lead to economic growth?; (2) what features of the financial sector structure provide

maximum support to economic growth?; and (3) how do financial structures lead to structural changes in the economy and technological progress?

Though it is now empirically well-established that financial development leads to economic growth, empirical analysis at the aggregate level does not capture the complexities of the financial structures and the multiple channels through which finance and the growth processes are linked. For such reasons, it is more instructive to study these issues at the country level. This paper reviews the underlying conduits between financial developments and economic growth, and seeks to apply the principles identified in the academic literature to the three questions with reference to the role of Pakistan's financial sector. We seek to identify weaknesses in the transmission channels and suggest remedial measures such that the financial services sector may play a robust role in economic growth.

3. How Does Finance Affect Economic Growth?

Economic growth depends upon the accumulation of production input factors and technical progress. Traditionally, finance has been linked primarily with the accumulation of capital leading to economic growth. Furthermore, finance makes it possible to realize technical progress as technical advances are embedded in the capital stock. In growth theory under the assumption of perfect markets, the interest rate brings into equilibrium the economy's savings and investment. Therefore, in the presence of perfect markets, the financial sector is "nothing but a veil on the true determinants of economic developments," and financing decisions become irrelevant. Over time there has been recognition of the problems arising out of asymmetric information and how it affects financial contracting between borrowers and lenders.

In dealing with the problems associated with asymmetric information, adverse selection and agency costs, the financial system assumes a more prominent role in facilitating an efficient allocation of capital. Financial institutions specialize in evaluating and monitoring investment opportunities, and thus obtain a comparative advantage in evaluating risks and designing financial contracts. In particular, banks build up information advantages from lasting relations with borrowers from accumulated experience. They also enjoy economies of scale from offering transaction services. Therefore, an increase in the efficiency of the financial system would lead to higher rates of economic growth.

The finance-growth nexus, in theory, may run through various transmission channels. Thiel (2001) has put these into three main

categories, stating that financial development: (1) reduces the transaction costs required to allocate capital; (2) increases the savings ratio; and (3) raises capital productivity. Lower transaction costs mean more efficient transformation of savings into investment, and that more net savings can be used for productive investments. A more efficient financial system improves the return-risk combinations for savers. It is uncertain, however, whether it can induce an increase of the saving ratio and thus stimulate higher economic growth. Financial development raises the productivity of capital through: (1) more efficient allocation of capital over investment projects; (2) the provision of liquidity; and (3) the allocation of risks. The development of the financial sector has an ongoing effect as it leads to a durable positive feedback effect between finance and growth.

The financial system contributes to economic development by reducing costs associated with acquiring information, enforcing contracts and conducting transactions. Financial systems also mitigate problems of moral hazard and adverse selection by producing information on investment returns, facilitating a more efficient allocation of resources. By providing diversification and risk-sharing opportunities, the financial systems also help mobilize saving and efficient intermediation of financial resources.

4. Governance, Financial Development and Growth

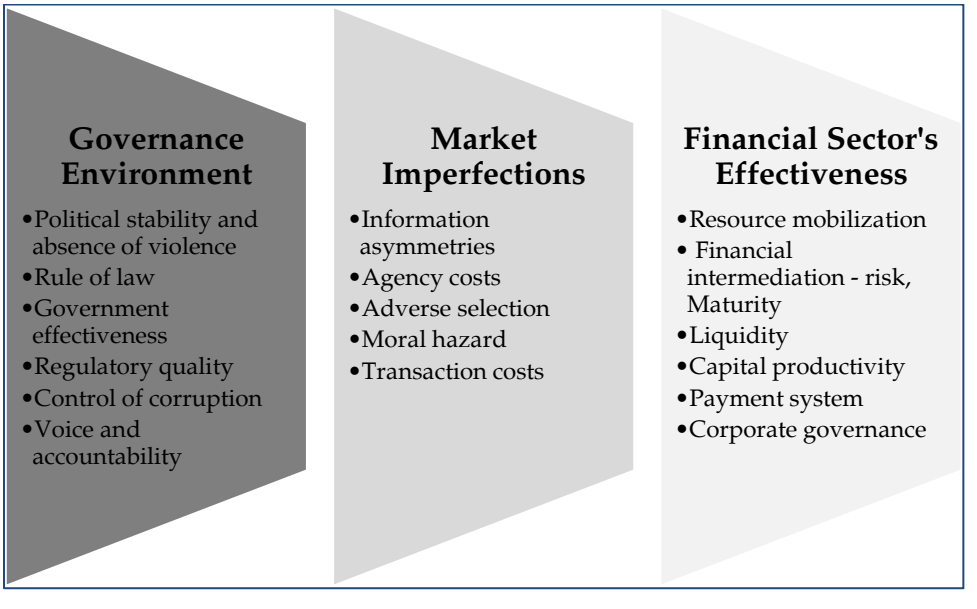
The main role of financial development is tackling the imperfections in the capital markets, and a growing body of research points to a strong link between corporate governance measures and financial development. Financial markets' depth and breadth is associated with higher quality institutions in general, including better property rights and rule of law (North, 1981; La Porta, Lopez-de-Silanes, Shleifer, & Vishny, 1999). La Porta, Lopez-de-Silanes, Shleifer, and Vishny (1997, 1998) have provided empirical evidence that measures of investor protection derived from corporate law are associated with stock market development. La Porta, Lopez-de-Silanes and Shleifer (2006) have examined the effect of securities laws on stock market development and have found strong evidence that laws mandating disclosure and facilitating private enforcement through liability rules benefit stock markets. Similarly, Burger and Warnock (2006) have concluded that policies and laws matter in the development of the local currency bond market. Their analysis indicated that both creditor-friendly policies and creditor-friendly laws can play an effective role in bond market development. They have shown that "strong rule of law is associated with deeper local bond markets, whereas countries with better creditor rights are able to issue a higher share of bonds in their

local currency." In the context of Pakistan, Uppal (2007, 2011) has provided evidence that the securities laws play an important role in the development of bond markets, because they facilitate private contracting rather than public enforcement.

Acknowledging the nexus between development and governance, World Bank's World Development Report for 2017 is subtitled "Governance and the Law". Governance is defined as "the process through which state and non-state actors interact to design and implement policies within a given set of formal and informal rules that shape and are shaped by power." The report addresses three core development outcomes: security, growth, and equity. It advocates that "commitment, coordination, and cooperation fundamentally underlie the effectiveness of policies to promote these outcomes, but the unequal distribution of power can constrain policy effectiveness."

Figure 1 presents a conceptual mapping of the linkages running from the governance and regulatory environment to lessening of the market imperfection and to a more effective role of the financial sector in economic growth.

Figure 1: Governance, Market Imperfections and Financial Sector's Role



Source: World Bank, 2006.

5. Patterns of Corporate Financing in Pakistan

The fundamental role of finance is to channel savings to investment. Therefore, it is instructive to examine how corporations in Pakistan have sourced funds to finance their operating assets up to now. Table 1 summarizes the liabilities and equity structure of the private corporations listed on the Karachi Stock Exchange (KSE) for the years 2011-2016. The data show that the shareholders' equity dominates the sources of funding at 44.2 percent in 2016. While it is consistent with the pecking order hypothesis whereby corporations' first choice is to use internally generated funds for investments, the steady trend of increasing use of equity over the six year period is notable; equity ratio increased from 35.9 percent in 2011 to 44.2 percent in 2016. While the overall equity ratio increased, the paid-up-capital decreased, from 14.0 percent to 12.2 percent, but equity reserves increased from 21.9 percent to 32.0 percent over the same period.

Table 1: Summarized Liabilities and Equity of KSE Listed Companies

Liabilities & Equity	**2010**		**2011**		**2012**		**2013**		**2014**		**2015**		**2016**	
Rs in billions	Rs	%	Rs	%	Rs	%	Rs	%	Rs	%	Rs	%	Rs	%
Shareholders' equity	1,129	35.9	1,269	36.0	1,354	34.9	1,554	39.8	1,662	39.4	1,857	42.0	2,067	44.2
Paid up capital	441	14.0	488	13.8	517	13.3	527	13.5	555	13.2	553	12.5	571	12.2
Reserves	689	21.9	781	22.2	837	21.6	1,027	26.3	1,106	26.3	1,303	29.5	1,495	32.0
Long-term borrowing	565	17.9	563	16.0	561	14.4	548	14.0	483	11.5	503	11.4	516	11.1
Other non-current liabilities	208	6.6	215	6.1	247	6.4	272	7.0	316	7.5	323	7.3	320	6.9
Short-term borrowing	437	13.9	562	16.0	586	15.1	569	14.6	701	16.6	675	15.3	674	14.4
Current liabilities	810	25.7	913	25.9	1,136	29.2	962	24.6	1,051	25.0	1,064	24.1	1,093	23.4
Total	3,150	100.0	3,523	100.0	3,884	100.0	3,905	100.0	4,212	100.0	4,423	100.0	4,671	100.0

Source: Authors' analysis from the Financial Statements Analysis of Companies (Non-Financial) Listed on the Karachi Stock Exchange, 2015, State Bank of Pakistan.

At the same time, we observed a lowering of the long-term debt ratios; long-term borrowing decreased as a percentage from 17.9 percent to 11.1 percent over the five year period. There was also an increase in the use of short-term borrowing; from 13.9 percent to 14.4 percent and a greater reliance on other non-current liabilities (e.g., employees benefit obligations) and current liabilities (e.g., trade credit).

The increasing use of internally generated funds indicates a trend of moving away from engagement with the financial sector, either with the banking sector for long-term loans or the financial markets for debt or equity issues. It implies that the pecking order considerations are increasingly dominating corporations' funding decisions. It points to an aggravation of the problems originating in informational asymmetry and agency cost on which the pecking order hypothesis is based.

Further insights are obtained by examining the corporate sectors' uses and sources of funds. This is presented in Table 2 in a format which shows the amounts and the percent of the funds raised (or remitted) in relation to the corporations' total investments.

Table 2: Summary of Investments and Sources of Finance of KSE Listed Companies

	2010-11		2011-12		2012-13		2013-14		2014-15		2105-16		Total	
Rs in billions	Rs	%	Rs	%	Rs	%	Rs	%	Rs	%	Rs	%	Rs	%
Total Investments	243		185		325		269		294		339		1,656	
Sources of Financing														
Cash flow from operations	206	84.9	266	143.3	506	155.7	311	115.4	443	150.5	512	151.1	2,244	135.5
Bank borrowing	113	46.5	26	14.2	(27)	-8.2	21	7.7	(25)	-8.6	10	2.9	(39)	-2.3
Debentures/TFCs(bonds)	10	4.3	(4)	-2.3	(4)	-1.1	(2)	-0.6	21	7.0	(6)	-1.8	18	1.1
Other non-current liabilities	6	2.6	32	17.3	25	7.6	44	16.4	8	2.6	(3)	-0.9	26	1.6
Paid-up capital & reserves	(5)	-2.0	(21)	-11.4	20	6.1	34	12.7	37	12.5	56	16.6	57	3.5
Dividends paid	(111)	-45.8	(109)	-58.9	(149)	-45.7	(151)	-56.0	(159)	-54.2	(187)	-55.1	(182)	-11.0
Changes in cash balances	23	9.5	(4)	-2.3	(47)	-14.4	12	4.6	(29)	-9.9	(43)	-12.7	(468)	-28.3
Total Sources	243	100.0	185	100.0	325	100.0	269	100.0	294	100.0	339	100.0	1,656	100.0

Source: Authors' analysis from the Financial Statements Analysis of Companies (Non-Financial) Listed on the Karachi Stock Exchange, 2015, State Bank of Pakistan.

Table 2 shows that for the six-year period, the cash flow from operations-generated funds was overall in excess (135 percent) of the investment need of the sector. Though the contribution of the operating cash flows to the investment requirements of the firms varies (min 85 percent, max 151 percent) from year to year, it is the dominant source. Bank borrowing or additional paid-up capital is not a major source, and the least important source is the financial securities, debentures and TFCs (bonds). The operating cash flows typically provide a surplus which is used to pay back loans and distribute substantial dividends. The dividends are so far in excess of the additional equity capital (from new equity issues/reserves) that there seems to be a drawdown of the capital by the shareholders, rather than a net inflow of capital into the firms.

The picture that emerges from the balance sheet and cash flow analyses is that there seems to be an increasing disengagement from the financial sector pointing to a diminishing role of the financial sector in providing funds for real investment. The changes in the pattern of financing imply that the ubiquitous problems of information asymmetry, agency costs and adverse selection have not improved. This phenomenon is reflected in the decreasing use of external financing and high dividends payouts.

6. Financial Development in Pakistan

The landmark year in Pakistan's financial development was 1991 when the country's capital markets were substantially opened to international investors. This was part of a larger set of measures to place the economy on market-based principles and end an era of financial repression. This included measures to liberalize foreign exchange regulations and foreign trade, and to privatize industrial units and banks. Securities markets were deregulated and auction markets for government securities were established. The regulatory controls on corporate public offering of equity and on foreign ownership and underwriting of securities were removed. The tax system was simplified and tax rates were reduced, particularly including exemption of capital gains on equity stock and a tax holiday for selected industrial and financial institutions.

As a result of the post-1991 liberalization, the financial sector saw the establishment of private sector mutual funds, off-shore funds, the creation of Employees' Stock Option Plans, corporate brokerage houses, investment advisory firms (many in collaboration with foreign securities firms) and investment banks. A process of privatization of nationalized commercial banks was initiated during the year 1991-92. A number of

private commercial banks sprang up creating greater competition within the banking sector. State controls on interest rates charged on bank loans and paid on deposits were removed. The banking sector's balance sheets were strengthened by removing non-performing loans (NPLs) and strengthening the legal framework for the recovery of bank dues. A credit rating agency, the Pakistan Credit Rating Agency, Limited (PACRA), was established in 1994. Another credit rating agency was incorporated in 1997. In 1994-95, a Central Depository Company (CDS) was established to implement an electronic book entry system for securities settlement.

In 1997, the government initiated a Capital Market Development Program (CMDP) with the help of the Asian Development Bank (ADB) to strengthen the capital market. The securities' regulatory body, the Corporate Law Authority, was reconstituted in 1999 as an autonomous Securities and Exchange Commission of Pakistan (SECP). The governance structure of stock exchanges was improved and its regulatory powers were enhanced. Towards the turn of the century, the policy emphasis shifted towards deepening and broadening the markets with the initiation of the Financial (Non-bank) Markets and Governance Program (FMGP) financed by the ADP. The 2000s saw continued broadening and deepening of financial markets through market-based financial instruments and institutions.

Since the market liberation measures of 1991, the equity market in Pakistan has undergone substantial structural changes and growth. Market capitalization, as a percentage of GDP, was only 6.5 percent in 1989, and rose to 23.9 percent by 1993 post-liberalization. The following years have seen a period of steady and strong growth pushing the capitalization ratio to 42.0 at the end of 2005. In the post-2001 period, continued privatization and liberalization policies, together with regulatory and structural reforms, have led to further maturation of the capital markets. The market capitalization was largely boosted by the listing of a number of large state-owned enterprises (SOEs), whose privatization drove market growth. Domestic institutional investors, such as mutual funds and insurance companies, also increased engagement in the capital markets, though the individual investors account for the bulk of exchange trading. The investor base has also expanded due to interest by foreign portfolio investors.

Despite the series of reforms and structural developments, capital market instruments still play a minor role in mobilizing primary financing to the real sector. In 2005 capital raised by corporations and financial institutions through equity and bond issues totaled only 0.3 percent of GDP. Pakistan lags behind other emerging markets in resource mobilization issues

of new equity through the capital market. Similarly, bond market issues in Pakistan compared to other emerging markets are almost non-existent. The market for derivative instruments also has not developed. The stock market lacks breadth, as well as depth. The 10 largest stocks accounted for 55 percent of the total market capitalization in 2007. Trading of stocks is likewise highly concentrated. Free float is also rather limited; an average of only 20 of the shares of the listed companies are available for trading, resulting in relatively low market liquidity. This, coupled with a high turnover, paints a picture of a highly speculative market.

According to Asian Development Bank report (ADB, 2007), the key issues of concern, among others, are high equity market volatility, small public float (shares available for trading) and weak securities market legislation. The ADB report also noted that the Pakistan stock market's volatility is due partly to a high volume of speculative short-term individual investment in shares and thin public float of the listed companies.

7. State of Financial Development in Pakistan

As the financial sector is crucial to any economy's growth, it is important that we monitor and compare its development across economies and over time. The World Bank's Financial Sector Development Indicators (FSDI) project has developed a comprehensive database containing financial sector statistics, which provide analytical tools for enhanced assessment and understanding of financial sector development (Svirydzenka, 2016; World Bank, 2006).

The FSDI database provides numerous variables spanning banking systems, capital markets, non-bank financial sectors, the accessibility to finance and institutional environments. It presents the main dimensions of a financial sector—size, access, efficiency and stability— for the traditional financial sub-sectors, such as banking and capital markets, thus providing practical assessment measures and the basis for assessing a country's overall financial sector, especially when benchmarked against international, regional, or cross-country standards.

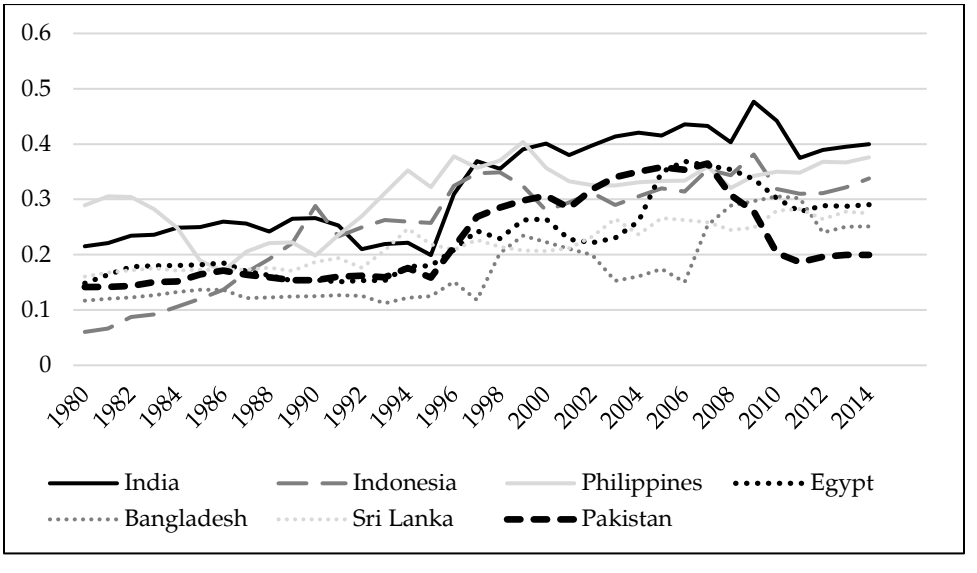
The FSDI indicators are grouped into four broad dimensions: (1) size; (2) efficiency; (3) access; and (4) stability. These headline indicators include traditional measures, such as private credit-to-GDP ratios, stock market capitalization-to-GDP ratios, non-performing loans and banking spreads, but also new indicators (collected via surveys), such as ease of access to a bank account by a household and ease of access to financing for a company.

The benchmarking indicators, combinations of ratios and synthetic statistics allow for the sorting of countries according to these four dimensions.

We examine the FSDI indicators for Pakistan, comparing these with cohort countries (i.e., lower-middle income countries). This analysis is done initially for the overall financial development index, and subsequently, for the financial institutions and financial markets, each having three constituent dimensions (access, depth and efficiency). Figure 2 below shows the Financial Development Index for Pakistan and six other developing countries. Table 3 in the Appendix provides a comparison for Pakistan with other lower-middle countries on the selected statistics underlying the FSDI.

As Figure 2 shows the financial development in Pakistan (thick line) took off around 1995, and, for a number of years, it ranked towards the top of the group, except for India. The country's position continued to improve until about 2007, after which, the index shows rapid decline. According to the latest available data, the country ranks at the bottom of the group, with India's score being twice as high.

Figure 2: Financial Development Index

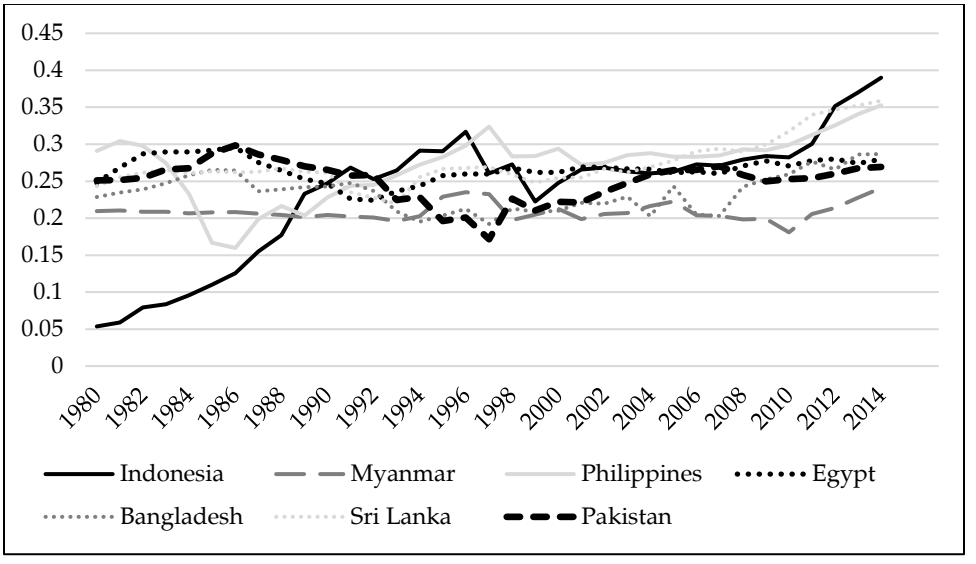


Source: Authors' compilation using data from World Bank (2006).

Figure 3 plots the FSDI's Financial Institutions Index from 1980-2014 for Pakistan and six other comparable countries. It depicts a picture of varying trends. There is a marked deterioration over the period of 1985-

1996, which is followed by institutional improvements observed over the next ten years. However, all other countries register steady improvement in institutional development over the last two decades, leaving Pakistan at the bottom of the group.

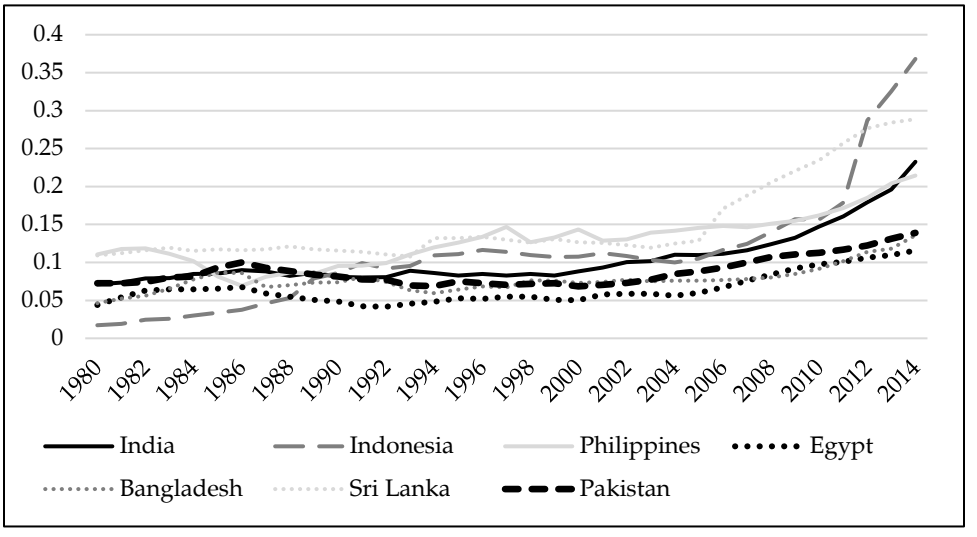
Figure 3: Financial Institutions Index



Source: Authors' compilation using data from World Bank (2006).

The Institutional Development Index is further broken into three indices - access, depth and efficiency - each shown in Figures 4, 5 & 6. The Institutional Access Index (Figure 4) does indicate a steady improvement over the years, but the trend is weaker when compared with the indices for other countries, especially Indonesia and India.

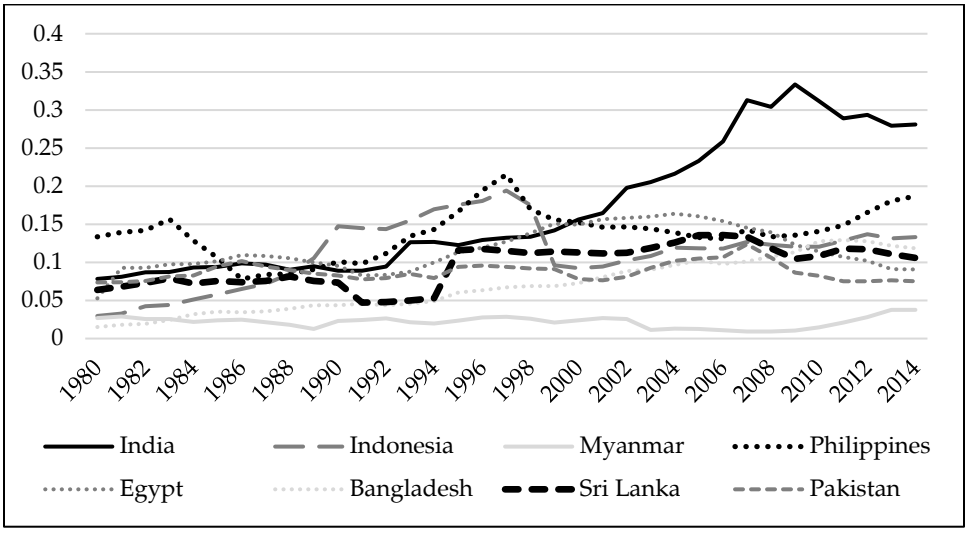
Figure 4: Financial Institutions Access Index



Source: Authors' compilation using data from World Bank (2006).

Pakistan particularly seems to be lagging with respect to the Institutions Depth Index (Figure 5). It has lagged behind the cohort significantly since about the year 2000. There is a significant difference in the ratings in comparison with India.

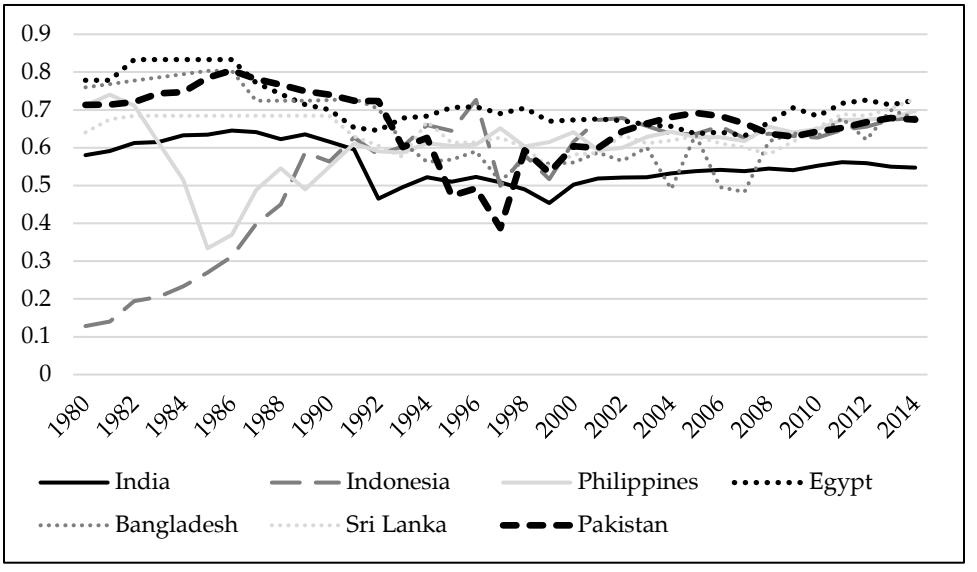
Figure 5: Financial Institutions Depth Index



Source: Authors' compilation using data from World Bank (2006).

The relative score of Pakistan on the Institution Efficiency Index (Figure 6) depicts a better picture. The country is placed in the middle of the reference group. It is noteworthy that India's position is least favorable within this group.

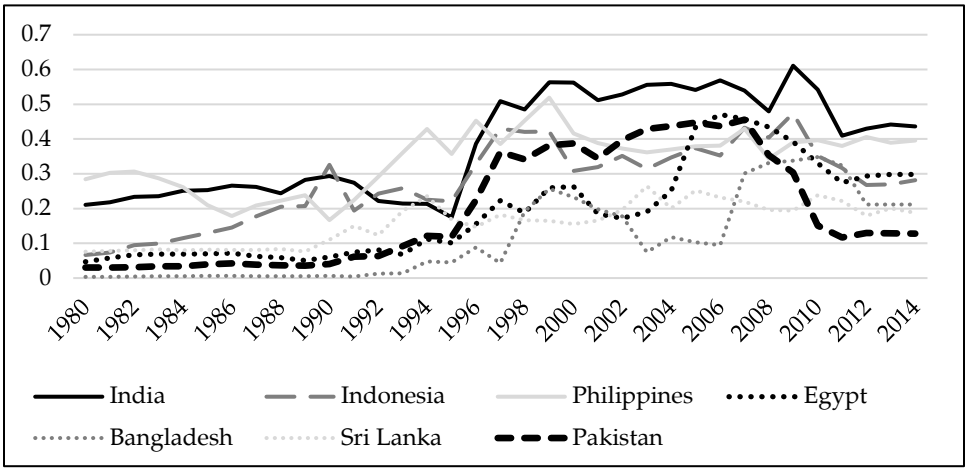
Figure 6: Financial Institutions Efficiency Index



Source: Authors' compilation using data from World Bank (2006).

The next set of indices displays the development of the financial markets (Figures 7 to 10). Figure 7 plots the overall Financial Markets Index over the period 1980-2014. There is a rapid rise in the index concurrent with financial market development in other emerging markets, beginning around the time financial liberalization measures were taken. The index understandably took a nosedive around 2007, when all markets where hit by the Global Financial Crisis. Other countries, however, seem to have either not been affected as much (India or Sri Lanka) or not at all (Bangladesh). Pakistan's capital market seems to have suffered a lasting setback.

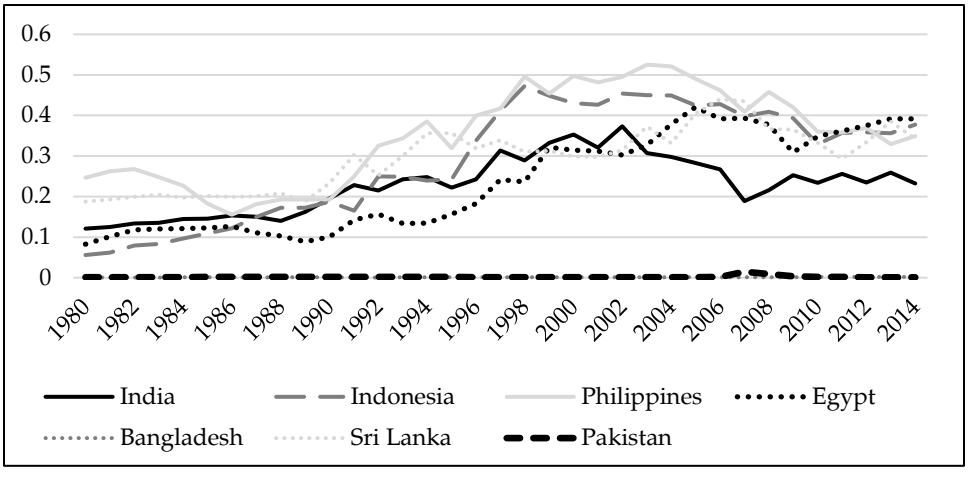
Figure 7: Financial Markets Index



Source: Authors' compilation using data from World Bank (2006).

Regarding market access, the index shown in Figure 8 places Pakistan at the bottom of the group, with scores that are almost zero. This index is based on statistics such as, concentration of top 10 firms (market capitalization), concentration of top 10 firms based on volume, closely held shares in top 10 firms, number of issuers, bonds listed and newly listed and foreign issues in local currencies. In summary, it is a reflection of Pakistani corporations not tapping into the financial markets, which confirms the observation made in the first section.

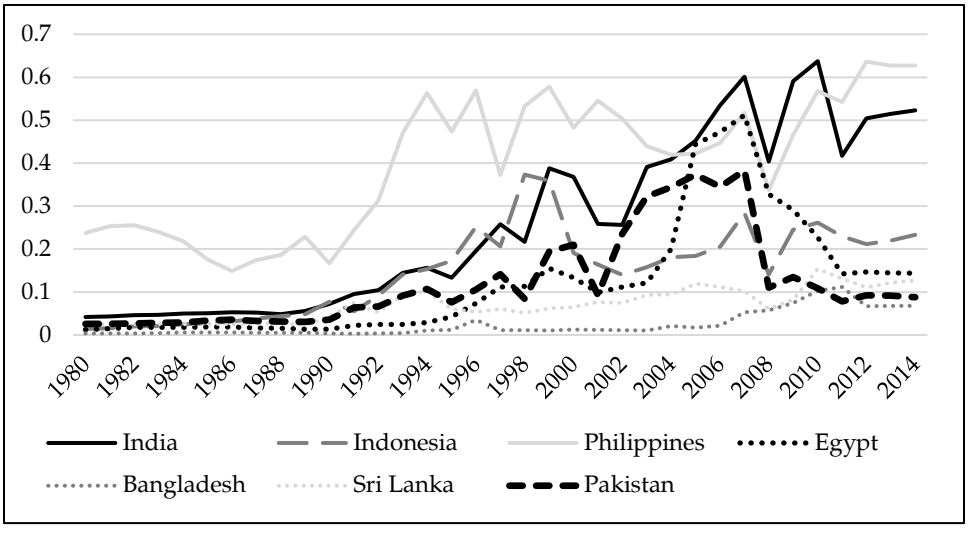
Figure 8: Financial Markets Access Index



Source: Authors' compilation using data from World Bank (2006).

The Markets Depth Index (Figure 9) also shows significant drop around 2007. Again, the country does not seem to have recovered from the external shock, unlike the other countries included in the index. It indicates that the markets lack resilience.

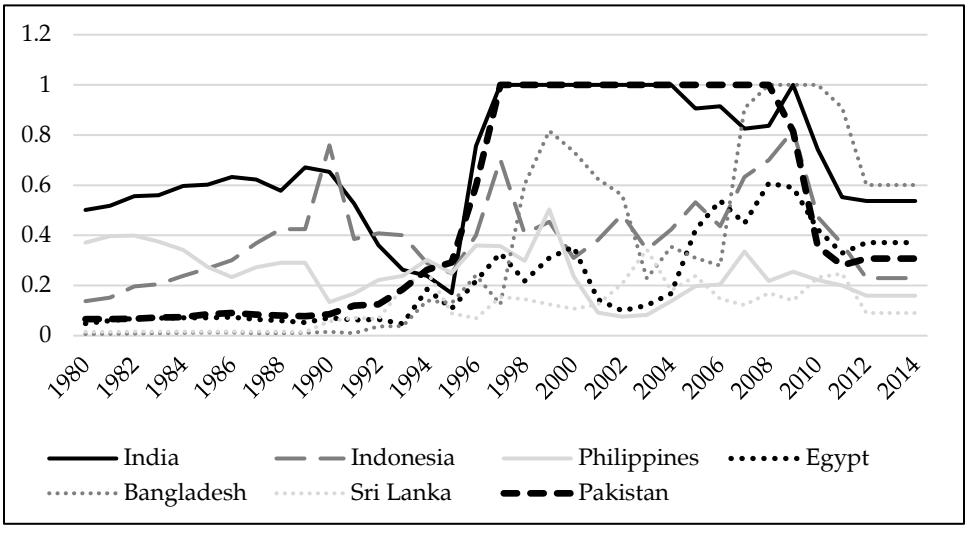
Figure 9: Financial Markets Depth Index



Source: Authors' compilation using data from World Bank (2006).

The Financial Markets Efficiency Index (Figure 10) depicts a contrasting picture. The Index increased sharply around 1995 to its maximum possible value. It dropped precipitously in 2007 and has been rather stable in the middle of the set of indices for the cohort group. It may be that the index is heavily based on trading volume, co-movement of stock returns, and market turnover ratio. All of these may also be indications of excessive trading based on speculation, and may not be significantly correlated with allocative efficiency of the stock market.

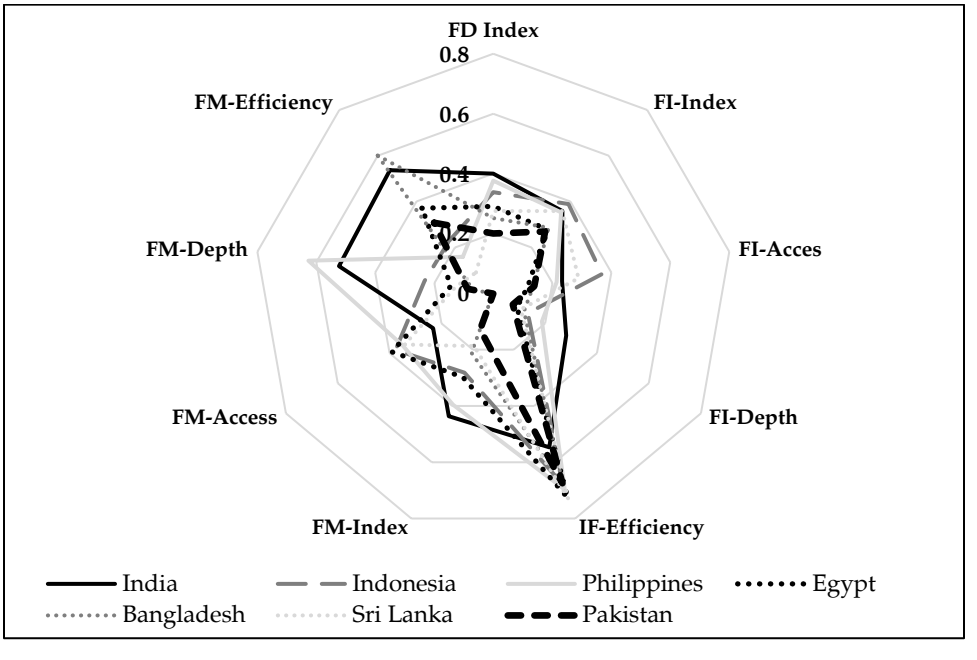
Figure 10: Financial Markets Efficiency Index



Source: Authors' compilation using data from World Bank (2006).

The overall profile of the Pakistan's financial sector is depicted in Figure 11 below.

Figure 11: Financial Development Indices



Source: Authors' compilation using data from World Bank (2006).

The figure shows that the country's financial development stands compares relatively unfavorably with six other countries from the lower-middle income group. The country fairs unfavorably in all three dimensions of financial development: access, depth and efficiency.

The above comparative analysis was done with respect to the selected sample of countries in terms of the Financial Sector Development Indicators, based on extensive databases, the Global Financial Development Database and the Financial Structure Development Database (Beck, Demirgüç-Kunt & Levine, 2000). Table 3 in the Appendix presents selected variables from these datasets, allowing for further comparison of Pakistan's financial sector with the lower-middle income countries. A comparison based on detailed statistics allows for more precise focus on the weaknesses in the financial sector that could be targeted for remedial policies. The detailed comparison supports conclusions based on these indices.

Examining the individual indicators (Table 3) we can compare Pakistan's standing vis-a-vis the other countries in the lower-middle income group with respect to the four dimensions of financial development - access, depth, efficiency and stability. Note that the country fares particularly unfavorably with respect to bank access by individuals and firms. For example, the country is placed in the lowest quartile of the indicators in Table 5 below:

Table 5

A: Indicator	Percent Rank
1. Firms with a bank loan or line of credit (%)	15
2. Small firms with a bank loan or line of credit (%)	5
3. Account at a formal financial institution (% age 15+)	2
4. Saved at a financial institution in the past year (% age 15+)	11

Source: *Worldwide Governance Indicators (WGI) dataset, the World Bank Group.*

Despite that, the indicator labelled "Bank branches per 100,000 adults" has a percent rank of 56, and the use of banking services is rather limited by the firm as shown on Table 6 below:

Table 6

B: Indicator	Percent Rank
1. Firms with a checking or savings account (%)	10
2. Firms using banks to finance investments (%)	10
3. Firms using banks to finance working capital (%)	15
4. Private credit by deposit money banks and other financial institutions to GDP (%)	6

Source: *Worldwide Governance Indicators (WGI) dataset, the World Bank Group.*

Fifty-seven of the firms are labelled as "not needing a loan", a percent rank of 63. Table 7 indicates that individuals tend to rely on informal credit.

Table 7

C: Indicator	Percent Rank
1. Loan through store credit in the past year (% age 15+)	94
2. Loan from family or friends in the past year (% age 15+)	68

Source: *Worldwide Governance Indicators (WGI) dataset, the World Bank Group.*

It seems that rather than tapping into banking loan facilities, firms tend to rely on equity capital; as such, "Investments financed by equity or stock sales (%)" has a percent rank of 84. Similarly, the private corporate sector is lagging behind in accessing capital through the capital markets. The issuance of new equity (IPOs) is negligible and the corporate bond issuance is even scarcer.

In contrast, the public sector seems to be the dominant player in the financial sector. Pakistan's "Central bank assets to GDP (%)" is at the 83rd percentile, and the "Outstanding domestic public debt securities to GDP (%)" is at 45, placing it at the top of the lower-middle income group. In "Credit to government and state owned enterprises to GDP (%)" Pakistan's percent rank is 97.

The uneven role of the Pakistan's financial sector is particularly puzzling when considering that it is quite competitive as well as quite profitable. All indicators of competitiveness (i.e., bank concentration, H-statistic, Lerner index, Boone indicator and 5-bank asset concentration) point to a competitive industrial structure. In addition, profitability ratios, bank return on assets (before tax) and bank return on equity (before tax) place the banks at a very high percentile among their cohorts; 72 and 86,

respectively. They also score around the median in institutional stability (i.e., bank Z-score, bank regulatory capital to risk-weighted assets), though are rated unfavorably in terms of the "bank non-performing loans to gross loans" indicator. This raises the question: What is constraining the banking sector from expanding its services to the non-financial private sector?

The tendency of bank financing towards the public sector may reflect the crowding out phenomenon that occurs when public borrowing stifles private borrowing. However, the banking sector does not seem to be short of loanable funds, as indicated by higher than average deposit-to-loan ratios: Bank credit to bank deposits is 49.6 with a percent rank of 9; Financial system deposits to GDP is 30.0 with percent rank of 18. We also note that the percentage of the firms identifying access to finance as a major constraint is only 13.2 (21st percentile). There also does not seem to be any evidence of "disintermediation" where firms would bypass financial intermediaries to directly access funds from capital markets. Therefore, it may be instructive to examine possible institutional and regulatory impediments in the economic environment, as well as ways the financial sector could be playing a more effective role in promoting real investment. However, the booming equity and the real estate markets indicate a large inflow of capital to these sectors.

3. An Empirical Exercise - Governance and Financial Development

In this section we present a brief empirical analysis of the link between effective governance and the development of the financial sector. Our panel data sample consists of 44 countries falling in the lower-middle income group over the period 1996-2014. In order to capture the governance environment in different countries we used aggregate governance indicators developed by the World Bank. The indicators are based on several hundred individual variables measuring perceptions of governance and are drawn from various separate data sources constructed by different organizations. These individual measures of governance are assigned to categories capturing key dimensions of governance and use an unobserved components model to construct six aggregate governance indicators. A detailed discussion can be found in Kaufmann, Kraay and Mastruzzi (2004). The indicators of the six governance dimensions are as follows:

1. Political stability and absence of violence (PV): perceptions of the likelihood that the government will be destabilized or overthrown by unconstitutional or violent means, including political violence and terrorism.

2. Rule of law (RL): the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, the police, and the courts, as well as the likelihood of crime and violence.
3. Government effectiveness (GE): the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies.
4. Regulatory quality (RQ): the ability of the government to formulate and implement sound policies and regulations which permit and promote private sector development.
5. Voice and accountability (VA): the extent to which a country's citizens are able to participate in selecting their government, as well as freedom of expression, freedom of association, and free media.
6. Control of corruption (CC): control over the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as "capture" of the state by elites and private interests.

In addition to the governance indicators, we used per capita income (GDP) and natural log of Gross Domestic Product (LNGDP) as control variables. Our dependent variables were the Financial Development Index, Financial Institutions Index and the Financial Markets Index.

The results of panel regression are placed in Table 5 in the Appendix. As can be seen from the results, all of the coefficients of the governance indicators were highly statistically significant and were of the expected positive sign. The coefficients on the control variables GDP and Per Capita Income were also significant and with positive signs, as expected. The results provided empirical support for the hypothesis that a country's financial development is linked with its governance environment. The implication is that an improvement in the governance environment would foster financial development, which in turn would nurture economic growth.

For Pakistan there seems to be much room for improvements in the governance environment. As can be seen in Table 8 the country ranks towards the lower quartile of countries across the world. Compared to similar countries, it scores unfavorably, particularly with respect to "Political Stability and Absence of Violence/Terrorism."

Table 8

	Percentile Rank - 2016						
Governance Indicators	**Pakistan**	**Indonesia**	**India**	**Philippines**	**Egypt**	**Bangladesh**	**Sri Lanka**
Control of Corruption	19	43	47	34	32	21	48
Government Effectiveness	29	53	57	52	28	25	45
Political Stability and Absence of Violence/Terrorism	1	33	14	10	9	10	50
Regulatory Quality	20	39	52	37	36	31	54
Rule of Law	27	50	41	54	18	22	51
Voice and Accountability	29	50	59	51	14	31	43

Source: Worldwide Governance Indicators (WGI) dataset, the World Bank Group.

4. A Digression – Some Illustrative Governance Issues

Heretofore, we have identified weaknesses in the linkages between finance and economic growth, which center on governance and the regulatory environment. We observed that in recent decades, while Pakistan's financial services sector has experienced remarkable growth and structural development, it has not contributed meaningfully towards promoting economic growth in the real sector. Our thesis is that this failure is associated with the worsening of the governance environment in Pakistan.[1] To bolster this inference, in this section, we will provide some recent examples to highlight the governance issues.

As of writing of this paper, there are ongoing discussions with the IMF for a possible bailout package which would help alleviate the balance of payment problems and dwindling foreign exchange reserves. Pakistan's recent approach to the IMF is the latest in a long series of near-defaults on its foreign debt obligations. It seems that the underlying problem is chronic, which cyclically reemerges as a balance of payments and foreign exchange reserve crisis, and necessitates relief and stabilization packages. While the stabilization programs may have helped to maintain a semblance of macroeconomic stability, they have not helped Pakistan to break the "begging bowl" cycle. Orthodox economic stabilization tools have been used to deal with each episode, but this has led to slowdown in economic and social development. Additionally, each episode was addressed with short-term measures, which did stabilize the economy, but adequate

[1] Decay of the institutions of governance is lamented by, among others, by Ishrat Husain in "Governing the Ungovernable," 2018.

follow-through and structural reforms to address the underlying weaknesses were not taken. Unsurprisingly, the economic crises simply manifested themselves again, triggered by the next external shock, or as a consequence of economic mismanagement. The inability to address the problem of chronic twin deficits, the current account and the fiscal deficit, may have its roots in the politico-economy of the decision-making processes. Real change would necessitate generating the political will to take the proverbial bitter pill of radical structural reforms. This political will has been missing due to weak governments and the diverse interests of key elements of the state and sections of society. Though the current crises were visible on the horizon for almost a year, we have yet to see a clear path forward in the government's approach towards handling these issues. Even the accuracy and clarity of economic projections by the Ministry of Finance (MOF) is doubtful (Pasha, 2018).

With hindsight, it is now evident that over the previous five years, the rupee was overvalued by up to 20-25 percent until the end of 2017 and early 2018, when the currency was allowed to depreciate. The abrupt and large drop in the foreign exchange rate was disruptive, amplifying uncertainties and sparking speculative adverse bets against the currency. Perhaps, a gradual increase in interest rates and exchange rate depreciation would have been a better policy option. However, it would have been a difficult decision for any government, particularly one whose credibility and public standing had been damaged. The efforts to improve tax collection, likewise, have been hindered by political considerations.

Independence of the institutions making economic decisions according to their mandates is a pillar of good governance. The State Bank of Pakistan (SBP) started raising the policy rates in 2018, rather belatedly, given the impeding economic challenges and the environment of raising interest rates across the globe. Still, the policy rate appears to be below the level required according to the magnitude of the crisis. It could be that the SBP would have played a more effective role if it enjoyed more independence from the MOF. Similarly, in the case of the Federal Board of Revenue, a separation of the functions of policy and administration would empower it to focus on raising revenue by, for example, undertaking more audits and proactively going after non-filers.

The stock market was deeply impacted by the political and economic uncertainties of 2017 and 2018. In 2017, the KSE-100 index saw its worst annual returns since 2008 and yielded a negative return of 16 percent in 2017. Conversely, 2017 was the best year for Asian markets since

2009. More remarkably, the volumes shrunk by a quarter over 2016, and continue to drop through 2017, from $146 million in the first quarter to less than half at $70 million in the final quarter. The macroeconomic policies, in the face of the current balance of payment crisis, have created a level of uncertainty inimical to effective functioning of the financial markets, as well as institutions. Hussain (2018) further points out that the SECP is currently in non-functional as three, of the required five, commissioners' seats are unoccupied. The front line regulator—the Pakistan Stock Exchange (PSX) has also not shown concern regarding financial markets conditions. Foreign investors are particularly sensitive to the exchange rate risk and have tended to exit the market under the uncertainties around the resolution of the balance of payments crisis. It is reported that the outflow from the stock market in the July-September 2018 period amounted to $186 million, which was partly responsible for the upheaval in the country's equity market (Hussain, 2018). Improvements in governance at the macroeconomic level would certainly create the environment conducive for better functioning and growth of the financial sector.

There is also room to improve governance at the level of financial institutions and regulatory bodies. Macroeconomic uncertainties have kept the investor base narrow, and have simultaneously discouraged corporations from tapping into the stock market to raise equity.[2] Thus, the financial markets are unable to fully contribute towards capital formation and economic development in Pakistan. In addition to the high market volatility, there is a general impression that it is a manipulated and unfair playing field. Thus, the retail investors trade mostly on speculation. There is a number of steps that can be taken at the exchange level to address this issue. For example, investor protection - assuring investors that their capital is safe with the PSX stock broker - needs to be improved. As Richard Morin, CEO of the PSX points out, "In the past 20 years, Pakistan has had an average of two broker bankruptcies every year. That is far higher than most markets," Richard Morin, CEO of PSX, quoted by Business Recorder (Business Recorder, 2018).

The exchange also needs to improve its self-regulation to win investors' confidence and create a fair playing field. This year, PSX fired some IT employees for data leaks and some higher management staff were also terminated. It appears that employees were regularly leaking data on major client orders. It is alleged that some investors were also being

[2] Retail investors number less than 0.2 percent of the nation's 200-million plus population, CEO of PSX quoted by Mangi and Kay (2018).

blackmailed through threats to leak their personal data. Insider trading, irregularities and blackmail are also alleged to be the source of the company's change in status as "defaulter." It is suspected that some of the malpractice at the exchange could be due to unwarranted influence of the brokers on the election of directors and staff appointments. If these allegations are true, the fact that PSX is now under Chinese ownership should help to ameliorate the situation.

5. Summary and Conclusions

The role of finance in economic growth and development is widely accepted. Therefore, promoting financial development should be a central piece of the economic growth strategy. It involves steps to strengthen institutional infrastructure by building effective legal and regulatory frameworks, and adopting best accounting and auditing standards and practices. There is a strong link between the governance environment and development of financial markets and institutions. We have suggested that the linkage runs from the governance and regulatory environment to the lessening of market imperfections and to a more effective role of the financial sector. Hence, public policies should prioritize measures to strengthen rule of law (particularly, enforceability of contracts), effectiveness of government, and regulatory quality, while enhancing control on corruption. Most importantly, in the context of Pakistan, improving political stability and control over violence/terrorism needs to be a top priority.

Even though in recent decades Pakistan's financial services sector has experienced remarkable growth and structural development, it has not contributed meaningfully towards promoting economic growth in the real sector. Our analysis of the financing pattern of the corporate sector suggests that there seems to be an increasing disengagement from the financial sector pointing to its diminishing role in providing funds for real investment. It implies that the problems of information asymmetry, agency costs and adverse selection have become worse in recent years. We infer that this phenomenon is associated with the worsening of the governance environment in Pakistan.

Indeed, the country's governance and regulatory indicators do not compare favorably with other developing countries. Additionally, the development of Pakistan's financial markets and institutions does not fare well in comparison to a cohort of developing countries. The weakness in the linkage between finance and economic growth seems to stem from a

weakness in the governance environment. The weaknesses in the country's governance are empirically documented in studies such as Khawja and Mian (2005a and 2005b), Shahzad (2018), and Uppal and Mangla (2011).

Therefore, the foremost challenge Pakistan faces in encouraging its financial services sector to become an effective driver of economic growth is to strengthen the country's governance and regulatory framework. There seems to be much room for improvement, particularly with respect to indicators of political stability and absence of violence.

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Appendix

Table 3: Global Financial Development Data – Lower Middle Income Countries–2015

No	Code	Indicator name	Lower-Middle Income Countries						Pakistan		
			Year	Count	Average	Median	Max	Min	Score	Rank	% Rank
1	AI	Bank accounts per 1,000 adults	2015	28	617.80	518.02	1864.16	111.11	336.13	22	0.22
2	AI	Bank branches per 100,000 adults	2015	45	13.85	8.37	70.44	0.56	10.04	20	0.56
3	AI	Firms with a bank loan or line of credit (%)	2013	20	28.69	27.80	66.80	4.70	6.70	17	0.15
4	AI	Small firms with a bank loan or line of credit (%)	2013	20	23.99	24.10	56.00	1.90	3.40	19	0.05
5	AI	Account at a formal financial institution (%age 15+)	2014	36	30.99	28.60	91.82	6.45	8.71	35	0.02
6	AI	Saved at a financial institution in the past year (%age 15+)	2014	36	12.46	10.05	33.21	0.86	3.28	32	0.11
7	AI	Saved any money in the past year (%age 15+)	2014	36	47.13	44.66	76.06	20.64	31.56	30	0.17
8	AI	Saved using a savings club in the past year (%age 15+)	2014	36	12.49	10.14	39.94	1.11	11.40	17	0.54
9	AI	Loan from a private lender in the past year (%age 15+)	2014	36	5.15	3.45	18.23	0.81	5.29	12	0.68
10	AI	Loan through store credit in the past year (%age 15+)	2014	35	9.96	6.13	36.53	1.50	25.05	3	0.94
11	AI	Loan from family or friends in the past year (%age 15+)	2014	36	27.88	25.43	60.47	9.00	33.96	12	0.68
12	AI	Credit card (%age 15+)	2014	36	3.81	2.35	27.50	0.00	0.13	35	0.02
13	AI	Debit card (%age 15+)	2014	36	17.06	13.25	65.72	1.70	2.94	34	0.05
14	Al	Mobile phone used to pay bills (%age 15+)	2012	52	17.84	11.55	92.48	0.09	5.47	41	0.21
15	AI	ATMs per 100,000 adults	2015	46	23.78	21.05	86.69	1.90	8.79	38	0.17
16	AI	Firms with a checking or savings account (%)	2013	20	82.61	91.45	98.20	35.00	58.10	18	0.10
17	AI	Firms using banks to finance investments (%)	2013	20	19.30	19.10	43.20	3.80	8.10	18	0.10
18	AI	Firms using banks to finance working capital (%)	2013	20	24.82	24.25	56.10	3.60	8.60	17	0.15
19	AI	Loans requiring collateral (%)	2013	20	85.18	88.20	99.50	56.40	64.00	19	0.05
20	AI	Value of collateral needed for a loan (% of the loan amount)	2013	20	217.53	226.60	299.30	130.80	153.40	19	0.05
21	AI	Firms not needing a loan (%)	2013	20	52.01	48.20	74.70	22.50	57.00	8	0.63
22	AI	Firms whose recent loan application was rejected (%)	2013	20	11.64	8.55	42.20	0.00	13.50	6	0.73
23	AI	Investments financed by banks (%)	2013	20	10.28	10.25	23.90	1.20	2.00	19	0.05
24	AI	Working capital financed by banks (%)	2013	20	9.84	9.95	20.60	1.20	2.50	17	0.15

No	Code	Indicator name	Lower-Middle Income Countries					Pakistan		
			Year	Count	Average	Median	Max	Min	Score	Rank	% Rank
25	AI	Firms identifying access to finance as a major constraint (%)	2013	20	26.19	24.90	62.20	5.20	13.20	16	0.21
26	AM	Investments financed by equity or stock sales (%)	2013	20	5.46	5.45	14.20	0.30	8.50	4	0.84
27	DI	Private credit by deposit money banks to GDP (%)	2015	45	35.09	31.53	102.79	6.70	14.90	41	0.09
28	DI	Deposit money banks' assets to GDP (%)	2015	45	43.68	39.90	118.06	9.88	39.90	23	0.50
29	DI	Nonbank financial institutions' assets to GDP (%)	2013	18	7.85	3.54	28.56	0.80	0.00	na	na
30	DI	Deposit money bank assets to deposit money bank assets and central bank assets (%)	2015	44	89.92	94.52	99.95	59.08	81.13	36	0.18
31	DI	Liquid liabilities to GDP (%)	2015	45	48.69	39.77	128.38	14.81	39.46	24	0.47
32	DI	Central bank assets to GDP (%)	2015	44	4.62	2.46	26.28	0.02	9.28	8	0.83
33	DI	Mutual fund assets to GDP (%)	2015	3	3.54	1.72	7.33	1.56	1.56	3	0.00
34	DI	Financial system deposits to GDP (%)	2015	45	41.41	39.18	89.84	10.04	30.05	32	0.29
35	DI	Life insurance premium volume to GDP (%)	2014	32	0.45	0.31	2.51	0.00	0.49	12	0.64
36	DI	Non-life insurance premium volume to GDP (%)	2014	36	0.62	0.52	1.69	0.05	0.22	30	0.17
37	DI	Insurance company assets to GDP (%)	2014	18	3.71	2.59	16.79	0.57	1.10	15	0.17
38	DI	Private credit by deposit money banks and other financial institutions to GDP (%)	2015	45	37.31	33.49	102.79	6.70	14.90	42	0.06
39	DI	Pension fund assets to GDP (%)	2014	10	9.24	3.37	32.31	0.04	0.04	10	0.00
40	DI	Domestic credit to private sector (% of GDP)	2015	45	38.40	34.89	111.93	7.14	15.38	41	0.09
41	DM	Stock market capitalization to GDP (%)	2013	10	37.86	31.50	81.92	13.24	0.00	na	na
42	DM	Stock market total value traded to GDP (%)	2014	14	5.91	2.46	30.93	0.13	0.22	13	0.07
43	DM	Outstanding domestic private debt securities to GDP (%)	2013	2	1.28	1.28	2.09	0.46	0.00	na	na
44	DM	Outstanding domestic public debt securities to GDP (%)	2015	4	28.91	28.99	45.44	12.24	45.44	1	1.00
45	DM	Outstanding international private debt securities to GDP (%)	2013	12	3.60	2.05	14.19	0.48	0.00	na	na
46	DM	Outstanding international public debt securities to GDP (%)	2015	17	7.03	4.49	21.57	0.38	1.87	14	0.18
47	DM	Outstanding total international debt securities / GDP (%)	2015	17	10.33	10.07	36.59	1.71	1.87	15	0.12
48	DM	Gross portfolio equity liabilities to GDP (%)	2015	22	2.80	1.21	15.19	0.00	2.15	8	0.66
49	DM	Gross portfolio equity assets to GDP (%)	2015	19	1.51	0.20	18.12	0.01	0.05	16	0.16
50	DM	Gross portfolio debt liabilities to GDP (%)	2015	19	7.44	4.63	27.57	0.00	1.90	12	0.38
51	DM	Gross portfolio debt assets to GDP (%)	2015	24	1.53	0.53	9.32	0.00	0.07	19	0.21

No	Code	Indicator name	Lower-Middle Income Countries						Pakistan		
			Year	Count	Average	Median	Max	Min	Score	Rank	% Rank
52	DM	Syndicated loan issuance volume to GDP (%)	2015	22	3.07	0.96	39.24	0.11	0.79	13	0.42
53	DM	Corporate bond issuance volume to GDP (%)	2013	9	0.88	0.84	1.77	0.11	0.00	na	na
54	DM	Syndicated loan average maturity (years)	2014	22	8.28	6.76	20.01	0.94	3.00	18	0.14
55	EI	Bank net interest margin (%)	2015	43	4.81	4.36	10.92	1.46	4.07	28	0.35
56	EI	Bank lending-deposit spread	2013	36	7.60	6.88	19.48	0.45	4.81	28	0.22
58	EI	Bank noninterest income to total income (%)	2015	41	19.28	11.73	93.18	2.47	6.33	37	0.10
59	EI	Bank overhead costs to total assets (%)	2015	44	5.35	2.97	89.42	0.71	2.36	30	0.32
60	EI	Bank return on assets (%, after tax)	2015	43	1.27	1.26	4.69	-4.22	1.47	16	0.64
61	EI	Bank return on equity (%, after tax)	2015	44	11.91	11.53	29.23	-18.91	15.56	14	0.69
62	EI	Bank cost to income ratio (%)	2015	41	77.22	75.43	155.94	20.00	62.16	31	0.25
63	EI	Credit to government and state owned enterprises to GDP (%)	2015	42	10.02	6.69	49.14	0.04	28.15	2	0.97
64	EI	Bank return on assets (%, before tax)	2015	44	1.15	1.81	4.69	-26.51	2.46	13	0.72
65	EI	Bank return on equity (%, before tax)	2015	44	16.84	16.15	38.41	-19.36	26.12	7	0.86
66	EM	Stock market turnover ratio (%)	2012	37	7.66	5.44	25.70	0.53	14.47	5	0.88
67	SI	Bank Z-score	2015	42	14.26	11.75	53.63	2.52	11.21	22	0.48
68	SI	Bank nonperforming loans to gross loans (%)	2015	33	8.12	5.99	28.03	0.42	11.36	8	0.78
69	SI	Bank capital to total assets (%)	2015	31	11.64	11.31	19.59	5.43	8.42	24	0.23
70	SI	Bank credit to bank deposits (%)	2015	45	96.97	79.88	684.20	32.28	49.60	41	0.09
71	SI	Bank regulatory capital to risk-weighted assets (%)	2015	33	17.89	16.18	36.70	10.15	17.34	15	0.56
72	SI	Liquid assets to deposits and short-term funding (%)	2015	45	29.73	25.57	85.04	10.96	11.84	44	0.02
73	SI	Provisions to nonperforming loans (%)	2015	32	66.70	60.57	243.30	23.42	84.95	5	0.87
74	SM	Stock price volatility	2015	17	14.23	13.37	29.18	6.84	13.26	11	0.37
75	OI	Bank concentration (%)	2015	36	62.93	56.99	100.00	28.48	46.09	27	0.25
76	OI	Bank deposits to GDP (%)	2015	45	41.36	39.18	89.84	10.04	30.05	32	0.29
77	OI	H-statistic	2015	27	0.54	0.54	0.97	0.12	0.74	6	0.80
78	OI	Lerner index	2012	34	72.26	71.52	100.00	34.52	58.91	24	0.30
79	OI	Boone indicator	2015	43	-0.05	-0.03	0.27	-0.66	0.23	2	0.97
80	OI	5-bank asset concentration	2015	31	73.36	68.91	100.00	35.93	63.22	23	0.26
81	OI	Loans from nonresident banks (net) to GDP (%)	2014	10	0.32	0.23	1.24	-0.90	0.41	5	0.55

No	Code	Indicator name	Lower-Middle Income Countries						Pakistan		
			Year	Count	Average	Median	Max	Min	Score	Rank	% Rank
82	OI	Loans from nonresident banks (amounts outstanding) to GDP (%)	2015	18	10.18	9.30	36.66	1.76	1.87	16	0.11
83	OI	External loans and deposits of reporting banks vis-à-vis the banking sector (of domestic bank deposits)	2015	43	23.03	14.39	100.95	1.80	12.50	24	0.45
84	OI	External loans and deposits of reporting banks vis-à-vis the nonbanking sectors (of domestic bank deposits)	2015	44	113.61	7.25	4491.24	0.59	3.46	32	0.27
85	OI	External loans and deposits of reporting banks vis-à-vis all sectors (% of domestic bank deposits)	2015	44	142.99	23.61	4819.92	3.81	15.96	30	0.32
86	OI	Remittance inflows to GDP (%)	2015	48	8.42	6.63	28.76	0.16	7.12	22	0.55
87	OI	Consolidated foreign claims of BIS reporting banks to GDP (%)	2015	48	35.82	11.95	1033.59	0.22	3.95	36	0.25
88	OI	Foreign banks among total banks (%)	2013	32	43.47	45.00	94.00	0.00	43.00	17	0.48
89	OI	Foreign bank assets among total bank assets (%)	2013	22	36.50	27.00	100.00	0.00	52.00	7	0.71
90	OM	Number of listed companies per 1,000,000 people	2014	16	3.94	2.68	14.15	0.80	3.01	7	0.60
91	OM	Stock market return (, year-on-year)	2015	17	-0.39	-0.01	14.83	-21.50	10.64	3	0.87

Source: World Bank, 2006.

Table 4: Financial Development Indices and Governance Indicators – Results

A) Dependent Variable: Financial Development Index

Control of Corruption (CC)				Government Effectiveness (GE)				Political Stability and Absence of Violence/Terrorism (PV)				Rule of Law (RL)				Regulatory Quality (RQ)				Voice and Accountability (VA)			
Variable	**Coeff**	**t-Stat**	**Prob.**	**Variable**	**Coeff**	**t-Stat**	**Prob.**	**Variable**	**Coeff**	**t-Stat**	**Prob.**	**Variable**	**Coeff**	**t-Stat**	**Prob.**	**Variable**	**Coeff**	**t-Stat**	**Prob.**	**Variable**	**Coeff**	**t-Stat**	**Prob.**
CC	0.065	11.531	0.000	GE	0.083	14.508	0.000	PV	0.024	5.755	0.000	RL	0.065	14.323	0.000	RQ	0.047	7.735	0.000	VA	0.032	8.637	0.000
LNGDP	0.032	25.719	0.000	LNGDP	0.025	23.366	0.000	LNGDP	0.032	19.833	0.000	LNGDP	0.031	27.479	0.000	LNGDP	0.024	20.324	0.000	LNGDP	0.028	23.844	0.000
PCAP	0.000	2.985	0.003	PCAP	0.000	3.727	0.000	PCAP	0.000	4.844	0.000	PCAP	0.000	3.080	0.002	PCAP	0.000	4.699	0.000	PCAP	0.000	5.173	0.000
C	-0.539	-19.582	0.000	C	-0.373	-14.228	0.000	C	-0.578	-16.392	0.000	C	-0.511	-19.971	0.000	C	-0.379	-12.788	0.000	C	-0.490	-17.730	0.000
Total panel observations 691				**Total panel observations 688**				**Total panel observations 685**				**Total panel observations 693**				**Total panel observations 689**				**Total panel observations 693**			
Adj R-sq	0.504	Akaike IC	-2.675	Adj R-sq	0.547	Akaike IC	-2.763	Adj R-sq	0.434	Akaike IC	-2.539	Adj R-sq	0.546	Akaike IC	-2.761	Adj R-sq	0.454	Akaike IC	-2.579	Adj R-sq	0.468	Akaike IC	-2.603
F-stat	234.4	Prob F	0.000	F-stat	277.2	Prob F	0.000	F-stat	175.5	Prob F	0.000	F-stat	278.4	Prob F	0.000	F-stat	192.0	Prob F	0.000	F-stat	204.3	Prob F	0.000

B) Dependent Variable: Financial Institutions Index

Control of Corruption (CC)				Government Effectiveness (GE)				Political Stability and Absence of Violence/Terrorism (PV)				Rule of Law (RL)				Regulatory Quality (RQ)				Voice and Accountability (VA)			
Variable	**Coeff**	**t-Stat**	**Prob.**	**Variable**	**Coeff**	**t-Stat**	**Prob.**	**Variable**	**Coeff**	**t-Stat**	**Prob.**	**Variable**	**Coeff**	**t-Stat**	**Prob.**	**Variable**	**Coeff**	**t-Stat**	**Prob.**	**Variable**	**Coeff**	**t-Stat**	**Prob.**
CC	0.063	11.755	0.000	GE	0.067	11.847	0.000	PV	0.030	7.739	0.000	RL	0.041	8.617	0.000	RQ	0.028	4.706	0.000	VA	0.019	5.308	0.000
LNGDP	0.019	16.445	0.000	LNGDP	0.013	12.031	0.000	LNGDP	0.021	13.813	0.000	LNGDP	0.017	14.416	0.000	LNGDP	0.012	10.617	0.000	LNGDP	0.015	12.924	0.000
PCAP	0.000	15.886	0.000	PCAP	0.000	17.862	0.000	PCAP	0.000	16.362	0.000	PCAP	0.000	17.359	0.000	PCAP	0.000	17.958	0.000	PCAP	0.000	18.634	0.000
C	-0.237	-9.072	0.000	C	-0.089	-3.436	0.001	C	-0.300	-9.112	0.000	C	-0.197	-7.438	0.000	C	-0.110	-3.790	0.000	C	-0.183	-6.727	0.000
Total panel observations 691				**Total panel observations 688**				**Total panel observations 685**				**Total panel observations 693**				**Total panel observations 689**				**Total panel observations 693**			
Adj R-sq	0.531	Akaike IC	-2.779	Adj R-sq	0.534	Akaike IC	-2.781	Adj R-sq	0.483	Akaike IC	-2.674	Adj R-sq	0.493	Akaike IC	-2.692	Adj R-sq	0.454	Akaike IC	-2.625	Adj R-sq	0.460	Akaike IC	-2.630
F-stat	261.7	Prob F	0.000	F-stat	263.1	Prob F	0.000	F-stat	213.9	Prob F	0.000	F-stat	225.3	Prob F	0.000	F-stat	191.9	Prob F	0.000	F-stat	197.8	Prob F	0.000

C) Dependent Variable: Financial Markets Index

Control of Corruption (CC)				Government Effectiveness (GE)				Political Stability and Absence of Violence/Terrorism (PV)				Rule of Law (RL)				Regulatory Quality (RQ)				Voice and Accountability (VA)			
Variable	**Coeff**	**t-Stat**	**Prob.**	**Variable**	**Coeff**	**t-Stat**	**Prob.**	**Variable**	**Coeff**	**t-Stat**	**Prob.**	**Variable**	**Coeff**	**t-Stat**	**Prob.**	**Variable**	**Coeff**	**t-Stat**	**Prob.**	**Variable**	**Coeff**	**t-Stat**	**Prob.**
CC	0.066	7.195	0.000	GE	0.098	10.358	0.000	PV	0.017	2.664	0.008	RL	0.089	12.184	0.000	RQ	0.066	6.885	0.000	VA	0.044	7.597	0.000
LNGDP	0.044	21.718	0.000	LNGDP	0.037	20.913	0.000	LNGDP	0.043	16.784	0.000	LNGDP	0.044	24.740	0.000	LNGDP	0.036	19.182	0.000	LNGDP	0.041	22.060	0.000
PCAP	0.000	-5.589	0.000	PCAP	0.000	-6.230	0.000	PCAP	0.000	-3.582	0.000	PCAP	0.000	-7.377	0.000	PCAP	0.000	-5.239	0.000	PCAP	0.000	-5.157	0.000
C	-0.835	-18.536	0.000	C	-0.652	-15.068	0.000	C	-0.849	-15.235	0.000	C	-0.818	-19.940	0.000	C	-0.644	-13.873	0.000	C	-0.791	-18.214	0.000
Total panel observations 691				**Total panel observations 688**				**Total panel observations 685**				**Total panel observations 693**				**Total panel observations 689**				**Total panel observations 693**			
Adj R-sq	0.421	Akaike IC	-1.690	Adj R-sq	0.461	Akaike IC	-1.759	Adj R-sq	0.384	Akaike IC	-1.624	Adj R-sq	0.488	Akaike IC	-1.814	Adj R-sq	0.417	Akaike IC	-1.682	Adj R-sq	0.425	Akaike IC	-1.700
F-stat	168.2	Prob F	0.000	F-stat	196.6	Prob F	0.000	F-stat	143.0	Prob F	0.000	F-stat	220.6	Prob F	0.000	F-stat	165.0	Prob F	0.000	F-stat	171.8	Prob F	0.000

Method: Panel Least Squares; Cross-sections included: 44

The Lahore Journal of Economics
23 : 2 (Winter 2018): pp. 109–150

Human and Social Capital Complementarities in the Presence of Credit Market Imperfections

Natasha Moeen*

Abstract

This paper models the individual-level social capital effect the credit market constraints that reduce the accumulation of costly human capital. Human capital, in turn, improves an individual's income as well as the bequest that they intend to leave for their children. It also helps reduce inequality across a country. Finally, the model shows that investment in social capital has a negative relationship with the interest rate, so that the initial inherited bequest of every individual affects the output and investment in the short-run, as well as in the long-run.

Keywords: Social capital, credit market, investment, interest rate.

JEL classification: E24.

1. Introduction

The significance of educational credentials for an individual's job market success is well established in labor economics. These market returns, which are realized in the future, incentivize individuals to accumulate human capital today. Spence's (1973) job marketing signaling theory reinforces the idea that education signals help employers identify the most productive employees. The direct effect of human capital on productivity is confirmed by Lucas (1988), Romer (1989) and Dinda (2008). The indirect effect through spillover has been shown by Nelson and Phelps (1966), and Becker and Mulligan (1997). This paper analyzes the role of individual-level social capital accumulation in easing the credit market constraints, which facilitate the accumulation of costly human capital and reduces income inequality.

Social capital has been described in various ways throughout the economic literature. Van Staveren and Knorringa (2007) find that relations matter though it is difficult to know all the factors that affect the productivity of individuals (Imandoust, 2011). Social capital is acquired by the repeated interaction of at least two people with the expectation of receiving mutual benefits in the future. Various strands of literature

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discuss the effect of social capital on economic growth (Putnam & Helliwell, 1995; Knack & Keefer, 1997; La porta et al., 1999 Chou, 2006; Dincer & Uslaner, 2010). However, the measurement of social capital varies since there is no perfectly generalizable variable.

Social capital accumulation is prioritized as it inculcates trust and understanding among people, which creates incentives for everyone to efficiently achieve a common goal. Potential benefits of social capital under discussion here will be with regards to material goods and services, including children's health care (Kawachi et al., 1997), information flow regarding the credibility of borrowers (Knack & Keefer, 1997; Putnam, 2000), trust formation for better access of credit (Duffhues & Weterings., 2011), reduced transaction costs (Coleman, 1988; Dinda, 2008) and complementing other capitals such as human capital (Coleman, 1988; Becker, 1994; Coleman, 1994; Glaeser et al., 2002. Besides the above mentioned monetary benefits, there are some non-monetary benefits attached to social capital accumulation, such as moral support for psychological happiness (La Porta et al., 1999).

The accumulation of social capital requires constant maintenance, or it will diminish like human capital. Becker (1964) posits that when an individual leaves a job, all the social capital gained horizontally or vertically is reduced over time. Therefore, a variable such as homeownership is a good indicator of whether one is likely to invest in one's social capital and unlikely to migrate (Glaeser et al., 2002). Physical distances determine social connections; therefore, the non-monetary cost of social exclusion is significant.

This paper aims to fill the gap in literature by modelling financial development with the help of social capital accumulation. Our focus is on two types of income groups: those who can afford costly education, and those who cannot given the bequest that they inherit from their parents. Empirical literature gives us inspiration as the vertical link between the two income groups can solve the problem of credit market constraint (Duffhues & Waterings, 2011). When low-income groups pursue loans to finance education, their credibility is usually unknown to the lenders which creates the problem of asymmetric information. Hence, the borrowers pay large interest rates on loans which include the borrowing cost as well as the monitoring costs borne by the lenders. In this model, income is examined in three components: consumption, bequest, and social capital. Consumption and bequest are discussed in the model by Galor and Zeirra (1993), whereas individual social capital has been discussed in the

model by Glaeser et al. (2002). We do not believe that social capital has been discussed in conjunction with the first two components in any model in the literature. In order to induce the efficient allocation of capital, we set up an economy in which individuals invest in social capital accumulation to bypass high monitoring costs. These financial arrangements change the incentives and constraints that the economic agents would face. This paper builds a theoretical model where individual level social capital accumulation helps lower the borrowing rates so that more skilled individuals can enter the labor force in the long-run.

This paper adds to the existing theoretical framework in two ways. First, it develops an explicit relationship of social capital with income, unlike the implicit relationship described in the literature. Second, it shows that for interest rates to vary for low-income borrowers, social capital accumulation is essential, as the individual aspect is being considered rather than aggregate. The model's results show that the interest rate is dependent upon social capital; therefore, higher social capital allows individuals to borrow at a lower rate when compared to what is offered in the market. Also, our model assumes that borrowers' costs are dependent upon the mobility cost of individuals. Individuals with sufficient social capital typically will not attempt to migrate as their movement will affect those relationships, and the borrowing cost will eventually increase due to monitoring becoming difficult for the lenders.

The following section describes the economy being modelled by specifying an individual's behavior and the incentive compatibility constraint they face. We describe various components of one's income and how a budget is optimally allocated for consumption, bequest and social capital. We then discuss how social capital accumulation lowers interest rates as compared with the market interest rates. We then solve for various threshold levels of bequest and define the region where agents are charged a lower interest rate with social capital accumulation. We have also perform a comparative static analysis on long-run equilibrium to see which economies would benefit the most in the future.

2 Description of the Economy

To account for the prevailing problem of risk, which is developed through trust and investment in social capital, we build an overlapping generations model (OLG), wherein there is a continuum of individuals of size, L, who live for two time periods. Our model settings and assumptions are based on the papers of Galor and Zeira (1993) and Glaeser, Laibson and

Sacerdote (2002), as we explore the theoretical linkage between an individual's initial inheritance and human capital via social capital accumulation.

2.1. Benchmark Model

It is assumed in this model that a small open economy produces only a single product. Each individual then decide how they wish to utilize this product – consumption or further investment. The good's production is carried out through two technologies. Two methods are employed for the good's production.

The first method uses unskilled labor, which is defined as:

$$Y_t^u = w_u \, . \, L_t^u \tag{1}$$

where Y_t^u is the unskilled output, L_t^u unskilled labor and w_u is the unskilled wage rate or the marginal productivity of labor. Also, $w_u > 0$ is used for anyone who works as an unskilled laborer.

The second method uses skilled labor as well as capital and is defined as:

$$Y_t^s = f(L_t s, K_t) \tag{2}$$

where Y_t^s is skilled output, f is a concave function with constant returns to scale, L_t^s is skilled labor, and K_t is the capital used in the production of this product. We assume that the technology used in the production of the good requires skill and knowledge; hence, the inclusion of physical capital only in the production of skilled output production function.

Taking the assumption from Galor and Zeira (1993), the investment in physical capital is made a period before, like human capital accumulation, and for model simplification it does not depreciate over time. The number of skilled individuals is anticipated because investment in human capital occurs one time period earlier, and their wage is dependent upon the lending rate and the level of technology. Due to this known number of skilled individuals entering the workforce, the capital-labor ratio remains constant along with the wage rate, w_s. Lastly, we assume that the labor and goods market described above are perfectly competitive.

2.2. Individuals

The economy contains agents living two periods with inter-generational altruism. Parents care about their children's well-being so they leave a certain bequest for them to be consumed in future. In time period 1, the individual is young and in time period 2, the individual is old. Parents care about their children and leave a certain amount, b_{t+1}, to their children according to their resources. We assume that population growth is constant with one parent and one child which creates a link between the two generations. Individuals within each generation are homogenous in terms of their preferences and innate abilities; they are heterogeneous in terms of the level of the initial bequest which they receive from their parents. Every agent is endowed with one unit of time in every period. When young, he/she allocates his/her time; receiving education, working and accumulating social capital, while the old agents can only utilize their time working in either skilled or unskilled labor depending upon the decisions made the first time period.

If agents do not acquire education in time period 1, they work as unskilled labor in time period 2. Individuals work as a skilled laborer in time period 2 only if costly human capital, h, is accumulated in time period 1. Human capital cost includes a fixed amount for tuition fee and other complementary expenditures. In the real world, this cost is divided by giving weight to each class of labor associated with the process of human capital acquisition. For instance, the weight given to skilled teachers is higher compared to the unskilled janitors working in the school. For model simplification, we are using the combined cost of human capital. Whether an individual joins the labor force as a skilled or unskilled laborer is dependent upon the initial conditions of each individual. For the sake of model simplicity, we take the assumption from Galor and Zeira (1993) that consumption only occurs in time period 2.

2.3. Preferences and Budget Constraint

We assume that the preferences and abilities of agents are identical for time period, t. Agents allocate their income toward domestic consumption for adulthood, intergenerational funds in the form of bequest for their children, and productive social capital which has defined returns. These preferences are described in log-linear utility function as:

$$U_{i,t+1} = \alpha log(c_{t+1}) + \beta log(b_{t+1}) + (1-\alpha-\beta) log\, R(\hat{S}).Si_{,t+1} \quad (3)$$

where $\alpha \epsilon (0,1)$, $\beta \epsilon (0,1)$

Equation *(3)* shows the log utility of an individual for a time period, where c_{t+1} represents consumption in time period 2, b_{t+1} is the level of inherited bequest received from their parents and $R(\hat{S}).S_t$ [1] is the return on social capital which everyone receives by investing in it.

Glaeser et al. (2002) define the variable $R(\hat{S})$ as the market and non-market returns individuals receive from investing in social capital. Monetary or market returns include better employment opportunities when one becomes skilled. This phenomenon is expected because when an individual has strong connections and information about the job vacancy, the chances are higher that he/she will successfully obtain their desired job (Leana III & Van Buren, 1999; Lin., N 2000) when compared to the individual with weaker connections. Likewise, non-monetary or non-market returns include subjective motives like happiness from relation building and improvement in health. α and β are the weights assigned to consumption, and $(1-\alpha-\beta)$ is the weight assigned to the individual-level social capital of each individual. He/she then chooses his/her optimal level of consumption, level of bequest and investment in social capital which maximizes utility.

The budget constraint of an individual from generation t in time period $t+1$ is:

$$y_{t+1} \geq c_{t+1} + b_{t+1} + \gamma_i S_{t+1} \tag{4}$$

where $\gamma \epsilon (0,1)$ and is dependent on index i.

From equation *(4)* we see that the income of individuals, y_{t+1}, in time period 2 (when they become adults) is constrained by the household consumption, the bequest for their offspring and the cost of social capital.

The proportion of income spent on consumption will be categorized as non-productive, whereas the proportion of income spent on social capital is productive, with the bequest being utilized as savings by the next generation. Higher consumption leads to an improved standard of living for the low- and high-income groups in the society. Spending can be on infrastructure, modern sanitation & water facilities, or on desirable food products (Dasgupta & Maler, 1995). However, marginal utility from

[1] This function, log $R(\hat{S}).S_{i,t+1}$ is identical to that of Glaeser, E. et.al (2001). An economic approach to social capital. *The Economic Journal*, *112*(483), F437-F458.

consumption by the low-income group is greater than that realized by the high-income group, even if spent on the same products.

In our model, individual investment in social capital is defined as spending time with family and friends (e.g., helping in times of crisis, paying a visit, or simply calling to socialize). Therefore, we also assume that the time cost of accumulating social capital is proportional to one's income as stated by Glaeser et al. (2002). This implies that the unit of time spent on social interaction, away from work, may cost more for skilled individuals than unskilled individuals with lower opportunity cost of time. Skilled people earning higher wages value their time more as they can be more productive than unskilled people given the same unit of time. Thus, individuals bear γw_s and γw_u which are the costs of skilled and unskilled workers respectively.

2.4. Optimization

Individuals maximize their utility function in equation *(3)* subject to the budget constraint in equation *(4).* Thus,

$$Max \quad U_{i,t+1} = \alpha log(c_{t+1}) + \beta log(b_{t+1}) + (1-\alpha-\beta) log\, R(\hat{S}).\, S_{i,t+1}$$

$$c, b, S_i$$

subject to:

$$y_{t+1} = c_{t+1} + b_{t+1} + \gamma_i S_{t+1}$$

By setting up a Lagrange, we find the first-order conditions[2].

By solving the first-order conditions, we find the optimal values:

$$c_{t+1^*} = \alpha y_{t+1} \tag{5}$$

$$b_{t+1}{}^* = \beta y_{t+1} \tag{6}$$

$$S_{t+1^*} = \frac{(1-\alpha-\beta) y_{t+1}}{\gamma_i} \tag{7}$$

By substituting for (γ_i) optimal social capital for skilled and unskilled labor is defined according to their wage rate as:

[2] For detailed working, see Appendix A

$$S_i^u = \frac{(1-\alpha-\beta)y_{t+1}}{\gamma w_u} \tag{7.1}$$

$$S_i^s = \frac{(1-\alpha-\beta)y_{t+1}}{\gamma w_s} \tag{7.2}$$

From their income, a fixed fraction of α is allocated to household consumption, a fraction of β is allocated for intergenerational transfers, while the remaining fraction *(1-α-β)* of income per respective cost (proportional to one's income) is allocated to optimal social capital accumulation.

By substituting for the optimal values from equation (5), (6) & (7), we find an indirect utility function, V_t [2]:

$$V = \alpha log(\alpha) + \alpha log(y_{t+1}) + \beta log(\beta) + \beta log(y_{t+1}) + (1-\alpha-\beta) log R(\hat{S}) + (1-\alpha-\beta) log(1-\alpha-\beta) + (1-\alpha-\beta) log y_{t+1} - (1-\alpha-\beta) log \gamma$$

$$Vt = log y_{t+1} - (1-\alpha-\beta)\ log\gamma_i + \varepsilon \tag{8}$$

$$where\ \varepsilon = \alpha log\alpha + \beta log\beta + (1-\alpha-\beta)\ log\ (1-\alpha-\beta) + (1-\alpha-\beta)\ logR\ (\hat{S})$$

3. Credit Markets

Due to imperfect information available to lenders regarding individual borrowers' credibility, the lending rate is higher than the borrowing rate in the credit market for individual borrowers. To account for this uncertainty, lenders' monitoring costs need to be positive to ensure that the borrowers do not default on their loans. This additional tracking cost must be covered by the lender so the lender will only lend at a rate greater than the risk-free interest rate, *r*.

Lenders have always been essential to the financial landscape. Therefore, it is important to classify the type of lenders on which our model focuses: anyone who can lend money to a person whose inherited bequest cannot cover human capital expenses. Thus, borrowed money in this model is assumed only to be spent on acquiring education to become skilled. This borrowing can be one-time or continued according to one's financial needs. Individuals may benefit from additional financial resources and secure their future by building the bequest. Whereas, the relationship with age is such that if an individual's peers die when he/she is old, there may be no one to look after him/her in times of need as the individual would have no additional resources. The interest rate is defined as:

$$i = r + z.f\,(S_i) \tag{9}$$

where i is the per unit interest rate which lenders charge. It is a sum of the risk-free per unit interest rate, r, along with the monitoring cost, z. Monitoring cost is a multiplicative function with $f(S_i)$. This function is linear with a negative relationship. As the investment in social capital increases, the interest rate on borrowings will be reduced as well as the monitoring cost, z. The channel has already been discussed in this paper as relation building helps individuals develop trust amongst each other. The lenders then incentivize the borrowers by giving cheap loans where collateral is trust and loyalty. These loans are established through social capital investment.

We propose that an individual lender's monitoring cost varies with the social capital of each individual. Whenever a social agreement is made between parties, individuals make sure to repay their debts in order to maintain their reputation (Stiglitz, 1990). We assume that borrowers with a dense network of friends, colleagues and family have high social capital. Similar types of people form social groups, an idea known as assortative mating (Mare, 1991). In this case, individuals with high social capital are well-connected, signaling to lenders that they are credible. Therefore, their mobility cost will also be high compared to those who are less connected with their peers. Thus, lenders are better able to monitor the former category of borrower. Eventually, this decreases lenders' monitoring cost for borrowers who possess higher social capital. These costs may consist of travelling expenditures, public relations or plain psychological costs (loss of happiness that results from moving away from home). In order to discourage borrowers from evading debt repayments, lenders keep z as high as possible.

The incentive compatibility constraint described in equation (10) shows that as the borrowed amount increases, the monitoring and non-monitoring cost of evasion both rise and the corresponding tracking cost borne by the lender rises as well:

$$d(1+i) = \beta m..zf(S_i) + \beta_{nm} f(S_i) \tag{10}$$

where β_m and β_{nm} are the monitoring and non-monitoring costs of evasion respectively and $d(1+i)$ is the interest charged on the amount borrowed. Also, $d=(b-h)$. This incentive compatibility shows that the individual will be indifferent if the total interest paid on borrowed amount is equal to the total cost of default in terms of monetary and non-monetary cost.

β_m has a negative linear relationship with social capital ($\beta_{nm)}$, and a positive linear relation with social capital. They are both multiplicative with social capital. Monitoring cost refers to the cost which lenders incur in order to verify the credibility of the borrowers (whether they will pay back the money or not). This is through repeated interaction which builds trust. These relations are either built intentionally (for instance, if lenders remain in touch with peers through frequent visits or phone calls) or unintentionally (for instance, if the borrower works for a third party but provides their services as a mediator to the lenders and leaves a positive impression). The non-monitoring cost of social capital is focused on the psychological cost where borrowers/lenders usually feel unhappy and disconnected if they migrate or move away from their current social circle. The individual faces a mobility cost in terms of spending more money to keep in touch with friends and relatives. Also, individuals may incur greater traveling costs to maintain their membership in a prominent society or to simply maintain good relationships. Individuals with higher social capital incur higher costs of each type.

In this setting, there are two players: the borrower as an agent (whose level of inherited bequest is smaller than the costly education) and the lender as a principal (whose level of inherited bequest is greater than the costly education and allocate their savings to the borrowers). If the principal is a financial intermediary, they will charge a higher interest rate which includes the lending rate as well as the cost of monitoring the borrower. Since borrowers are investing by building trust and social capital within their vertical links, this monitoring cost is reduced substantially. In this way, social capital investment creates incentives for the borrowers to a) borrow at a lower rate than the market, and b) invest in their costly education to become skilled in time period 2.

Equation (10) depicts how individuals will be indifferent when they pay interest rate, *i*, on the borrowed amount as it equals the monitoring cost and non-monitoring costs borne by the lenders. Galor and Zeira (1993) discuss only a general monitoring cost. We have introduced a sub-division with functional characteristics of the monitoring cost having a negative relationship with social capital and a positive relationship between non-monitoring (psychological cost) and social capital.

By solving for the incentive compatibility constraint using equations *(9)* and *(10)*, we can find *i*:

$$i = \frac{d + r\beta_m - \beta_{nm} \cdot f(Si)}{(\beta_m - d)} \tag{11}$$

$$1 + i = \frac{\beta_m[1 + r] - \beta_{nm} \cdot f(Si)}{(\beta_m - d)} \tag{12}$$

The comparative static for $\frac{\partial(1+i)}{\partial Si}$ shows a negative relationship[3]. Equation *(11)* implies that the interest rate that a lender charges to individual borrowers decreases with individual social capital accumulation.

4. Income of Individuals

In time period 1, individuals or agents acquire education and work in time period 2, receiving the wages as skilled laborers or they can work as unskilled laborers in both time periods, 1 and 2. It is dependent upon the inherited bequest and/or if they invest in social capital accumulation to become skilled/unskilled in time period 2.

4.1. Income of an Unskilled Worker

In time period 1, when an individual is a child, if he/she opts to work, his/her compensation will be that of an unskilled worker's wage rate, w_u. At the beginning of time period 1, an individual receives a bequest from his/her parents, b_t. Individuals then decide whether to become skilled in the next time period or work as unskilled in both time periods. They then become borrowers if the bequest is less than the human capital cost.

For unskilled individuals who work in time period 1, their income consists of childhood savings $(w_u + b_t)$, capital gains on savings $(w_u + b_t)\, r$, along with their current wage, w_u which they receive in time period 2. Therefore, cumulative wealth of an unskilled individual in $t+1$ will be:

$$y^u_{t+1} = bt(1+r) + wu\,(2+r) \cong\ y^u_{t+1}(b_t) \tag{13}$$

4.2. Income of a Skilled Worker

In time period 1, when an individual is a child, if he/she opts to acquire education, he can then work as a skilled worker in time period 2 as an adult. His/her compensation will be that of a skilled worker's wage rate, w_s. In time period 1, this individual receives bequest, b_t, from his/her parents. The level of bequest determines one's wealth for $t+1$.

[3] For detailed working, see Appendix B

If the bequest is sufficient to cover h, when $(b_t\text{-}h) > 0$, the additional funds are saved for time period 2. Therefore, the individual can afford to finance costly human capital and can lend the savings to make capital gains. Thus, income in $t+1$ comprises wage income, w_s, capital gains on savings, $(b_t\text{-}h)r$, in addition to the savings $(b_t\text{-}h)$ themselves.

When $(b_t\text{-}h) < 0$, the additional funds are borrowed at an interest rate, i. In time period 2, the individual has to repay the loan amount plus interest amount to the lender as they are unable to finance the entire cost of human capital. Thus, income in $t+1$ comprises wage income w_s, net of additional borrowings and the interest charged on them, $(b_t\text{-}h)(1+i)$. Therefore, the wealth of a skilled worker in $t+1$ depends on the levels of b_t that they receive:

$$y^s_{t+1} = (b_t - h)(1+r) + w_s \qquad b_t \geq h \tag{14}$$

$$y^s_{t+1} = (b_t - h)(1+i) + w_s \qquad b_t \geq h \tag{15}$$

5. Agents' Decision Problem

Agents make a choice in time period 1 whether to accumulate human capital or not based on the initial inheritance level.

Individuals accumulate human capital only if the utility of being skilled (b > h) is greater than that of being unskilled.

$$V_s \geq V_u$$

$$log[(b_t - h)(1+r) + w_s] + log(1-\alpha-\beta)\log R(\hat{S}) - (1-\alpha-\beta)log\gamma w_s \geq$$

$$log[b_t(1+r) + w_u(2+r)] + (1-\alpha-\beta)\log R(\hat{S}) - (1-\alpha-\beta)log\gamma w_u$$

$$\frac{(b-h)(1+r)+w_s}{b(1+r)+w_u(2+r)} \geq \left(\frac{w_s}{w_u}\right)^{1-\alpha-\beta} \tag{16}$$

Proposition 1

Equation *(16)* implies that if the optimal ratio of a skilled individual's income to an unskilled individual's income is greater than the ratio of their wages, they will invest in human capital and become skilled adults.[4] This also implies that those individuals whose ratio of skilled income to unskilled income is less than the ratio of their wages,

[4] For detailed working, see Appendix C

they will not acquire human capital, and work as an unskilled laborer throughout their lives.

The third group of individuals can borrow money to invest in human capital. Therefore, the interest charged to them can be reduced if they simultaneously invest in social capital as well.

Individuals accumulate social capital only if the utility of being skilled (b < h) and borrowing at *(1+i),* is greater than the utility of being unskilled.

$$V_S^* \geq V_u$$

$$log[(b_t - h)(1+i) + w_s\ ] - (1-\alpha-\beta)log\gamma w_s \geq log[b_t(1+r) + w_u(2+r)\ ] - (1-\alpha-\beta)log\gamma w_u$$

Simplifying the expression, we get:

$$S^* \geq S^u \tag{17}$$

Equation *(17)* gives a threshold level, *f*, above which all individuals invest in social capital to ease their credit constraint and invest in human capital. [5] This means indivisible education is limited to those individuals who can afford it completely or can borrow money by reducing their interest rate to become skilled in the future. This characteristic of indivisibility of human capital leads to multiple equilibria in the short-run and long-run.

Since the initial bequest level is the determinant of an individual's future occupation, we assume that, I_t, is the distribution of inheritance of all the individuals who are born in the first time period, *t*.

$$\int_0^\infty dI_t(l_t) = L_t \tag{18}$$

This distribution of inheritance decides the number of skilled and unskilled individuals that will be in labor force, l_t, of a respective economy such that:

$$L_t^s = \int_f^\infty dI_t(l_t) \tag{19}$$

is the skilled labor force, and

[5] For detailed working, see Appendix D

$$L_t^u = \int_0^f dI_t(l_t) \tag{20}$$

is the unskilled labor force.

I_t is the distribution of inheritance for all the individuals who are born in time period 1 and L_t is the distribution of all the individuals who are in the labor force.

In Figure 1, we show that the shape of the distribution is a piecewise distribution: from threshold 0 to f there is a linear upward sloping graph (point f is the inflection point since the second derivative is zero), from threshold f to h, there is a convex upwards, and from h to ∞, there is a linear upward sloping function. For the entire distribution of individuals who are in the labor force, L_t, their distribution of inheritance, I_t, lies between 0 and ∞.

The results from the distribution demonstrate that from threshold 0 to f, individuals work as unskilled laborers, and from threshold f to ∞, individuals work as skilled laborers. Note that this distribution will vary across countries due to credit market imperfections and how different individuals invest in social capital to finance their education through cheap loans. Due to the non-convexities and indivisibility of human capital investment, we will have multiple long-run equilibria for all countries.

6. Social Capital Accumulation

Individuals make decisions regarding optimal investment into social capital once they have internalized its benefits. From equation (7), we find the general form of optimal investment in social capital.

Therefore, we find the optimal investment by applying the value of *(1+i)* from equation *(12):*

$$S^* = \frac{(1-\alpha-\beta)[(b-h)\{\beta_m(1+r)-ws\}+ws\beta_m]}{(b-h)[(1-\alpha-\beta)\beta_{nm}-\gamma w_s]+\gamma ws\beta_m} \tag{21}$$

Social capital increases with a higher bequest level. When the second derivative is positive, the social capital for those who borrow to become skilled increases in a convex manner. [6]

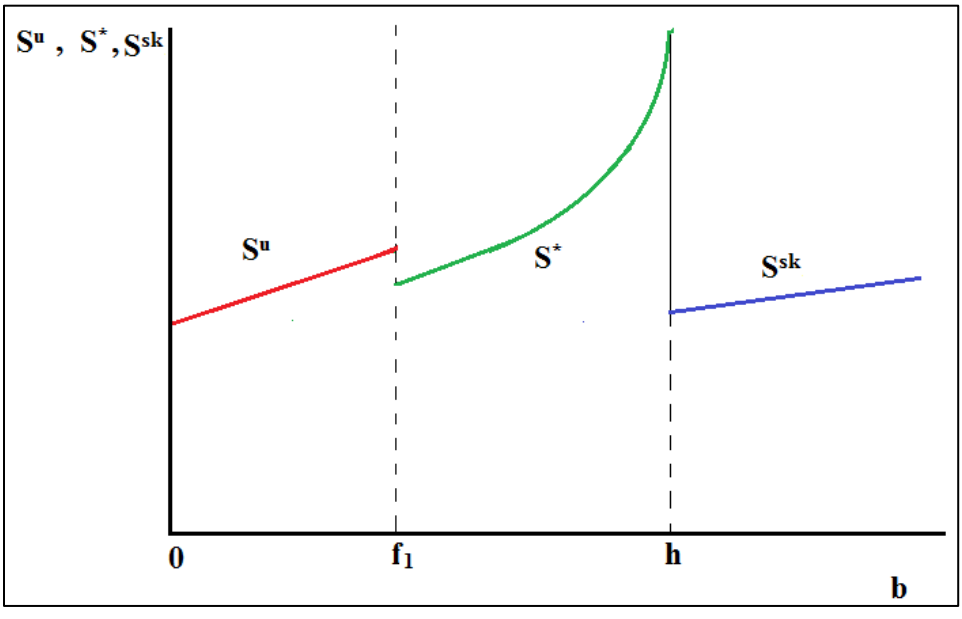
[6] For detailed working, see Appendix E

We can also find the optimal investment in social capital for an unskilled and skilled individual from equation (7.1 and 7.2):

$$S^u = \frac{(1-\alpha-\beta)[b(1+r)+w_u(2+r)]}{\gamma w_u} \quad (22)$$

$$S^{sk} = \frac{(1-\alpha-\beta)[(b-h)(1+r)+w_s]}{\gamma w_s} \quad (23)$$

Figure 1



Source: Authors calculations.

Figure 1 shows the social capital for three individuals in the society.[7] The three different portions show social capital of unskilled individuals, skilled borrowers and skilled individuals, respectively.

Since this expression was used to find the threshold *f*, $S^* \geq S^u(\frac{w_u}{w_s})^{\alpha+\beta}$, the social capital for unskilled individuals will scale down in Figure 1.

It scales down because of the condition:

$w_s > w_u$ Therefore: $(\frac{w_u}{w_s})^{\alpha+\beta} < 1$

[7] For detailed working of graph, see Appendix E & F

7. Zero Bequest Level

When an individual must finance the entire cost of education, we can determine whose social capital will be higher, by comparing those who borrow money to become skilled to those who prefer to remain unskilled. To make this comparison simpler, we find a threshold level of non-monetary cost of social exclusion. An individual who has a non-monetary cost below this threshold will have a higher social capital by remaining unskilled versus that individual who borrows money to become skilled. If the non-monetary cost crosses this threshold level, all individuals who borrow money to become skilled will have a higher social capital compared to those who prefer to remain unskilled. Thus, this condition is found by comparing:

$$S^{*}(b=0) \leq S^{un}(b=0)\left(\frac{w_u}{w_s}\right)^{\alpha+\beta} \tag{24}$$

$$\frac{(1-\alpha-\beta)[(-h)\{\beta_m(1+r)-ws\}+ws\beta_m]}{(-h)[(1-\alpha-\beta)\beta_{nm}-\gamma w_s]+\gamma ws\beta_m} \leq \frac{(1-\alpha-\beta)[b(1+r)+w_u(2+r)]}{\gamma w_u}\left(\frac{w_u}{w_s}\right)^{\alpha+\beta}$$

$$\beta_{nm} \leq \frac{2+r[\gamma ws(h+\beta_m]-\left(\frac{w_s}{w_u}\right)^{\alpha+\beta}\gamma[-h\{\beta_m(1+r)-ws\}+ws\beta_m]}{(h)(2+r)(1-\alpha-\beta)} \tag{25}$$

Therefore, as long as $\beta_{nm} \leq \overline{\beta_{nm}} = S^{*}(b=0) < S^{un}(b=0)\left(\frac{w_u}{w_s}\right)^{\alpha+\beta}$

8. Bequest Dynamics

The evolution of bequest is determined by the following sequence:[8]

For an unskilled individual:

$b_{t+1} = \beta\log[b(1+r) + w_u(2+r)]$ if $0 \leq b_t \leq f$

For skilled borrowers:

$\beta\log[(b-h)(1+i) + w_s]$ if $f \leq b_t \leq h$

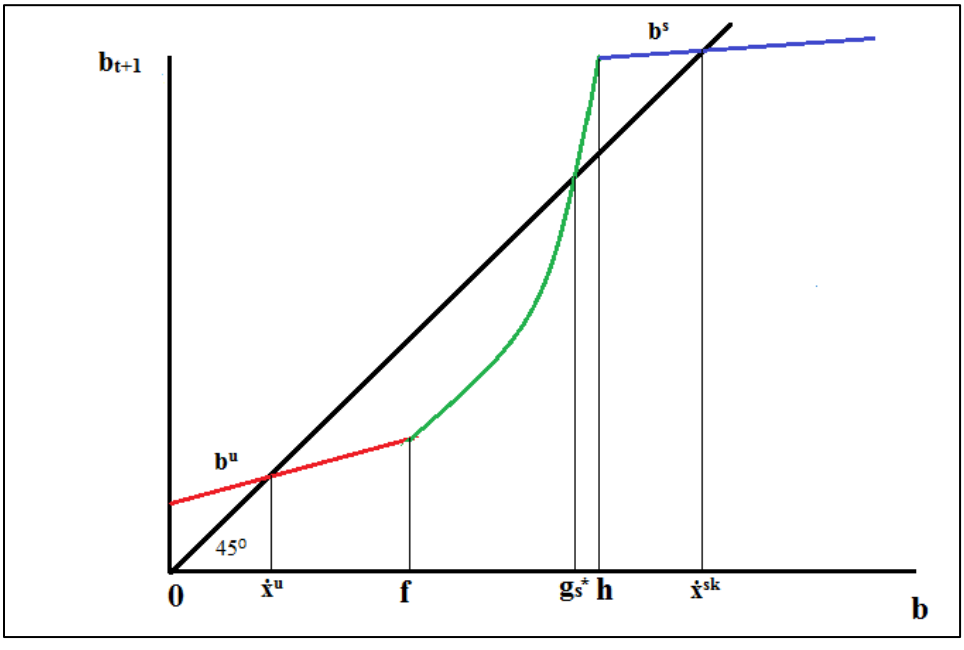
For skilled individual:

$\beta\log[b(1+r) + w_s]$ if $h \leq b_t$

[8] For detailed working, see Appendix G

Such that the long-run equilibrium for all three classes are shown in figure 2.

Figure 2



From Figure 2, we can see that individuals who inherit a bequest that is less than *f* remain unskilled throughout their lives as will their children. In the long-run, their bequest converges to the level, $\dot{x}^u$:

$$b = \frac{\beta[wu(2+r)]}{1-\beta b(1+r)} = b^u \text{ or } \dot{x}^u \qquad (26)$$

Those who inherit a bequest level more than *f*, invest in social capital and receive a reduced interest rate on borrowed money in order to accumulate costly education. Their descendants may or may not become skilled as it depends on the critical point, g_s^*.

$$b = \beta(S^*) \qquad (27)$$

Individuals who inherit less than this critical point initially invest in human capital, but their future generations may be unable to become skilled, and converge to an unskilled long-run equilibrium, $\dot{x}^u$. For those who inherit more than this critical point, their descendants are able to become skilled and converge to the skilled long-run equilibrium level, $\dot{x}^{sk}$:

$$b = \frac{\beta[ws-h(1+r)]}{1-\beta b(1+r)} = b^s \text{ or } \dot{x}^{sk} \quad (28)$$

Proposition 2

If an economy fulfills the condition where $0 < g_s^* < \dot{x}^{sk}$ then its composition of skilled and unskilled laborers depends on the number of individuals who inherit less than g_s^* in time period, *t*.

This proposition highlights a critical point, g_s^*, upon which the dynamics of the economy are dependent. In Figures 1 and 2, this critical point occurs between threshold *f* and *h*. In an economy with initially poor conditions and low bequest levels, individuals prefer to remain unskilled in both time periods 1 and 2. For this group, investment in human capital is not a preference since utility for being skilled is less than utility for being unskilled. This economy converges to the long-run equilibrium of unskilled individuals at $\dot{x}^u$ as proved in equation *(16).*

In an economy which inherits greater bequest than the critical point, g_s^*, utility for being skilled is greater than that for being unskilled. There are two further categories: 1) those who can cover the costly human capital and have additional funds to lend and earn a return, and 2) those who still invest in social capital accumulation and acquire loans at an interest rate, i, which is lower than the market interest rate to invest in human capital accumulation. The latter group is able to earn skilled labor wages in the future to cover the critical point, g_s^*, in order to converge to the long-run equilibrium of skilled individuals, $\dot{x}^{sk}$.

From Figure 2, we can see that the threshold *f* and g_s^* are the critical thresholds for short-run and long-run, respectively. Thus, we perform a comparative static analysis to see if these thresholds can be reduced to zero.

Proposition 3

$$\frac{\partial f}{\partial \beta_{nm}} \textbf{ is positive } \frac{\partial gs*}{\partial \beta_{nm}} \textbf{ is negative}^9$$

This comparative static shows that in the short-run, a higher non-monetary cost is going to increase the threshold, *f*. This implies that fewer people are initially aware of the benefits of social capital. On the contrary, in the long-run, a higher non-monetary cost decreases the threshold, g_s^*. This implies that due to the benefit of better information, more people are

[9] For detailed working, see Appendix H

going to become skilled by borrowing at lower-than-market interest rates, as will their future descendants. However, as stated earlier, those who inherit more than g_s^* converge to a higher long-run equilibrium, $\dot{x}^{sk}$, where all individuals are skilled.

9. Conclusion

The results of our model show that various inherited bequest levels will influence individuals to make optimal decisions to a) invest in social capital and, b) to borrow money. An inherited bequest below the costly human capital implies that such individuals decide that it is not optimal not to borrow money or invest in education. An individual with an inherited bequest below the level of costly education, but higher than what unskilled individuals inherit, find it optimal to borrow money to become skilled. They are charged a lower-than-market interest rate if they continue to invest in social capital. A third category of individuals can finance their entire education without borrowing; this group becomes the lenders of the society.

This paper comes to a different conclusion than that of Galor and Zeira (1993). They concluded that the distribution of skilled and unskilled labor is solely dependent upon the individual's initial inheritance level, which also determines the aggregate output and macroeconomic equilibrium in the long-run. Those who inherit more than the critical threshold will converge to a higher long-run equilibrium. Thus, if all individuals converge to the same long-run equilibrium, then the future descendants will know their bequest level. On the other hand, our paper's focus is on the psychological cost of social exclusion from mobility, and that skilled wages can create a difference in the long-run equilibria. Also, those who require additional funds to finance their education can do so by investing in social capital and receiving a reduced interest rate on their loans. The wealth distribution have implications in the short-run and long-run.

The long-run policy of subsidized education has a negative effect due to several factors. In economics, the price of a product, in this case, education, is derived from the interaction of supply and demand. When its value is artificially reduced by government policy, it creates a shortage where many parents want to enroll their children in school but the supply of teachers is comparatively low. In this way, only select students can enroll. Also, employee satisfaction is reduced as their job is no longer performance-based and the education standards drop. Other problems include interest rate caps on loans where marginalized groups in society or those with fewer political connections are unable to receive reduced-rate loans to finance their children's education.

All governments are endowed with limited resources and efficient allocation of those resources is important. Long-run government policies to promote social capital should aim to provide participatory and inclusive projects. This does not mean that similar policies can be applied across all nations since the benefits of social capital are localized. Government can promote volunteer work, network building, or participation in community-building programs with promised rewards. Government also could discourage the negative externalities that arise from wrongful use of social capital by certain influential groups of the society. Special interest groups can also exploit the community when they invest in the social capital within their network. Lastly, governments can spend resources on advertising where networking benefits are heavily focused. Social capital comes as a complementary feature when policies are designed towards it. Well-connected individuals are better employed, housed, and are ultimately more content and satisfied with their surroundings. The welfare effects of health, once internalized, leads to higher long-run aggregate output. Also, the government itself can invest in developing trust by ensuring property rights and not expropriating individual's assets.

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Appendix

Appendix A

In this appendix, we give a detailed exposition of the Lagrangian calculations and the optimal values of different components.

$$\underset{c,\, b,\, S_i}{\text{Max}} \quad U_{i,t+1} = \alpha\log(c_{t+1}) + \beta\log(b_{t+1}) + (1-\alpha-\beta)\log R(\hat{S}).\, S_{i,t+1} \qquad (3)$$

subject to:

$$y_{t+1} = c_{t+1} + b_{t+1} + \gamma_i S_{t+1}$$

By setting up the Lagrange, we derive the following expressions:

$$L = \alpha\log(c_{t+1}) + \beta\log(b_{t+1}) + (1-\alpha-\beta)\log R(\hat{S}).\, S_{i,t+1} + \lambda\,[y_{t+1} - c_{t+1} + b_{t+1} + \gamma_i S_{t+1}\,]$$

$$\frac{\partial L}{\partial c} = \frac{\alpha}{c_{t+1}} = \lambda \qquad (i)$$

$$\frac{\partial L}{\partial b} = \frac{\beta}{b_{t+1}} = \lambda \qquad (ii)$$

$$\frac{\partial L}{\partial S} = \frac{1-\alpha-\beta}{S_{t+1}} = \lambda \qquad (iii)$$

$$\frac{\partial L}{\partial \lambda} = y_{t+1} = c_{t+1} + b_{t+1} + \gamma_i\, S_{t+1} \qquad (iv)$$

By using equation *(i) & (iii)*, we find*:*

$$c_{t+1} = \frac{\alpha\gamma_i\, St+1}{1-\alpha-\beta} \qquad (A)$$

By using equation *(ii) & (iv)*, we find*:*

$$b_{t+1} = \frac{\beta\gamma_i St+1}{1-\alpha-\beta} \qquad (B)$$

Applying *(A) & (B)* to equation *(iv)*, we get*:*

$$y = \frac{\alpha\gamma_i St+1}{1-\alpha-\beta} + \frac{\beta\gamma_i St+1}{1-\alpha-\beta} + \gamma_i S_{t+1}$$

$$S_{t+1}^{*} = \frac{(1-\alpha-\beta)y_{t+1}}{\gamma_i}$$

Applying to *(A)* and *(B)* to find c^* and b^*

$$c_{t+1}^{*} = \alpha y_{t+1}$$

$$b_{t+1}^{*} = \beta y_{t+1}$$

The indirect utility function is calculated as:

$$V = \alpha\log(c_{t+1}) + \beta\log(b_{t+1}) + (1-\alpha-\beta)\log R(\hat{S}).\ S_{i,t+1}$$

Apply the optimal values for consumption, bequest and social capital in the function above to find the indirect utility function.

$$V = \alpha\log(\alpha y_{t+1}) + \beta\log(\beta y_{t+1}) + (1-\alpha-\beta)\log R(\hat{S}).\ \frac{(1-\alpha-\beta)y_{t+1}}{\gamma}$$

$$V = \alpha\log(\alpha) + \alpha\log(y_{t+1}) + \beta\log(\beta) + \beta\log(y_{t+1}) + (1-\alpha-\beta)\log R(\hat{S}) + (1-\alpha-\beta)\log(1-\alpha-\beta) + (1-\alpha-\beta)\log y_{t+1} - (1-\alpha-\beta)\log\gamma$$

Simplifying the expression, we get:

$$V_t = \log y_{t+1} - (1-\alpha-\beta)\log\gamma_i + \varepsilon$$

$$\varepsilon = \alpha\log\alpha + \beta\log\beta + (1-\alpha-\beta)\log(1-\alpha-\beta) + (1-\alpha-\beta)\log R(\hat{S})$$

Appendix B

In this appendix, we solve for the incentive compatibility constraint where an individual is indifferent between the default amount or incurring monitoring as well as non-monitoring cost.

$d(1+i)=\beta_{m}.zf(S_i) + \beta_{nm}f(S_i)$

Making 'z' the subject of the equation, we get:

$zf(S_i) = \frac{d(1+i)-\beta_{nm}f(Si)}{\beta_m}$ (z and β_{nm} are linear functions of social capital)

Applying to the equation below, which shows per unit cost of interest rate which the lender charges:

$$i = r + zf(S_i)$$

$$i = r + \frac{d(1+i)-\beta_{nm}f(Si)}{\beta_m}$$

$$i\,\beta_m = r\,\beta_m - \beta_{nm}(Si) + d(1+i)$$

$$i\,\beta_m - di = r\,\beta_m - \beta_{nm}(Si) + d$$

$$i = \frac{r\beta_m + d - \beta_{nm}f(Si)}{(\beta_m - d)}$$

$$1+i = \frac{\beta_m[1+r] - \beta_{nm}f(Si)}{(\beta_m - d)}$$

Note: d=(b-h) is negative since this is the amount borrowed.

$\beta_{nm} = f(S_i)$ (linear function)

Now, we will perform the comparative static analysis on *(1+i)* with respect to non-monetary cost of social capital

$$\frac{\partial(1+i)}{\partial S_i} = \frac{-(\beta_{nm})}{(\beta_m - d)} < 0$$

Since, (b-h) is negative, the derivative becomes negative. This relationship implies that as the social capital accumulation of an individual increases, the interest charged on the amount borrowed decreases.

Appendix C

In this appendix, we find the solution to the assumption that was used in the paper.

Assumption 1 proves whether an individual invests in human capital or not. For this we compare the indirect utility of being skilled (b>h) with that of being unskilled (b<h).

$V_s \geq V_u$

$log[(b_t - h)(1+r) + w_s] + log(1-\alpha-\beta)\log R(\hat{S}) - (1-\alpha-\beta)log\gamma w_s \geq$

$log[b_t(1+r) + w_u(2+r)] + (1-\alpha-\beta)\log R(\hat{S}) - (1-\alpha-\beta)log\gamma w_u$

By taking the anti-log, we find:

$$[(b_t - h)(1+r) + w_s] \geq \left(\frac{w_s}{w_u}\right)^{1-\alpha-\beta} [\, b(1+r) + w_u(2+r)\,]$$

$$\frac{(b-h)(1+r)+w_s}{b(1+r)+w_u(2+r)} \geq \left(\frac{w_s}{w_u}\right)^{1-\alpha-\beta}$$

The ratio of a skilled individual's income to an unskilled individual's income is greater than the ratio of their wage rates. If this binding condition is satisfied, an individual invests in human capital.

Appendix D

The second condition shows if an individual invests in social capital or not. For this we compare the indirect utility of being skilled by borrowing (b<h) *(1+i)* with that of an unskilled individual (b<h).

Finding threshold *f* from the condition:

$V_s^* \geq V_u$

$\log[(b_t - h)(1+i) + w_s\ ] - (1-\alpha-\beta)\log\gamma\, w_s \geq \log[b_t(1+r) + w_u(2+r)\ ] - (1-\alpha-\beta)\log\gamma\, w_u$

By taking the anti-log, we find:

$[(b_t - h)(1+i) + w_s\ ] \geq (\frac{w_s}{w_u})^{1-\alpha-\beta}\ [\ b(1+r) + w_u(2+r)\ ]$

Simplifying the expression, we get:

$S^* \frac{\gamma w_s}{(1-\alpha-\beta)} \gtreqless S^u.\ \frac{\gamma w_u}{(1-\alpha-\beta)}.\ (\frac{w_u}{w_s})^{\alpha+\beta}$

Factoring out $\frac{\gamma}{(1-\alpha-\beta)}$

Now apply the values for S^* and S^u in the expressions above:

$(1-\alpha-\beta)[\frac{(b-h)\{\beta_m[1+r]-w_s\}+w_s\beta_m}{[(b-h)\{(1-\alpha-\beta)\beta_{nm}-\gamma w_s\}+\gamma w_s\beta_m]}] \geq \frac{(1-\alpha-\beta)}{\gamma w_u}(\frac{w_u}{w_s})^{\alpha+\beta}\ [\ b(1+r) + w_u(2+r)\ ]$

$\gamma w_u.\ [(b-h)\{\beta_m[1+r] - w_s\} + w_s\beta_m] \geq [(b-h)\{(1-\alpha-\beta)\beta_{nm} - \gamma w_s\} + \gamma w_s\beta_m].\ (\frac{w_u}{w_s})^{\alpha+\beta}\ [\ b(1+r) + w_u(2+r)\ ]$

$\gamma w_u.\ [(b-h)\{\beta_m(1+r) - w_s\}] + \gamma w_u w_s\beta_m] \geq$

$(\frac{w_u}{w_s})^{\alpha+\beta}\ [\ b(1+r)].\ [(b-h)\{(1-\alpha-\beta)\beta_{nm} - \gamma w_s\} + \gamma w_s\beta_m].\ +$

$(\frac{w_u}{w_s})^{\alpha+\beta}.\ w_u(2+r)\ [(b-h)\{(1-\alpha-\beta)\beta_{nm} - \gamma w_s\} + \gamma w_s\beta_m]$

Note: We assume: $\gamma w_s > (1-\alpha-\beta)\beta_{nm}$ throughout our analysis:

$b^2(1+r)\ (\frac{w_u}{w_s})^{\alpha+\beta}\{\gamma w_s - (1-\alpha-\beta)\beta_{nm}\}$

$$+b[\gamma w_u\{\beta_m(1+r)-w_s\}-h(1+r)(\frac{w_u}{w_s})^{\alpha+\beta}\{\gamma w_s-(1-\alpha-\beta)\beta_{nm}\}-(1+r)(\frac{w_u}{w_s})^{\alpha+\beta}\gamma w_s\beta_m+wu(2+r)(\frac{w_u}{w_s})^{\alpha+\beta}\{\gamma w_s-(1-\alpha-\beta)\beta_{nm}\}]$$

$$+[-\gamma w_u.h\{\beta_m(1+r)-w_s\}+\gamma w_u w_s\beta_m-wu(2+r)h(\frac{w_u}{w_s})^{\alpha+\beta}\{\gamma w_s-(1-\alpha-\beta)\beta_{nm}\}-wu(2+r)(\frac{w_u}{w_s})^{\alpha+\beta}\gamma w_s\beta_m]$$

Checking if the positive/negative root is $\gtreqless h$

$$f_{positive}\gtreqless h$$

$$\frac{-b+\sqrt{b^2-4ac}}{2a}\gtreqless h$$

$$f_{positive}\gtreqless h$$

$$\frac{-b+\sqrt{b^2-4ac}}{2a}\gtreqless h$$

$$b^2-4ac\gtreqless(2ah+b)^2$$

$$b^2-4ac\gtreqless(4a^2h^2+b^2+4ahb)$$

$$-c\gtreqless ah^2+bh$$

$$-[-\gamma w_u.h\{\beta_m(1+r)-w_s\}+\gamma w_u w_s\beta_m-wu(2+r)h(\frac{w_u}{w_s})^{\alpha+\beta}\{\gamma w_s-(1-\alpha-\beta)\beta_{nm}\}-wu(2+r)(\frac{w_u}{w_s})^{\alpha+\beta}\gamma w_s\beta_m]\gtreqless$$

$$h^2\ (1+r)\ (\frac{w_u}{w_s})^{\alpha+\beta}\{\gamma w_s-(1-\alpha-\beta)\beta_{nm}\}+h\gamma w_u\{\beta_m(1+r)-w_s\}-h^2(1+r)(\frac{w_u}{w_s})^{\alpha+\beta}\{\gamma w_s-(1-\alpha-\beta)\beta_{nm}\}-h(1+r)(\frac{w_u}{w_s})^{\alpha+\beta}\gamma w_s\beta_m+hwu(2+r)(\frac{w_u}{w_s})^{\alpha+\beta}\{\gamma w_s-(1-\alpha-\beta)\beta_{nm}\}]$$

$$-\gamma w_u w_s\beta_m+wu(2+r)(\frac{w_u}{w_s})^{\alpha+\beta}\gamma w_s\beta_m\gtreqless-h(1+r)(\frac{w_u}{w_s})^{\alpha+\beta}\gamma w_s\beta_m$$

Factoring out $\gamma w_s\beta_m$:

$$w_u\ [(2+r)(\frac{w_u}{w_s})^{\alpha+\beta}-1]\gtreqless-h(1+r)(\frac{w_u}{w_s})^{\alpha+\beta}$$

Since, L.H.S > R.H.S, the positive root > h

$$f_{negative} \gtrless h$$

$$\frac{-b-\sqrt{b^2-4ac}}{2a} \gtrless h$$

$$-b^2+4ac \gtrless (2ah+b)^2$$

$$-b^2+4ac \gtrless (4a^2h^2+b^2+4ahb)$$

$$2ac \gtrless 2a^2h^2+b^2+2ahb$$

Applying the values:

$$2(1+r)\left(\frac{w_u}{w_s}\right)^{\alpha+\beta}\{\gamma w_s-(1-\alpha-\beta)\beta_{nm}\}[-\gamma w_u.h\{\beta_m(1+r)-w_s\}+\gamma w_u w_s\beta_m-wu(2+r)h\left(\frac{w_u}{w_s}\right)^{\alpha+\beta}\{\gamma w_s-(1-\alpha-\beta)\beta_{nm}\}-wu(2+r)\left(\frac{w_u}{w_s}\right)^{\alpha+\beta}\gamma w_s\beta_m] \gtrless$$

$$h^2(1+r)^2\left(\frac{w_u}{w_s}\right)^{\alpha+\beta^2}\{\gamma w_s-(1-\alpha-\beta)\beta_{nm}\}^2+\gamma^2 {w_u}^2\{\beta_m(1+r)-w_s\}^2$$

$$+\ h^2(1+r)^2\left(\frac{w_u}{w_s}\right)^{\alpha+\beta^2}\{\gamma w_s-(1-\alpha-\beta)\beta_{nm}\}^2+(1+r)^2\left(\frac{w_u}{w_s}\right)^{\alpha+\beta^2}\gamma^2 {w_s}^2{\beta_m}^2$$

$$+{w_u}^2(2+r)^2\left(\frac{w_u}{w_s}\right)^{\alpha+\beta^2}-2\gamma w_u\{\beta_m(1+r)-w_s\}.h(1+r)\left(\frac{w_u}{w_s}\right)^{\alpha+\beta}\{\gamma w_s-(1-\alpha-\beta)\beta_{nm}\}-2\gamma^2 w_u\{\beta_m(1+r)-w_s\}.\{(1+r)\left(\frac{w_u}{w_s}\right)^{\alpha+\beta^2}w_s\beta_m\}+\ 2\gamma {w_u}^2(2+r)\{\beta_m(1+r)-w_s\}.\left(\frac{w_u}{w_s}\right)^{\alpha+\beta}\{\gamma w_s-(1-\alpha-\beta)\beta_{nm}\}\ +2h(1+r)^2\left(\frac{w_u}{w_s}\right)^{\alpha+\beta^2}\gamma w_s\beta_m.\{\gamma w_s-(1-\alpha-\beta)\beta_{nm}\}-2h(1+r)\left(\frac{w_u}{w_s}\right)^{\alpha+\beta^2}.wu(2+r).\{\gamma w_s-(1-\alpha-\beta)\beta_{nm}\}^2-2\left(\frac{w_u}{w_s}\right)^{\alpha+\beta^2}(1+r).wu(2+r).\gamma w_s\beta_m.\{\gamma w_s-(1-\alpha-\beta)\beta_{nm}\}^2$$

$$+2(1+r)\left(\frac{w_u}{w_s}\right)^{\alpha+\beta}\{\gamma w_s-(1-\alpha-\beta)\beta_{nm}\}h\,\gamma w_u\{\beta_m(1+r)-w_s\}-$$
$$2h^2(1+r)^2\left(\frac{w_u}{w_s}\right)^{\alpha+\beta^2}\{\gamma w_s-(1-\alpha-\beta)\beta_{nm}\}^2-$$
$$2(1+r)^2\left(\frac{w_u}{w_s}\right)^{\alpha+\beta^2}.\gamma w_s\beta_m.\{\gamma w_s-(1-\alpha-\beta)\beta_{nm}\}+2(1+$$
$$r)\,h\left(\frac{w_u}{w_s}\right)^{\alpha+\beta^2}wu(2+r)\{\gamma w_s-(1-\alpha-\beta)\beta_{nm}\}^2$$

Solving the expression, we get:

Therefore,

$$2(1+r)\left(\frac{w_u}{w_s}\right)^{\alpha+\beta}\{\gamma w_s-(1-\alpha-\beta)\beta_{nm}\}\gamma w_u w_s\beta_m[\,1-2\left(\frac{w_u}{w_s}\right)^{\alpha+\beta}]$$

$$\lessgtr$$

$$2\;h^2(1+r)^2\left(\frac{w_u}{w_s}\right)^{\alpha+\beta^2}\{\gamma w_s-(1-\alpha-\beta)\beta_{nm}\}^2+\gamma^2{w_u}^2\{\beta_m(1+$$
$$r)-w_s\}^2\;\;(1+r)^2\left(\frac{w_u}{w_s}\right)^{\alpha+\beta^2}\gamma^2{w_s}^2{\beta_m}^2\;+{w_u}^2(2+$$
$$r)^2\left(\frac{w_u}{w_s}\right)^{\alpha+\beta^2}+2\gamma{w_u}^2(2+r)\{\beta_m(1+r)-$$
$$w_s\}.\left(\frac{w_u}{w_s}\right)^{\alpha+\beta}\{\gamma w_s-(1-\alpha-\beta)\beta_{nm}\}-2\gamma^2w_u\{\beta_m(1+r)-$$
$$w_s\}.\{(1+r)\left(\frac{w_u}{w_s}\right)^{\alpha+\beta^2}w_s\beta_m\}+2(1+r)\left(\frac{w_u}{w_s}\right)^{\alpha+\beta}\{\gamma w_s-$$
$$(1-\alpha-\beta)\beta_{nm}\}h\,\gamma w_u\{\beta_m(1+r)-w_s\}$$

$$-2\left(\frac{w_u}{w_s}\right)^{\alpha+\beta^2}(1+r).wu(2+r).\gamma w_s\beta_m.\{\gamma w_s-(1-\alpha-$$
$$\beta)\beta_{nm}\}^2+2(1+r)\,h\left(\frac{w_u}{w_s}\right)^{\alpha+\beta^2}wu(2+r)\{\gamma w_s-$$
$$(1-\alpha-\beta)\beta_{nm}\}^2$$

L.H.S is negative due to the term $1<2\left(\frac{w_u}{w_s}\right)^{\alpha+\beta}$ and R.H.S is positive.

Therefore, $f_{negative}<h$

This threshold depicts that whoever inherits a bequest level beyond f finds it optimal to invest in social capital irrespective of their occupation.

Appendix E

In this appendix, we find the optimal investment in social capital given the individuals borrow money. Since interest rate is a function of social capital and the general form of social capital is a function of interest rate, we will solve them simultaneously.

$$1+i = \frac{\beta_m[1+r]-\beta_{nm}.Si}{d(\beta_m-1)}$$

$$S = \frac{(1-\alpha-\beta)[(b-h)(1+i)+ws]}{\gamma w_s}$$

By applying the value for *(1+i)* in the equation for optimal investment in social capital, we find S^*:

$$S = \frac{(1-\alpha-\beta)[(b-h)(\frac{\beta_m[1+r]-\beta_{nm}.Si}{(b-h)(\beta_m-1)})+ws]}{\gamma w_s}$$

$$S^* = \frac{(1-\alpha-\beta)[(b-h)\{\beta_m(1+r)-ws\}+ws\beta_m]}{-(b-h)[\gamma w_s-(1-\alpha-\beta)]+\gamma w_s\beta_m}$$

$\beta_{nm} = Si$ (linear function)

Note: We assume $\gamma w_s > (1-\alpha-\beta)$ and b<h in this case

To check the functional form of S^*, we find the first and second derivative.

$$\frac{\partial S^*}{\partial b} = \frac{[-(b-h)\{\gamma w_s-(1-\alpha-\beta)\beta_{nm}\}+\gamma w_s\beta_m].\{\beta_m(1+r)-ws\}.(1-\alpha-\beta)-[(1-\alpha-\beta)[(b-h)\{\beta_m(1+r)-ws\}+ws\beta_m]...}{[-(b-h)\{\gamma w_s-(1-\alpha-\beta)\}+\gamma w_s\beta_{nm}]^2}$$

$$\frac{[.-(b-h)\{\gamma w_s-(1-\alpha-\beta)\}}{[-(b-h)\{\gamma w_s-(1-\alpha-\beta)\}+\gamma w_s\beta_{nm}]^2}$$

Checking numerator for the sign:

$$\begin{aligned}[-(b-h)\{\gamma w_s-(1-\alpha-\beta)\beta_{nm}\} &+\gamma w_s\beta_m].\{\beta_m(1+r)-ws\}.(1-\alpha-\beta)\\ &\gtrless -[(1-\alpha-\beta)[(b-h)\{\beta_m(1+r)-ws\}\\ &+ws\beta_m](b-h)\{\gamma w_s-(1-\alpha-\beta)\end{aligned}$$

Factoring out: $(1-\alpha-\beta)$, we get:

$$\gamma w_s{\beta_m}^2(1+r)-\gamma {w_s}^2\beta_m \gtrless w_s\beta_m(1-\alpha-\beta)\beta_{nm} -\gamma {w_s}^2\beta_m$$

$\gamma\beta_m(1+r) > (1-\alpha-\beta)\beta_{nm}$ is positive

$\frac{\partial S^*}{\partial b}$ = +ve

Keeping $\frac{\partial S^*}{\partial b}$ = 0, we get 0. Thus, function is minimum at value of

$S^* = \frac{(1-\alpha-\beta)[(b-h)\{\beta_m(1+r)-ws\}+ws\beta_m]}{(b-h)[(1-\alpha-\beta)\beta_{nm}-\gamma w_s+]+\gamma ws\beta_m}$ when b=0

$\frac{\partial^2 S^*}{\partial b^2}$ =

Taking $\gamma\beta_m(1+r) > (1-\alpha-\beta)\beta_{nm}$ from the first derivative as A (+ve value)

$$\frac{A}{[-(b-h)\{\gamma w_s-(1-\alpha-\beta)\}+\gamma w_s\beta_{nm}]^2}$$

$$A.[-(b-h)\{\gamma w_s-(1-\alpha-\beta)\}+\gamma w_s\beta_{nm}]^{-2}$$

$$\frac{-2A(-1)\{\gamma w_s-(1-\alpha-\beta)[-(b-h)\{\gamma w_s-(1-\alpha-\beta)\}+\gamma w_s\beta_{nm}]}{[-(b-h)\{\gamma w_s-(1-\alpha-\beta)\}+\gamma w_s\beta_{nm}]^3}$$

Since, $\gamma w_s > (1-\alpha-\beta)\ and\ b < h$ so the derivative is positive

$\frac{\partial S^*}{\partial b}$, $\frac{\partial^2 S^*}{\partial b^2}$ both are positive which implies S^* is convex upwards. Also, there are two roots of threshold *f*. Therefore, we proved in Appendix D that the positive root comes after h whereas the negative root is less than h.

Appendix F

In this section, we find the intersection points of S^u, S^{sk}, S^* . Also, their slopes and intercepts in order to perform a graphical analysis.

$$S^u = \frac{(1-\alpha-\beta)[b(1+r)+w_u(2+r)]}{\gamma w_u}$$

$$S^{sk} = \frac{(1-\alpha-\beta)[(b-h)(1+r)+w_s]}{\gamma w_s}$$

$$S^* = \frac{(1-\alpha-\beta)[(b-h)\{\beta_m(1+r)-ws\}+ws\beta_m]}{(b-h)[(1-\alpha-\beta)\beta_{nm}-\gamma w_s+]+\gamma ws\beta_m}$$

Slopes:

$$\frac{\partial S^u}{\partial b} = \frac{(1-\alpha-\beta)}{\gamma w_u} > 0$$

$$\frac{\partial S^{sk}}{\partial b} = \frac{(1-\alpha-\beta)}{\gamma w_s} > 0$$

$$\frac{\partial S^{un}}{\partial b} = \frac{\gamma w_s \beta_m{}^2(1+r)-w_s\beta_m(1-\alpha-\beta)\beta_{nm}}{[-(b-h)\{\gamma w_s-(1-\alpha-\beta)\}+\gamma w_s\beta_{nm}]^2} > 0$$

Slope $S^u \gtreqless S^{sk}$

$$\frac{(1-\alpha-\beta)}{\gamma w_u} \gtreqless \frac{(1-\alpha-\beta)}{\gamma w_s}$$

$$w_s \gtreqless w_u$$

Therefore, Slope $S^u > S^{sk}$

Since skilled wages are greater than the unskilled wages. Slope of S^u $is > S^{sk}$

Intercepts:

$$S^u(0) = \frac{(1-\alpha-\beta)[(2+r)]}{\gamma}$$

$$S^{sk}(0) = \frac{(1-\alpha-\beta)[(-h)(1+r)+w_s]}{\gamma w_s}$$

Intercept $S^u \gtreqless S^{sk}$

$$\frac{(1-\alpha-\beta)[(2+r)]}{\gamma} \gtreqless \frac{(1-\alpha-\beta)[(-h)(1+r)+w_s]}{\gamma w_s}$$

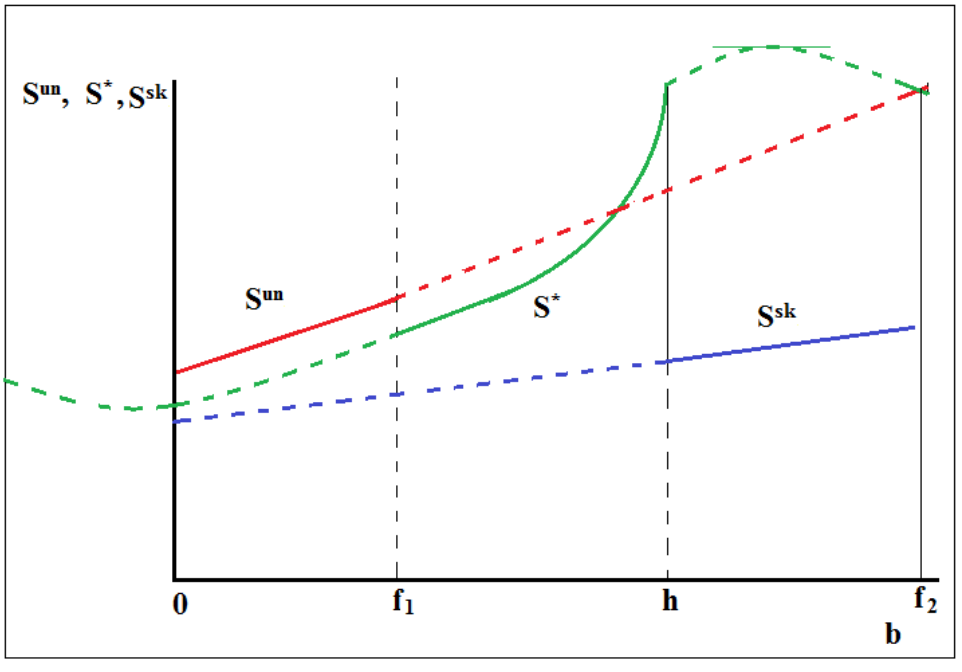
$$w_s(2+r) \gtreqless (-h)(1+r) + w_s$$

$$w_s \gtreqless (-h)$$

Therefore, intercept $S^u > S^{sk}$

$$S^*(0) = \frac{(1-\alpha-\beta)[(-h)\{\beta_m(1+r)-ws\}+ws\beta_m]}{(-h)[(1-\alpha-\beta)\beta_{nm}-\gamma w_s]+\gamma ws\beta_m}$$

This figure below is a graphical representation of three kinds of social capital of individuals.



Source: Authors calculations

The first solid line shows the steeper social capital of an unskilled individual.

Since, we are using a scaler $(\frac{w_u}{w_s})^{\alpha+\beta} < 1$ to calculate intersection of S^{un} and S^*; therefore, it will scale down proportionately to intersect with S^*. The second solid line is of S^* which is convex upwards and it is point of

inflection comes after *h.* The positive root, *f*, is greater than *h* too. Hence, we are only considering the portion before threshold *h*. The thrid solid line is social capital of a skilled individual. Its slope is flatter than the unskilled individual's social capital. Since these individuals can afford costly education, their intersection comes after *h* cost.

Keeping $\frac{\partial S^*}{\partial b} = 0$, we get 0. Thus, function is minimum at value of

$$S^* = \frac{(1-\alpha-\beta)[(b-h)\{\beta_m(1+r)-ws\}+ws\beta_m]}{(b-h)[(1-\alpha-\beta)\beta_{nm}-\gamma w_s]+\gamma ws\beta_m} \text{ when b=0}$$

We will now prove if $S^*(b=0) \gtreqless S^{un}\ (b=0)\ (\frac{w_u}{w_s})^{\alpha+\beta}$

$$\frac{(1-\alpha-\beta)[(-h)\{\beta_m(1+r)-ws\}+ws\beta_m]}{(-h)[(1-\alpha-\beta)\beta_{nm}-\gamma w_s]+\gamma ws\beta_m} \gtreqless \frac{(1-\alpha-\beta)[(2+r)]}{\gamma}(\frac{w_u}{w_s})^{\alpha+\beta}$$

$$(\frac{w_u}{w_s})^{\alpha+\beta} < \frac{(2+r)[(-h)\{(1-\alpha-\beta)\beta_{nm}-\gamma w_s\}+\gamma ws\beta_m\ \{\beta_m(1+r)-ws\}+ws\beta_m]}{\gamma[(-h)\{\beta_m(1+r)-ws\}+ws\beta_m}$$

If this condition is satisfied, at bequest level = 0, $S^*(b=0) < S^{un}\ (b=0)\ (\frac{w_u}{w_s})^{\alpha+\beta}$

At the intersection, b=h, we prove if $S^*(b=h) \gtreqless S^{un}\ (b=h)\ (\frac{w_u}{w_s})^{\alpha+\beta}$

$$\frac{(1-\alpha-\beta)ws\beta_m]}{\gamma ws\beta_m} \gtreqless \frac{(1-\alpha-\beta)[h(1+r)+w_u(2+r)]}{\gamma w_u}(\frac{w_u}{w_s})^{\alpha+\beta}$$

$$1 \gtreqless \frac{[h(1+r)+w_u(2+r)]}{w_u}(\frac{w_u}{w_s})^{\alpha+\beta}$$

$$(\frac{w_s}{w_u})^{\alpha+\beta} > \frac{[h(1+r)+w_u(2+r)]}{w_u}$$

Or

$$w_s > [\frac{\{h(1+r)+w_u(2+r)\}}{w_u}]^{\frac{1}{\alpha+\beta}}.\ w_u$$

Thus, at the intersection b=h, $S^* > S^{un}(\frac{w_u}{w_s})^{\alpha+\beta}$. Due to this binding condition, even if the condition, $S^*(b=0) < S^{un}\ (b=0)\ (\frac{w_u}{w_s})^{\alpha+\beta}$ is not satisfied, it will not change our results.

Appendix G

In this appendix, we will show the calculations for the long-run equilibrium of unskilled as well as the skilled individuals. This will be calculated using optimal value of bequest and the income which corresponds to each category of workers. This is shown below as:

Long-run equilibrium of an unskilled individual is:

$b=b_{t+1}$

$b=\beta\ (y_{t+1})$

$b=\beta[b(1+r)+w_u(2+r)]$

$b-\beta b(1+r)=\beta w_u(2+r)$

$b=\frac{\beta[wu(2+r)]}{1-\beta b(1+r)}=b_u$ or $\dot{x}^{un}$

Long-run equilibrium of skilled individual is:

$b=b_{t+1}$

$b=\beta(y_{t+1})$

$b=\beta[(b-h)(1+r)+w_s]$

$b-\beta b(1+r)=\beta[w_s-h(1+r)]$

$b=\frac{\beta[ws-h(1+r)]}{1-\beta b(1+r)}=b_s$ or $\dot{x}^{sk}$

Finding the critical point, g_s^*

$b=\beta(S)^*$

$b=\beta[\frac{(1-\alpha-\beta)[(b-h)\{\beta_m(1+r)-ws\}+ws\beta_m]}{(b-h)[(1-\alpha-\beta)\beta_{nm}-\gamma w_s]+\gamma ws\beta_m}]$

$b\ [(b-h)[(1-\alpha-\beta)\beta_{nm}-\gamma w_s]+\gamma ws\beta_m]=\beta\ (1-\alpha-\beta)[[(b-h)\{\beta_m(1+r)-ws\}+ws(\beta_m)]$

$$-b^2\,[\gamma w_s - (1-\alpha-\beta)\beta_{nm}] + b\,[h\{\gamma w_s - (1-\alpha-\beta)\beta_{nm}\} - \beta\,(1-\alpha-\beta)\{\beta_m(1+r) - ws\} + \gamma ws\beta_m\,] + [\beta\,(1-\alpha-\beta)(h)\{\beta_m(1+r) - ws\} - \beta\,(1-\alpha-\beta)ws(\beta_m)]$$

Now, we will prove that the positive root will be higher than h so we will consider the lower/negative root only just like for *f* threshold.

$$g_{spositive}^{*} \gtrless h$$

$$-c \gtrless ah^2 + hb$$

$$-\beta\,(1-\alpha-\beta)(h)\{\beta_m(1+r) - ws\} + \beta\,(1-\alpha-\beta)ws(\beta_m)] \gtrless [-h^2[\gamma w_s - (1-\alpha-\beta)\beta_{nm}] + h^2[\gamma w_s - (1-\alpha-\beta)\beta_{nm}] - h\beta\,(1-\alpha-\beta)\{\beta_m(1+r) - ws\}$$

$$+h\gamma ws\beta_m$$

$$\beta\,(1-\alpha-\beta)ws\beta_m \gtrless h\gamma ws\beta_m$$

$$\beta\,(1-\alpha-\beta) \gtrless h\gamma$$

L.H.S > R.H.S thus, we ignore the positive root.

$$g_{snegative}^{*} \gtrless h$$

$$2ac \gtrless 2a^2h^2 + b^2 + 2ahb$$

$$-2[\gamma w_s - (1-\alpha-\beta)\beta_{nm}].\beta\,(1-\alpha-\beta)(h)\{\beta_m(1+r) - ws\} + 2[\gamma w_s - (1-\alpha-\beta)\beta_{nm}].[\beta\,(1-\alpha-\beta)ws(\beta_m)]$$

$$\lesseqgtr$$

$$+2h^2[\gamma w_s - (1-\alpha-\beta)\beta_{nm}]^2 + h^2\{\gamma w_s - (1-\alpha-\beta)\beta_{nm}\}^2 + \beta^2(1-\alpha-\beta)^2\{\beta_m(1+r) - ws\}^2 + \gamma^2 {w_s}^2 {\beta_m}^2 - 2h\beta\,(1-\alpha-\beta)\{\beta_m(1+r) - ws\}.\{(1-\alpha-\beta)\beta_{nm} - \gamma w_s\} + 2h[\gamma w_s - (1-\alpha-\beta)\beta_{nm}]\gamma w_s\beta_m - 2\beta\,(1-\alpha-\beta)\{\beta_m(1+r) - ws\}\gamma w_s\beta_m - 2h^2[\gamma w_s - (1-\alpha-\beta)\beta_{nm}]^2 - 2h[\gamma w_s - (1-\alpha-\beta)\beta_{nm}]\gamma w_s\beta_m + 2h[\gamma w_s - (1-\alpha-\beta)\beta_{nm}].\beta\,(1-\alpha-\beta)(h)\{\beta_m(1+r) - ws\}$$

Simplifying the expression:

$$-2[\gamma w_s - (1-\alpha-\beta)\beta_{nm}].[\beta\,(1-\alpha-\beta)(h)\{\beta_m(1+r) - ws\} - \beta\,(1-\alpha-\beta)ws(\beta_m)]$$

$$\lessgtr$$

$$h^2(1-\alpha-\beta)\beta_{nm} - \gamma w_s\}^2 + \beta^2(1-\alpha-\beta)^2\{\beta_m(1+r) - ws\}^2 + \gamma^2 {w_s}^2 {\beta_m}^2 - 2\beta\,(1-\alpha-\beta)\{\beta_m(1+r) - ws\}\gamma w_s\beta_m$$

Since $\gamma w_s > (1-\alpha-\beta)\beta_{nm}$, we get:

L.H.S < R.H.S

Therefore, we will consider the negative root which is:

$$\frac{[h\{\gamma w_s - (1-\alpha-\beta)\beta_{nm}\} - \beta(1-\alpha-\beta)\{\beta_m(1+r) - w_s\} + \gamma w_s\beta_m]}{2[\gamma w_s - (1-\alpha-\beta)\beta_{nm}]}$$

$$+\frac{\sqrt{h^2\{\gamma w_s - (1-\alpha-\beta)\beta_{nm}\}^2 + \beta^2(1-\alpha-\beta)^2\{\beta_m(1+r) - w_s\}^2 + \gamma^2 {w_s}^2 {\beta_m}^2 \ldots}}{2[\gamma w_s - (1-\alpha-\beta)\beta_{nm}]}$$

$$\frac{\sqrt{-2h\{\gamma w_s - (1-\alpha-\beta)\beta_{nm}\}.\beta(1-\alpha-\beta)\{\beta_m(1+r) - w_s\} + h\{\gamma w_s - (1-\alpha-\beta)\beta_{nm}\}\gamma w_s\beta_m \ldots}}{2[\gamma w_s - (1-\alpha-\beta)\beta_{nm}]}$$

$$\frac{\sqrt{-2\gamma w_s\beta_m\beta(1-\alpha-\beta)\{\beta_m(1+r) - w_s\} + 4\{\gamma w_s - (1-\alpha-\beta)\beta_{nm}\} \ldots}}{2[\gamma w_s - (1-\alpha-\beta)\beta_{nm}]}$$

$$\frac{\sqrt{.\beta(1-\alpha-\beta)h\{\beta_m(1+r) - w_s\} + 4\{\gamma w_s - (1-\alpha-\beta)\beta_{nm}\}w_s\beta_m\}}}{2[\gamma w_s - (1-\alpha-\beta)\beta_{nm}]}$$

Appendix H

In this appendix, we will perform the comparative analysis on g_s^* to see which variable can reduce these short-run and long-run equilibriums.

We will derivate the first part of the fraction:

$\frac{\partial gs*}{\partial w_s}$= -ve

Hence, the derivative is negative. Higher skilled wages decrease the long-run threshold.

Shorter proof of the derivation:

Since, this is lower root so we simplify it accordingly to find the relationship:

$$\frac{-b-\sqrt{b^2-4ac}}{2a} \gtreqless 0$$

$$-b \gtreqless \sqrt{b^2-4ac}$$

$$b^2 \gtreqless b^2-4ac$$

$$0 \gtreqless -4ac$$

$$\frac{\partial f}{\partial \beta_{nm}} = 0 \gtreqless -4ac$$

$$b^2(1+r)\left(\frac{w_u}{w_s}\right)^{\alpha+\beta}\{\gamma w_s-(1-\alpha-\beta)\beta_{nm}\}$$

$$+b[\gamma w_u\{\beta_m(1+r)-w_s\}-h(1+r)\left(\frac{w_u}{w_s}\right)^{\alpha+\beta}\{\gamma w_s-(1-\alpha-\beta)\beta_{nm}\}-(1+r)\left(\frac{w_u}{w_s}\right)^{\alpha+\beta}\gamma w_s\beta_m+wu(2+r)\left(\frac{w_u}{w_s}\right)^{\alpha+\beta}\{\gamma w_s-(1-\alpha-\beta)\beta_{nm}\}]$$

$$+[-\gamma w_u.h\{\beta_m(1+r)-w_s\}+\gamma w_u w_s\beta_m-wu(2+r)h\left(\frac{w_u}{w_s}\right)^{\alpha+\beta}\{\gamma w_s-(1-\alpha-\beta)\beta_{nm}\}-wu(2+r)\left(\frac{w_u}{w_s}\right)^{\alpha+\beta}\gamma w_s\beta_m]$$

$$0 \gtreqless [-4(1+r)(\frac{w_u}{w_s})^{\alpha+\beta}\{\gamma w_s - (1-\alpha-\beta)\beta_{nm}\}].[-\gamma w_u.h\{\beta_m(1+r) - w_s\} + \gamma w_u w_s \beta_m - wu(2+r)h(\frac{w_u}{w_s})^{\alpha+\beta}\{\gamma w_s - (1-\alpha-\beta)\beta_{nm}\} - wu(2+r)(\frac{w_u}{w_s})^{\alpha+\beta}\gamma w_s \beta_m]$$

Derivate w.r.t β_{nm}

$$0 \gtreqless -4(1+r)(\frac{w_u}{w_s})^{\alpha+\beta}.\gamma w_u.h\{\beta_m(1+r) - w_s\} + 4(1+r)(\frac{w_u}{w_s})^{\alpha+\beta}\gamma w_u w_s \beta_m$$

$$-8wu(2+r)h(\frac{w_u}{w_s})^{\alpha+\beta^2}(1+r)\{\gamma w_s - (1-\alpha-\beta)\beta_{nm}\}(1-\alpha-\beta)$$

$$-4(1+r)(\frac{w_u}{w_s})^{\alpha+\beta^2}wu(2+r)\gamma w_s \beta_m(1-\alpha-\beta)$$

Since, L.H.S > R.H.S because R.H.S is negative, therefore, derivative is positive

In the short-run, the threshold, *f*, will increase with higher non-monetary cost.

$$\frac{\partial g^*}{\partial \beta_{nm}} = 0 \gtreqless -4ac$$

$$-b^2[\gamma w_s - (1-\alpha-\beta)\beta_{nm}] + b[h\{\gamma w_s - (1-\alpha-\beta)\beta_{nm}\} - \beta(1-\alpha-\beta)\{\beta_m(1+r) - ws\} + \gamma ws\beta_m] + [\beta(1-\alpha-\beta)(h)\{\beta_m(1+r) - ws\} - \beta(1-\alpha-\beta)ws(\beta_m)]$$

$$0 \gtreqless +4[\gamma w_s - (1-\alpha-\beta)\beta_{nm}][\beta(1-\alpha-\beta)(h)\{\beta_m(1+r) - ws\}] - 4\beta(1-\alpha-\beta)ws(\beta_m)][\gamma w_s - (1-\alpha-\beta)\beta_{nm}]$$

Derivate w.r.t β_{nm}

$$0 \gtreqless -4[\beta(1-\alpha-\beta)^2(h)\{\beta_m(1+r) - ws\}] + 4\beta(1-\alpha-\beta)^2 ws(\beta_m)]$$

$$0 \gtreqless -(h)\{\beta_m(1+r) - ws\}] + ws(\beta_m)]$$

Simplifying it, we get:

$$0 \gtreqless hws + (\beta_m)[ws - h(1+r)]$$

Since, R.H.S is positive, L.H.S < R.H.S and the derivative is negative

In the long-run, the critical threshold, g_s^* will decrease with a higher non-monetary cost of social exclusion.

The Lahore Journal of Economics
23 : 2 (Winter 2018): pp. 151–182

Is Pakistan Ready to Embrace Fintech Innovation?

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Abstract

Pakistan is an emerging market for fintech, with increasing facilitation for digital payments, widespread internet and smartphone penetration, consumer preferences for social media and booming online commerce. Also, the State Bank of Pakistan provides sound regulations, which act as a platform for fintech growth. While regulations are necessary, they might also become a threat for an industry still in its infancy. This paper aims to provide a qualitative assessment of economic, demographic and technological factors that are conducive for the penetration and growth of fintech in Pakistan. A second, but no less important, objective of this paper is to look at the regulatory framework governing fintech and its contribution in making the segment an active or dormant player in the financial services industry.

Keywords: Fintech, disruption, innovation, financial services, emerging market, Pakistan.

JEL classification: G20, K20, O16.

1 Introduction

Fintech is a segment of industries consisting of technology-focused companies with innovative products and services, traditionally provided by the financial services industry. These companies work in the areas of stocks trading, peer-to-peer lending, cryptocurrencies, transfer payments and equity crowdfunding, among others. Globally, fintech innovation has aided financial advancement, resulting in new business models, processes, applications, products, or services, changing the face of global payments with a substantial effect on financial institutions and the efficiency of financial services. According to some estimates, by the end of 2017, the size of the global fintech market had already reached 3.6 trillion USD and is expected to reach as high as 8.3 trillion USD by 2022. Fintech influence on

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financial services is growing, as 82% of incumbents expect to increase fintech partnerships in the next three to five years, and the annual ROI on fintech related projects is expected to be around 20% (Rickert et al. 2017).

The fintech market is continuously evolving and expanding with an increasing diversity of funding sources, scope of business and geographic spread. These innovations are intense in nature; hence they hold a considerable potential to alter and restructure existing financial services. Most fintechs combine financial services with additional activities associated with e-commerce, sharing-economy businesses and big data analytics to provide new added-value (Nakaso 2016). Apart from the technology-led platform for the users of financial services, fintech innovations also provide a wide array of choices for users, ranging from efficient and secure payments to better accessibility of financial services, resulting in improved financial inclusion and an ideal experience in terms of cost and efficiency.

For consumers, fintechs offer personalized and interactive services by allowing them to conduct transactions over their mobile device, boosting customer experience. Among the notable services that allow consumers to make online payments are *PayPal* that supports purchases made through *eBay*, and *Amazon pay* for purchases made through *Amazon.com.* In China, *Alipay* works with *Taobao*, the Chinese equivalent of *eBay*. Among other recent advancements in developed and BRIC markets, companies like *Venmo, Google Wallet, WeChat, Facebook Messenger* and *Snapchat* have set up Person-to-Person (P2P) internet-based solutions that enable people to send money to each other using a mobile device. This seems to be more convenient than physically transferring cash or making online bank transfers (Mccaffrey & Schiff, 2017).

Fintechs also complement the conventional role of financial institutions by assisting incumbents in providing products and services efficiently and increasing the spread of the industry. Fintechs, by developing easier and innovative financial products and solutions at lower costs have enabled the provision of these to the poorer segment of society, who heretofore have been financially excluded (KPMG, UK, 2017). For businesses, some fintechs operate to detect fraud (e.g., Ravelin), manage risks and deal with compliance issues (e.g., Covi Analytics).

Among its other significant impacts on the traditional banking sector (payment systems, lending and financial advice) and capital markets, fintechs have provided improved access to services, a reduction

in prices, costs of intermediation and information asymmetries, and have improved efficiency (Gregorio, 2017). In terms of transaction payments, banks still dominate the market, but payments made through non-bank sources such as Apple, Google, PayPal and other mobile payment options are gaining popularity, disrupting traditional modes of payment. Digital currencies, such as *Bitcoin* or *Ethereum*, use advanced encryption methods to control the generation of currency units through blockchain technology. This technology comprises a digital database for the verification of transactions, with a system of decentralized blocks of records. This allows peer-to-peer transfer of value to take place without the need for an intermediary to confirm the transaction, as computers validate every transaction. Blockchain technology has the potential to be disruptive, as it paves the way for various cost-saving innovations and permits a currency without the support of a government or intermediary - the function traditionally performed by banks.

The upsurge of pioneering fintech solutions is posing an ever-growing risk to the existing players in the traditional banking business models. Many fear losing business to innovators, beginning with payments, fund transfer and personal finance sectors. This disruptive shift in technology and business model innovations has also raised regulatory concerns globally, as strong regulations exist for mainstream financial institutions only and may not be adequate to deal with the complexities of fintechs (disruptors). Therefore, most fintech companies face regulatory uncertainty in terms of the laws with which they will need to comply, or possible over-regulation as an intimidation to their growth.

Fintech has reshaped the financial sector on a global scale, and its transformative potential is also seen in developing economies. Pakistan, being the world's sixth most populated country, is a cash-based economy with 85 percent of its population being financially excluded. The high banking infrastructure costs act as a barrier to the diffusion of financial services beyond a small fraction of the population. At present, only a few fintechs operate in the country, and those are primarily in the developed cities of Lahore, Karachi and Islamabad. This sluggish growth and the shortage of fintechs in Pakistan is a consequence of investment in this sector only at the local level, and therefore inadequate. The fintech ecosystem in the country is hobbled by threats to data security and intellectual property, trouble attracting the right talent and customer base, and uncertainty in future regulation, which discourages entrepreneurs from venturing into the fintech environment (Shahid et al. 2016).

However, Pakistan possesses the potential to be an attractive market for fintech growth, owing to the increasing youth population, disruptive internet and smartphone penetration, consumer preference for mobile phones and social media, booming online commerce facilitating digital payments and an overall financial system having absorption capacity for innovation. The regulatory framework for financial services is fairly strong in Pakistan, with laws such as Payment System Operators (PSOs), Payment Service Providers (PSPs) and Branchless Banking regulations issued by the State Bank of Pakistan (SBP). All of these could act as platforms for carefully controlled and regulated *fintech-led* growth. Nonetheless, stringent regulations should not be viewed only as a support, as it might also become a threat for the emerging fintech industry, which is still in its infancy stage.

This paper primarily provides a qualitative assessment of economic, demographic and technological factors that could be conducive for the penetration and growth of fintech in Pakistan. The secondary, but equally important, contribution of this paper is the analysis of the regulatory framework governing fintech in Pakistan and the contribution of these regulations in making the segment an active or dormant player in the financial services industry.

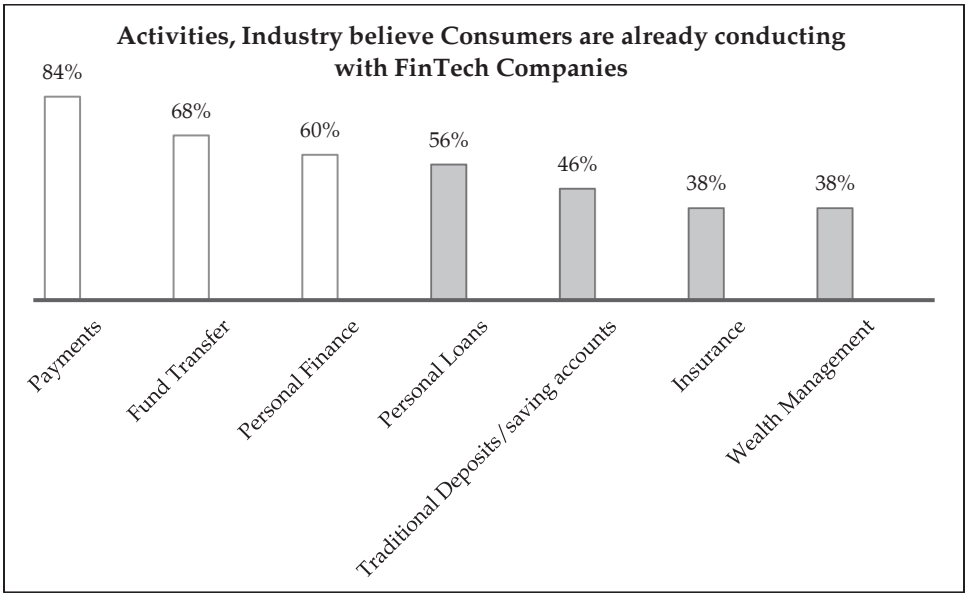
The paper is organized as follows: section 2 provides an overview of the global fintech industry and its various categorizations, drivers, impacts, opportunities and challenges for growth; section 3 presents the current state of the fintech industry in Pakistan; section 4 provides a qualitative assessment of the opportunities and challenges faced by fintechs in Pakistan; section 5 discusses the regulators and regulations governing fintech in Pakistan and stresses the need to create a balance between rectifying inaccuracies of fintechs with the flexibility to revolutionize in order to develop a favorable environment for fintechs in Pakistan; and section 6 concludes with forward-looking policy recommendations, for the industry players and regulators based on the learning of global best practices that several countries have adopted to deal with this digital revolution.

2 Understanding Fintech

Fintech is a global advancement of financial services driven by technology and shifts in customer expectations. Fintech firms employ technology to deliver the best financial solutions to clients with an aim to digitize the financial segment, resulting in cost reductions and new ways of working to gain transparency in the market (Gregorio, 2017).

Primarily operating in areas of banking, insurance and asset management (KPMG UK 2017), fintechs have been classified into various domains. Gregorio (2017) identifies five broad areas where fintech firms are operational. These include 1) finance and investment (venture capital and crowdfunding), 2) internal finance operations and risk management, 3) payments and infrastructure (electronic payments and Over-the-Counter derivate trading), 4) data monetization and security, and 5) customer interface.

Figure 1: Business Domains where Fintechs are Active



Source: Adapted from PWC Global Fintech Report, 2017.

Fintechs spread into many domains of financial services, ranging from products to markets to services. Figure 1 shows that payments, fund transfers, and personal finance are the most active sectors in which fintechs operate. In other domains, such as insurance and wealth management, consumers are less active.

Fintechs, based on the stages of their life cycle, can be classified into start-ups, unicorns and GAFAs. These can be defined as follows:

a) A **Start-up** is a firm whose aim is to initiate a business activity associated with technology, the internet or innovation. Such young firms have an inventive business plan and are growing in the market. Their human organization develops products and services in diverse

ways by applying innovation, with the aim of decreasing costs. The focus of their design and commercialization is customer oriented and the internet platform is used to move it forward (Prashantham & Yip, 2017). These firms provide services using social networks and conduct activities previously managed by banks (Romānova & Kudinska, 2016).

b) **Unicorns** are companies having a theoretical value of more than US$1 million. Their market value is largely based on the percentage of speculation linked with their expectation of profitability and future growth. The business model focuses on acquiring a large customer base. It is expected that in the future they will have to be regulated to control their actions.

c) **GAFAs** (Google, Amazon, Facebook and Apple**)** are the revolutionary firms of the stage ".com" and are presently working as digital monopolies, well known as GAFAnomics (MEDICI Team, 2016).

2.1. Drivers of Fintech Growth

Fintech growth has been driven by a number of factors, including technological evolutions, innovation spirals, changing consumer demands and fluctuations in the macroeconomic and financial background.

Technology is the center of the changing payments setting, with better solutions and capabilities swaying consumer behavior and expectations also driving considerable industry transformation (Broom, 2015). The technological and payment system developments, such as cloud-based solutions and application programming interfaces (APIs), are being adopted by businesses, especially startups, to build and adapt their operations more efficiently. New cloud and API technology has aided the start-up sector to disrupt recognized players and quicken change.

The prevalence of mobile devices has driven the move towards adopting mobile financial services, such as mobile banking and payments. Smartphone technology itself has given a boost to fintech innovations such as mobile payment technologies, online brokerage and banking products that are needed to match the progressively mobile lifestyle that smartphones have facilitated.

The growth in e-commerce, mainly due to demand by consumers, has facilitated further transformation in digital payment experiences, with a shift towards a post-cash economy. Those tech-savvy consumers engaged in online

shopping and banking value ease-of-use, convenience and speed, which has pushed businesses to incorporate financial technology into their setup.

Also contributing to fintech growth are millennials, known as Generation Y, who value innovation and are more likely to use new financial services and products. Along with innovation, their social media openness and adaptability towards the latest automated gadgets makes them keen to demand fintech products that fit their busy way of life and mindset. The demand for personalized and easy-to-use products and services by consumers is an opportunity for fintechs to respond by developing products well-suited to their needs (Lei, 2014).

Further, in this era, digital or cashless payments are seen as an alternative to cash and plastic money since they are more convenient and secure in the daily lives of individuals in terms of their consumption (Japan-METI, 2017). Digital technology has begun to dominate so that the physical act of paying is rarely seen. Instead, the automation of payment has converted money from a physical form of exchange into another form of data (OECD, 2002); thus acting as a key driver of fintech growth.

Globalization and other changes in market trends have also contributed to the rapid development of this sector. The world has become globalized as developing markets have the capacity to surpass their more advanced equivalents, and the transferal of new information is both rapid and worldwide. Currently, penetration of innovations is possible at a much faster rate than ever before. The remarkable growth of smartphone and mobile usage is now placing digital services in the hands of consumers who earlier could not be reached, providing a richer, more valuable experience around the globe.

From an unorthodox perspective, it can be claimed that the global financial crisis in the United States in 2008, which later spread to Europe and Asia, has also played a revolutionary role in increasing the prominence of fintech. During the financial crisis, banks were not willing to borrow money. This dysfunctionality of the credit market had negative effects on the economy in terms of consumption and investment. The increased number of layoffs and uncertainty about the future caused consumption to plummet, further negatively affecting employment. These factors signaled firms to cut their prices and costs in order to keep up sales. As a consequence, fintech companies came into play as one of their objectives was to reduce costs and reach out to many customers over the internet (Gregorio, 2017).

Since the onset of the Global Financial Crisis, the banking industry has witnessed changes in growth, digitization and the regulatory environment. The increasing pressure of competition is fierce. The regulators who were once opposed to non-bank entrants have now become open to the idea of allowing them, acting as threats to banks. The cutthroat competition between banks creates a need for collaboration with fintechs to provide new products in order to meet the growing demand of consumers and digitizing processes.

2.2. The Impact of Fintech in the World

Fintechs have had expected impacts on the banking industry and financial markets. The substantial digitalization of processes has reduced transaction costs and increased convenience for end users. Specifically, widespread internet access and mobile phone penetration have distributed the advantages in reduction of the cost of transactions, due to novel communications technologies, to billions of people. Now, fintechs offer products and services to customers that are much more in line with their demands compared to products offered by traditional intermediaries. By reducing the role of intermediaries and improving working efficiencies, fintech firms are better able to offer products and services at diminished costs, increasing returns for consumers (KPMG, UK, 2017). This reduction in transaction costs eventually puts pressure on the conventional financial intermediaries who are competing to develop products that meet the ever-growing needs of consumers (Bergara & Ponce, 2017). A possible consequence of this changing market structure could be the vertical integration of the financial intermediaries and fintech firms. Additionally, falling transaction costs have had implications for financial inclusion of the underserved population and business sector, especially in developing economies (KPMG, UK, 2017). According to Manyika, Lund, Singer, White & Berry, 2016, 45 percent of adults lack access to a financial account at a bank or other financial institution. By providing the underserved population with low cost innovative solutions and small businesses with funding resources and access, fintechs improve financial inclusion. Fintechs also increase the accessibility of information on financial services, such as online/mobile banking services and investment advice (Alexander, 2017). Moreover, business practices improve with digital payments, allowing them to maintain an electronic record of sales and expenses, monitor cash flows that enhances their understanding of business operations, eventually boosting profitability and productivity (Manyika et al., 2016). The development of branchless banking (BB) has reduced the cost of conducting transactions and of setting up bank

branches, which contributes to economic growth through networks of output growth, employment creation, productivity, lessened transaction costs, improved functioning markets and financial inclusion, eventually resulting in poverty alleviation (Triki & Faye, 2013).

In conclusion, fintechs have had pronounced effects on economies, ranging from reductions in transaction costs and information asymmetry to improvements in financial inclusion, efficiency and competition, and a wider access to financial services.

3.1. Opportunities and Challenges Faced by Fintechs Globally

The fintech revolution is considered by many to be among the most important global innovations in the financial industry and has been growing rapidly in previous years. Global investment in fintechs have experienced a 67 percent annual increase from the first quarter of 2015 to 2016, reaching $5.3 billion, with Europe and Asia-Pacific experiencing the highest increases (Lee & Shin, 2018).

Fintechs require an encouraging business environment in order to develop. Closely integrated technology hubs and the availability of skilled staff, such as IT developers, banking analysts and management staff, are important elements for the development of a healthy fintech environment. The state of physical infrastructure (road networks), utilities (power, telecommunication, internet) and distance to existing business hubs are also imperative. Government support in the form of implementing regulations to facilitate ease of doing business, setting licensing requirements and providing financial support for the construction of the fintech hubs, creation of seed funds, grants, or subsidies provide opportunities for fintech development (Diemers, Lamaa, Salamat & Steffens, 2015).

The U.S. is a successful market for fintech growth as it is a leading international financial hub, has strong support structures, healthy financers (Barclays, Bank of America, and Wells Fargo), incubators and accelerators, tax credits for research and development, possesses a large financial technology workforce and attracts large investments (Diemers et al., 2015). The Middle East has also witnessed rapid fintech growth, with success primarily due to strong regulatory support, government-driven funding programs (e.g., Hamdan Innovation Incubator, SeedStartup, In5), venture capitalists, and local financial services providing early-stage funding for startups. For China, the growth in its middle-class, together with a progressive educational system and its dynamic participation in global

supply chains, has led to a strong tech ecosystem comprising large local tech firms, robust engineering and business skillsets, and active private equity and venture capital investors. India has also experienced advances in infrastructure, specifically the ability to connect a digital identity to bank accounts enabling financial institutions to expand outreach to millions of new customers. These improvements are paving the way for augmented delivery of financial services from both traditional and nontraditional providers. Further, demonetization of currency notes in 2016 has enhanced the shift from paper to electronic payments and driven the technology-based transformation of financial services in the country (IFC, 2017).

Advances in financial technology improve access to services for the financially underserved community or small businesses by improving the speed, cost and ease of use of such services. Fintech businesses offering financial services have an opportunity to improve their product to gain market share and decrease per-customer operating costs (Mnuchin & Phillips, 2018).

Consumer expectations from financial service providers are a major driver of the fintech revolution. Consumers want financial institutions to rapidly respond to their growing needs and have an increased demand for personalized services. Fintechs, in areas of e-commerce and online banking, have an opportunity to capitalize on these consumer needs (Rickert et al., 2017). Digitization increases competition among traditional firms and opens doors for new firms with distinctive business models, such as peer-to-peer lending, digital-only banks and crowdfunding platforms. Though these fintech firms start at a smaller scale, their expertise in technology helps them to disrupt the status quo. Increased digitization in the payment process has also led to significant cost reductions for firms using existing payment processes, for example, substituting paper checks with electronic payments and minimizing inefficiencies in cross-border payments.

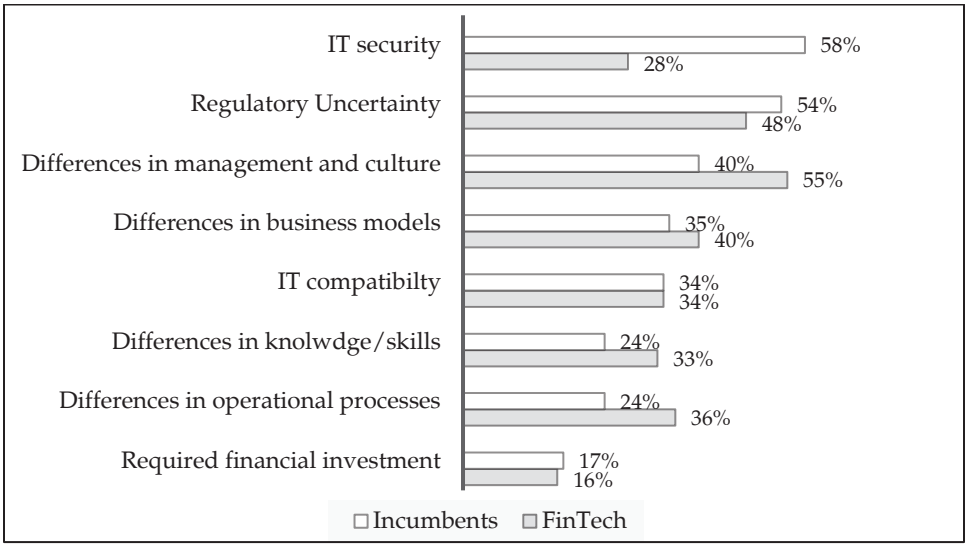
Despite growing impressively, fintechs face a number of complex challenges: regulatory concerns, technology integration, and data privacy and security (Lee & Shin, 2018). Unlike conventional banks and financial institutions, fintechs face regulatory uncertainty, i.e., they are unaware or unsure of the regulations and procedures with which they will need to comply. These could be regulatory challenges for anti-money laundering, capital requirements, data security, and privacy. Each of these could cause registration delays or raise the possibility of being hit with heavy fines.

Since fintechs are built with new technologies, it is a challenge to integrate the fintech applications with the present systems. For the internal development of fintech startups, it is necessary to collaborate or establish joint ventures with banks through incubator programs and corporate ventures. Without a comprehensive integration design, existing banking processes may become unsuitable for use with new technologies, which financial institutions may then not be able to use.

Information security and privacy breach is another major challenge fintechs have encountered worldwide. In online payment applications, such as Google Wallet and MasterCard Pay Pass, critical information stored on mobile devices can become lost or stolen. To counter this, fintech companies must develop, strengthen and maintain suitable measures to protect sensitive consumer data from illegal access. To accomplish this and build consumer trust, they should work closely with regulatory bodies and consumer protection agencies.

PwC, in their Global Fintech Report 2017, have also identified challenges faced by fintech companies and incumbents globally as shown in the Figure 2 below.

Figure 2: Challenges faced by Fintechs and Incumbents Globally



Source: Adapted from PWC Global Fintech Report, 2017.

Figure 2 shows differences in management and culture (55 percent), regulatory uncertainty (48 percent) and business models (40 percent) are

identified as major challenges for fintechs. Information technology security (58 percent) is the biggest challenge for most incumbents, followed by differences in management and culture (54 percent), and regulatory uncertainty (40 percent).

3 Fintech in Pakistan

Pakistan, the world's sixth most populated country, is a cash-based economy. The problem of low access to finance has long plagued the Pakistani economy (World Bank, 2017). Ninety-three percent of the adult population remains unbanked (Rizvi, Naqvi & Tanveer, 2017). Pakistan occupies a low rank in financial inclusion when compared to regional and global standards (Nenova & Ahmad, 2009). High intermediation costs with high interest rate spreads, financial illiteracy, high collateral requirements, and prohibitive lending rates have put finance out of the reach of small and medium enterprises. Such high financial exclusion not only makes individuals and businesses vulnerable to income shocks, but also increases their operating costs and dampens future investments. Technology can be harnessed to enlarge geographical outreach, as well as overcome low literacy levels. Through the new technological solutions of branchless banking and mobile banking, physical access to finance can be improved. Partnerships between banks and informal providers could make their services more geographically reachable, less intricate, and more easily understandable for consumers. Pakistani consumers' general perception regarding the (in)significance of formal finance in their daily lives, difficult banking procedures, low outreach, and unsuitable products provides an opportunity for fintechs to design personalized products (World Bank, 2017). Microfinance Institutions (MFIs) in Pakistan are faced with the need for greater funding in order to grow and integrate with financial markets, though they possess immense potential to expand outreach. The use of technology and partnerships with fintech startups will allow them to expand outreach. Current weaknesses of the financial sector could serve as an opportunity for digital financial services to offer solutions to the problem of outreach.

3.1. Type of Fintechs in Pakistan

The fintech industry already exists in Pakistan. Originally, Automatic Teller Machines (ATMs), debit and credit cards were the main products developed by these firms for commercial banks. The introduction of these services was driven by globalization and the rapid technological advancement that was taking place around the globe. Presently, a new

class of fintech has emerged in Pakistan that has revolutionized technology and enabled solutions for delivering financial products and services. The products and applications developed by these fintechs aim to revolutionize payment systems, improve financial inclusion, and increase the overall productivity of the economy. The reduced transaction costs for fintech firms allow them to develop products specific to consumer needs, creating competition for the incumbent financial service providers in the country, who, in order to compete, will need to collaborate with fintech firms. This collaboration can be mutually beneficial for both parties, since fintechs have an entrepreneurial approach and incumbent banks possess a large customer base and a repository of customer data. Banks provide the regulatory cover to firms, which focus on innovation and the development of products to be used by the bank's customer base. A successful example of this is the FINCA Microfinance Bank-Finja partnership. Finja, a fintech startup, is developing a mobile wallet application, while FINCA provides a regulatory cover by maintaining a branchless banking license.

Table 1 provides an overview of the fintechs that currently operate in Pakistan, classified into traditional and emergent fintechs.

As a distinction, traditional fintechs work together with incumbent financial service providers as their technology providers through traditional pricing models. Emergent fintechs, also known as disruptors, collaborate with a bank or financial service firm by means of new engagement models where they provide new technology solutions to facilitate existing needs.

Table 1: Fintechs Currently Present in Pakistan

Traditional Fintechs	Services Offered	Emergent Fintechs	Services Offered
ABACUS	Management Consulting, Technology and Outsourcing Services	**BATWA**	Mobile Wallet
AUTOSOFT	Banking products, Consulting Services	**FINJA**	Zero Cost Payment Systems and Cloud Based Payroll Solutions
INNOV8	Technology and Consulting Solutions	**ONELOAD**	Online Mobile Top-up
KARLOCOMPARE	Web Application for Personal Finance	**PAYLOAD**	Payment Solutions
MONET	E-Payment Processing	**RED BUFFER**	Customized Cloud and Mobile Solutions
TPS	Payment Solutions	**STOCKSFM**	Social Investment Network

Note: Adapted from (Shahid et al., 2016) and improved by the authors.

- *Abacus Consulting*, founded initially as a management consulting firm, has now grown into one of the leading business solutions providers in Pakistan. Their primary focus is on developing finance-related business solutions for business and organizations.
- *AutoSoft Dynamics* is a software development venture that develops financial applications used by domestic and international banks.
- *Inov8* is a digital payment company that is growing rapidly in the region. In collaboration with *Easypaisa*, it links its massive distribution setup to all commercial banks that have implemented Inov8's technology. Another application under the name, Fonepay, has also been launched which allows the use of smartphones for making payments.
- *KarloCompare* is a web and mobile application that allows users to compare and buy easily a range of financial products such as personal/auto loans, credit card and travel insurance, with a few clicks.
- *Monet* is an e-payment provider that focuses on digitizing payments in cash-based economies. It was established with the idea and directive to offer electronic payment processing and flexible services in the Branchless and Alternate Banking Channels sphere. Currently, Monet has its own infrastructure and systems operated at Monet Data

Centre(s) to aid banks, financial institutions, and merchants in furnishing their payment transaction processing requirements.

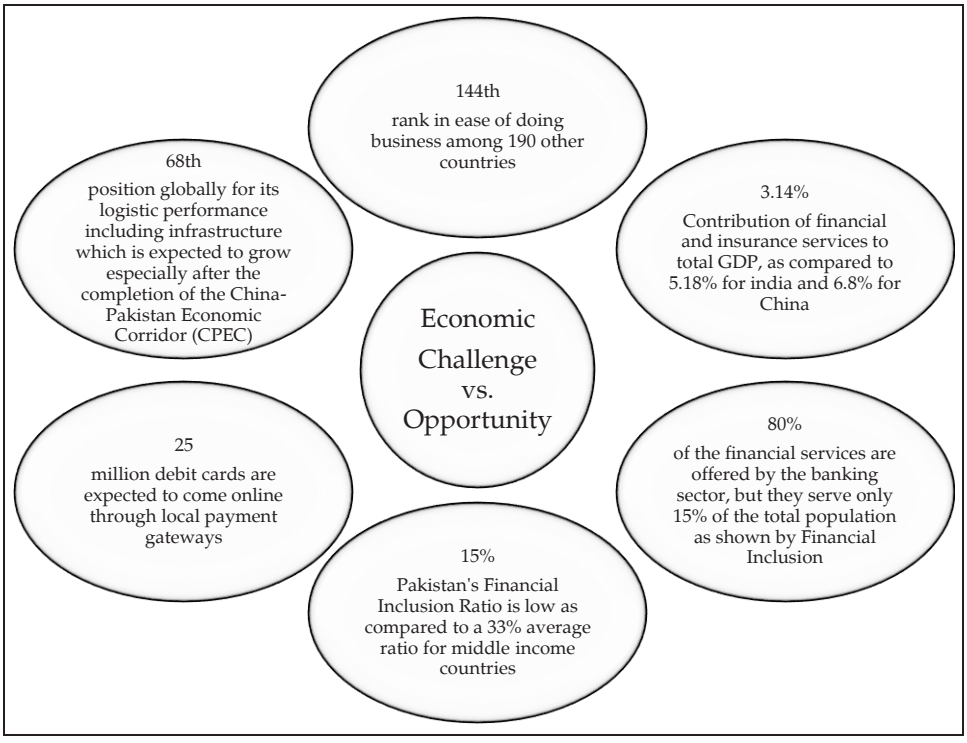
- *TPS* provides cards and payment solutions enabling banks, payment processors, telecoms and other institutions in digitizing payments. They also offer business and technical expertise in pre-paid cards, card management, delivery channel management, and internet and mobile banking.
- *BATWA* is a small startup and provides a mobile wallet to its users for payment purposes.
- *FINJA,* founded by banking and tech industry experts, is a fintech startup serving as a zero cost payment platform and a unified loan and e-commerce marketplace. The SimSim app solution is the first payment solution in Pakistan for free and frictionless payments made instantaneously. This application will be interconnected with the users' current account, allowing them to make payments at a variety of partner retail businesses through their smartphones.
- *OneLoad* is an online platform that allows users to purchase top up credits for their mobile accounts with all mobile companies simply through its efficient mobile application and web portal.
- *Payload* is incubated at *Plan9,* and has developed an easy-to-use technology that permits businesses to receive bitcoin payments while dealing with payments in Pakistani Rupees.
- *Red Buffer* focusses on developing data science services, machine learning/natural language processing (ML/NLP), and cloud and mobile applications.
- *Stocksfm* is a financial communications platform for the financial and investing public. Stocksfm generated the $TICKER tag to allow users to organize and establish "streams" of information around stocks and markets across the web and social media. These streams provide new forms of insight, ideas and information that are used by investors, analysts, media and others as they research stocks and manage their investments across the internet and social media websites. This provides understanding and ideas to investors, media analysts, and others for use in researching and managing their financial investments (Tamoor, 2017).

4 Fintech Growth in Pakistan: Challenges vs Potentials

This section provides a qualitative assessment of economic, demographic and technological factors that could serve either as threats or opportunities for the penetration and growth of fintech in Pakistan.

At present, only a few fintechs operate in Pakistan and those are primarily in the developed cities of Lahore, Islamabad and Karachi. The sluggish growth and shortage of fintechs in Pakistan is a consequence of primarily local, and therefore inadequate, investment in the segment. The current fintech ecosystem in Pakistan could be characterized by holes in various information areas, hindering all ecosystem members and hierarchies. Limited fintech investment raised solely from local investors, a dearth of partnership platforms for fintech incumbents and investors, poor quality of the IT sector (Figure 5), an unwelcoming attitude by incumbent organizations towards partnerships with fintech firms, and difficulties in modifying the behavior of customers are among the key challenges fintech firms have faced (Shahid et al., 2016). The Fintech ecosystem is also subject to several hindrances comprising threats to data security and intellectual property, trouble attracting the right talent and customer base, and an uncertain regulatory environment discouraging entrepreneurs from venturing into the fintech environment. The economic, demographic and technological environment in Pakistan also presents a number of challenges to fintech growth as shown in Figures 3, 4 & 5 below.

Figure 3: Economic Challenges and Opportunities in Pakistan

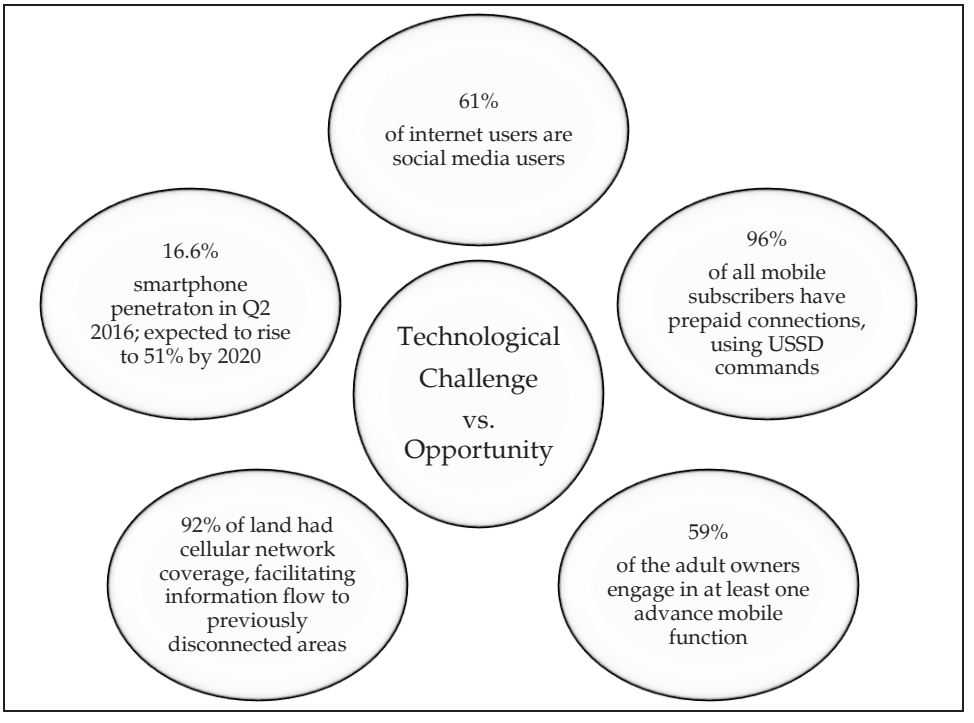


Source: World Bank, State Bank of Pakistan, Karandaz, UNESCO, Pakistan Telecommunication Authority.

Figure 3 presents the economic challenges and opportunities for fintechs in Pakistan. The current state of financial inclusion in the country is disappointing as Pakistan is ranked 16th of 26 nations according to *The State of Financial and Digital Inclusion Project Report 2017*. Figure 3 also shows a financial inclusion ratio of 15 percent, well below the average rate (33 percent) among middle income countries. However, according to the Fintech Survey 2016, in evolving markets where financial inclusion numbers are low, fintechs play a considerable role as they offer a means to digitization. This weakness of the economy can serve as an opportunity for fintechs to grow (Shahid et al., 2016). The provision of financial services is dominated by banks in Pakistan, which could present a challenge for fintech startups to enter the market. But since only a fraction (15 percent) of the population is currently being served by the banking sector, this is an open door for fintechs to exploit and target the remaining population with digital payment solutions, eventually improving financial inclusion and the share of financial services in the country's GDP. The improvements in infrastructure expected with the completion of China Pak Economic

Corridor (CPEC) are also expected to reap substantial benefits for future fintech growth.

Figure 4: Technological Challenges and Opportunities in Pakistan

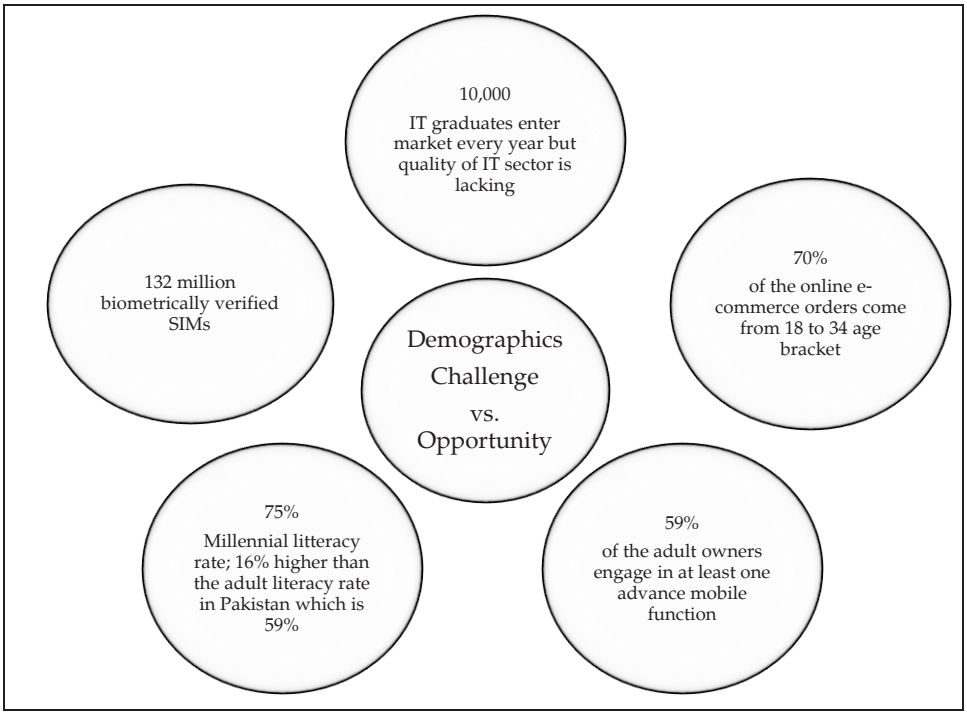


Source: World Bank, State Bank of Pakistan, Karandaz, UNESCO, Pakistan Telecommunication Authority.

Technological opportunities and challenges for fintech growth are shown in Figure 4. The still low (16.6 percent), but growing smartphone penetration, internet and social media usage, improving mobile ownership numbers and adult literacy rate of 59 percent presents an opportunity to digitize financial services and provide them through mobile phones. The diffusion and adoption of mobile technology in the Pakistani market – mobile teledensity is 69 percent - has been growing over the years. To further supplement this, the number of mobile internet and mobile internet subscribers is expected to increase from 9 million in 2014 to an estimated 59 million in 2019, making Pakistan the country with the fastest growing mobile internet access rates. In the Global Fintech Survey, mobile data analytics, cyber-security, public cloud infrastructure, biometrics and identity management were considered the most relevant technologies for financial institutions investment by in in order to embrace the disruptive

nature of fintechs; it could be safe to say that technological factors in Pakistan are also moving in the right direction.

Figure 5: Demographic Challenges and Opportunities in Pakistan



Source: World Bank, State Bank of Pakistan, Karandaz, UNESCO, Pakistan Telecommunication Authority.

Moreover, current demographics serve as a challenge and opportunity for Fintechs in Pakistan, as presented in Figure 5. Pakistan has the fifth largest youth population, a potential market for the new cohort of financial products and services available over the nexus of Social Media, Mobile, Analytics and Cloud (SMAC). These products are not only appealing, smooth, fast and easy-to-use, but they also match the lifestyle of millennials, who are literate and widely engaged in online e-commerce, demanding fintech products. Secondly, the shift in consumers' preference towards mobile phone usage and social media platforms and away from desktop computers has given rise to digital payments. The verification of 132 million biometrically certified SIMs has paved the way for digital wallets, allowing payments to be made through mobile phones. Many players, including non-bank "banks" and non-profit organizations, are currently working on financial technology to make their applications an actuality in Pakistan. Among non-bank players, one of the biggest

examples is that of *Easypaisa*, by Telenor Pakistan, a prominent mobile phone service operator. *Easypaisa* provides financial services such as opening a bank account, withdrawal and deposit of money, funds transfer and bill payments, through more than 70,000 agents in the country. Karandaaz Pakistan, a non-profit organization, is also assisting Fintech startups by providing them grants to advance and encourage financial technology solutions in Pakistan. Access to financial services, payments, e-commerce and interoperability are their main areas of focus.

Together, the assessment of economic, technological and demographic factors reveals that the current fintech ecosystem in Pakistan could be characterized by various challenges hindering all ecosystem members and hierarchies. However, Pakistan still possesses the potential to be an attractive market for fintech companies to grow due to the increasing youth population, disruptive internet and smartphone penetration, consumer preference for mobile phones and social media, booming online commerce facilitating digital payments, and an overall financial system having absorption capacity for innovation.

While fintech innovations are fascinating and can have major positive impacts on any economy like Pakistan's, their darker side should not be ignored. Most fintechs offer financial products which have the ability to generate direct or indirect cash flows. The incentives attached with cash flow generation of fintech products have a strong influence on the product design and usage. Such influences, if compromised, can be used to alter the design or usage of fintech products. This has happened in the past, when derivative instruments that were originally designed for hedging risk became purely speculative instruments due to their inherent leveraged structure. Fintech products are no exception and are prone to such threats, originating both from the innovators and users. One such example is of Bitcoin, which was initially portrayed as a secure alternative digital currency based on blockchain technology. However, as it increased in popularity, its highly secure and complex structure became a vehicle for illegal fund transfers and money laundering. Enormous demand generated by individuals or organizations interested in conducting such covert transactions drove up its price. This price hike, coupled with its online trading, forced ordinary investors to view it as an alternative financial asset. Ironically, no asset with such price volatility as that of Bitcoin can be used as a medium of exchange (i.e., currency), which was the original mandate behind its creation (Chiu, 2016). Nonetheless, regulators are aware of some of these concerns and their approach to fintech regulation can address these concerns.

5 Regulators and Regulations

5.1. Inside the Minds of Regulators

Examining the conduct of financial regulators around the globe, we find that approximately three decades ago, their policies and actions were rather supportive for the entities and products being developed within the financial system. In the 1980s, a number of regulators around the globe either significantly reduced the regulatory constraints that supported competition or at least refrained from adding more.

However, a major shift in the regulatory paradigm occurred in the aftermath of the Global Financial Crisis of 2008, which many people view as a direct consequence of the lax regulatory environment prevalent during the years preceding the crisis. Under this new regulatory paradigm, most financial regulators now hold extremely conservative views towards innovative financial products and are preemptive in formulating policies so to avoid another financial meltdown. Of course, not all regulators hold these same views and there exist the so called 'active' regulators working closely with fintech companies. The ideology of these regulators is to understand and address the key challenges of fintech firms as a priority. This active approach of regulators could surely foster the growth of fintech, but it also raises concerns about conflicts of interest if the users' protection is immolated to protect fintech companies.

Let us restate here, that irrespective of the view taken by the regulators, one cannot disagree with the fact that the regulatory framework of a country has valuable effects on the overall economy and it is important, therefore, for governments to create the appropriate balance between supporting fintechs and protecting the public interest. The problem is that the fintech sector has been developing rapidly and institutions have found it difficult to craft regulation, pertinent to this segment. The rapid growth makes it difficult to design laws for firms of various sizes. Technology, primarily the internet, has boosted the development of new players in the market, for instance, venture capital firms, crowdfunding firms, and virtual currencies such as Bitcoin. Though benefits from such innovations accrue in the form of the creation of new assets and reduced firm costs, it does raise risk and security concerns. Therefore, there is a need for regulators to understand the technology's applicability in order to understand what exactly to regulate (Kalmykova & Ryabova, 2016).

5.2. Fintech Regulations in Pakistan

The situation in Pakistan is relatively better than the conservative and pre-emptive view of most regulators around the globe. In fact, the State Bank of Pakistan (SBP) has proven itself to be very progressive in the area of digital finance. The attempts SBP has taken to promote branchless banking and mobile banking (e.g., mobile wallets and over-the-counter transactions) have been documented in detail. One study traces the history and models of mobile banking in Pakistan to assess how the segment evolved and transformed conventional banking structures in the country (Rizvi et al. 2017). Owing to the collective efforts of a number of stakeholders, including the government, regulatory bodies, development agencies, financial institutions, telecom operators and technology companies, developments in the mobile banking sector have been growing.

The State Bank of Pakistan's support for the branchless sector was demonstrated with the issuance of branchless banking regulations and the drafting of a regulatory framework policy in 2008. Under these regulations, many branchless banking models were encouraged to set up. Since 2008, SBP and other government bodies have continued to promote technology in banking, which has created the necessary foundation on which to build a strong digital financial architecture - including fintech - in the country. Additionally, the National Financial Inclusion Strategy (NFIS), developed by SBP in 2015, with the support of the World Bank, provides clearly defined targets and incentives to strengthen the effort towards the utilization and promotion of fintech in the country.

The most important and direct step taken by SBP to promote and facilitate fintechs was the drafting and enacting of laws pertaining to Payment System Operators (PSOs) and Payment Service Providers (PSPs) in 2014[1]. These regulations are applicable to the players interested in becoming licensed operators in Pakistan for payment systems. Interested players can be granted licenses under PSOs and PSPs for the development of an electronic platform with the capability to clear, process route and switch electronic transactions. The entities licensed as a PSO or PSP can also make agreements with banks, financial institutions, merchants, other PSOs and PSPs, or any other company for the provision of services they

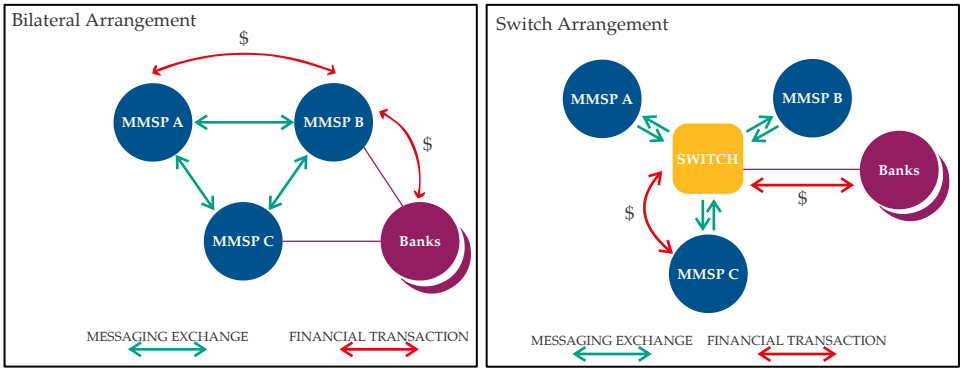
[1] Rules for PSOs and PSPs: http://www.sbp.org.pk/psd/2014/C3-Annex.pdf

intend to provide under the license. So far, only two institutions have been granted the status of PSO/PSP, namely, *One Link*[2] and *NIFT*[3].

In May 2016, the SBP introduced Regulations for Mobile Banking Interoperability[4]. Under these regulations, fintechs are expected to achieve long-awaited Transactional Interoperability that would allow users to transfer funds between mobile accounts from one service provider to another. Account-to-Account Interoperability (A2A Interoperability), the other type of interoperability, has been enjoyed by customers and fintech service providers since 2014.

The most significant feature of the 2016 regulations is the clear guidelines regarding Third Party Service Providers (TPSPs), a new player made mandatory by SBP to execute transactional interoperability. The models requiring involvement of TPSPs can also be referred to as a switch arrangement as opposed to a bilateral arrangement. The differences between the two is explained in Figure 6, below.

Figure 6: Bilateral vs Switch Arrangement



Source: (GSMA 2015).

Under the bilateral arrangement, each Mobile Money Service Provider (MMSP) must establish one-to-one links with all other players (i.e., other MMSPs or banks). Under the switch arrangement, a third party entity, a TPSP in the case of Pakistan, takes the responsibility of creating a hub with which all MMSPs and banks must establish a link.

[2] http://1link.net.pk/
[3] https://www.nift.pk/
[4] Regulations for Mobile Banking Interoperability 2016: http://www.sbp.org.pk/bprd/2016/C3-Annx-A.pdf

The Regulations for Mobile Banking Interoperability (2016) enabled the Pakistan Telecommunication Authority (PTA) to make a decision to issue the first Third Party Service Provider (TPSP) license in April 2017, which upon realization will set the foundations to achieve full interoperability across the telecom networks and entities providing mobile wallets or BB accounts. On the basis of the information available through PTA, we have compiled some important features of TPSP licensing in the following table.

Table 2: Salient Features of Third Party Service Provider (TPSP) License in Pakistan

License Period	10 Years
Due Diligence by	PTA-SBP Joint Regulatory Committee
License Issuing Authority	PTA
Initial License Fee (ILF)	Rs. 1,000,000/- (Pak Rupees one million)
Non Refundable Processing Fee	Rs. 50,000/-
Performance Bond	Rs. 10 Million in the shape of Bank Guarantees
Paid-up Capital Requirement	Rs. 200 Million (Set by SBP) with the following caveats; **10% as security deposit at the Central Bank** 5% of security deposit in a non-remunerative current account with the SBP Banking Service Corporation. 5% of security deposit in the form of Government securities to be kept under lien at the same department.
Scope of Work	TPSP license authorizes the licensee to establish, maintain and operate for the provision of Financial and Application Service Provider and permits the Channeling, Routing and Switching Transactions for branchless/mobile banking only under Service Level Agreement(s) between Financial Institution (bank), cellular mobile operator(s) and TPSP(s)
Technical Requirement	Capability of switching and routing all interbank Wallet to Wallet and Wallet to Bank account transfers from BB Issuer to BB Acquirer through an authorized PSO which will be responsible for clearing and providing day-end reports for reconciliation.
Jurisdiction	TPSP License shall be granted nationwide for the whole of Pakistan excluding Azad Jammu & Kashmir and Gilgit Baltistan.
License Holder	"None" as of March 2018 at the time of writing this paper. However two applications have been received by PTA and decision to award license is expected by Mid-2018.

Rather than waiting for other commercial players to act first, SBP has proactively developed a mobile application for Asaan Mobile Account (AMA) to facilitate mobile banking interoperability. The app is expected to

achieve universal operability by providing a single platform to all bank account holders on different mobile phone networks to conduct financial transactions. According to SBP officials, the app will be simple and available to the users of feature phones as well as users of fully-capable smart phones. An account can be easily opened after verification from NADRA, which is expected to cost the user PRs. 10. With these features, AMA may prove to be an important and innovative fintech product, and can also help to achieve the target of 50 million mobile wallet users set in NFIS 2015. National Financial Inclusion Council (NFIC) approved the AMA scheme in September 2017.

5.3. Future Challenges for State Bank of Pakistan as a Fintech Regulator

Despite the progressive attitude of SBP as a fintech regulator, there are pending issues that require immediate regulatory deliberation. The first issue to address is: Who should actually be the regulator for fintechs in Pakistan? As explained earlier, fintech is on the frontier where finance meets technology, creating questions regarding its main regulator. Should fintechs be treated as financial institutions and be governed by SBP (the current situation, owing to the bank-led model of fintechs prevailing in Pakistan)? Or should the players be treated as mobile technology providers? This is an essential element of fintechs. If they should be treated as a mobile technology, would they consequently be placed under the purview of Pakistan Telecom Authority (PTA)? Is there a need for a new regulator specifically for fintech, considering its unique and evolutionary structure?

Presently, every form of fintech is heavily dependent on digitally-stored data, which is not only susceptible to privacy concerns, but is also exposed to theft and cyber-attacks. In Pakistan, where a large number of intermediaries (e.g., financial institutions, telcos, PSPs, PSOs, TPSPs, NADRA etc.), are mandatory in order to set up viable fintechs, the task of determining exact liability in the case of data breach is itself nontrivial, and the measures that must be taken to ensure data security are a top regulatory priority.

Fintech products or services, being either heavily reliant on mobile technology or based on complex coding technologies (e.g., blockchain, Directed Acyclic Graph (DAG), Tangle, or IOTA), open the doors for unlimited possibilities, but can also create opportunities for fraudsters aiming to extract money from consumers and Fintech companies. The world saw a glimpse of this danger when the popularity of Bitcoin helped

a number of fake cryptocurrency providers to sell hoax products to customers and investors.

Another important concern is the potential use of fintech in money laundering and breach of capital controls. The archaic, bureaucratic structure of regulations in Pakistan has proven itself ineffective in dealing with such issues. Incidents like the recent inclusion of Pakistan in the grey list of the Financial Action Task Force (FATF) are enough to expose the weaknesses of regulators in this domain. Now the question is how regulators would deal with the fintech transactions which are far more secured, protected, encrypted, and faster paced compared to conventional financial transactions. This is an area which requires further thought and discussion.

It is also important for regulators in Pakistan to allow healthy competition. Around the globe, fintechs are primarily driven by startups, and Pakistan is no exception. However, it has been observed that the innovative technology developed by these startups is subsequently acquired by existing industry players of variable sizes. The recent partnership between Finja and FINCA Microfinance Bank, which allowed the fintech to receive regulatory approval for its innovative product, a mobile wallet called SimSim, is one such example where a small startup needs to seek the patronage of larger industry players to advance to a higher level.

The SBP has made efforts to promote and outline regulations for the fintech sector as it has a role to play in improving financial inclusion, which is viewed as a key driver of economic growth. However, the proliferation of fintechs is accompanied by threats of cybercrime, money laundering, terror financing, and privacy breach of customer data. SBP and other regulatory bodies have outlined guidelines to protect against the perceived risks associated with fintechs, as public security cannot be compromised.

5.4. Regulator as Competitor

Finally, despite its good deeds and inherent role of guardian, there are incentives for a regulator to become a competitor – a potential threat for much of the fintech sector. The threat arises from the possibility of a Central Bank-Issued Digital Currency (CBDC) or Central Bank-issued Crypto Currency (CBCC). The idea of CBDC creation is feared due to the increasing use of electronic payment systems all over the world and the resulting influx of alternative digital currencies such as Bitcoin. However,

there are several reasons why a central bank would not be incentivized to pursue the creation of CBDCs or CBCCs. First, being a regulator, no central bank can actually offer what is considered the primary attraction of digital currencies - anonymity. Digital currencies maintain their popularity so long as they provide anonymity for financial transactions and any action taken by central banks to offer something similar could become a topic of public debate or even lead to litigation. The idea of CBDC creation is far from reality. Another important reason to not pursue this is that any central bank-issued currency, whether physical or digital, is meant for payment purposes and its value should remain stable and on par with the other forms of currencies in the country. If that is the case, then the CBDC would be no different from the already existing currency in bank accounts that exist in digital form. Additionally, although central banks could pitch CBDC as an alternative payment system for retail transactions, the question remains as to what do CBDCs offer that is superior to existing payment systems like Alibaba, Tencent, Facebook, WeChat, and, in Pakistan's case, Finja or Masterpay.

Proponents of CBDC provide a range of possibilities and objectives a central bank can achieve with its issuance, such as a wider spectrum of monetary policy options, direct provision of risk-free assets, general public and consequent safety of financial systems by the reduced systemic importance of commercial banks, and more control over money creation (Dyson & Hodgson, 2016). At the same time, even these proponents are concerned that if a central bank were to issue CBDC and begin to realize these objectives, it could potentially fuel bank runs all over the world (Bech & Garratt, 2017).

6. Conclusion and Policy Recommendations

Fintech growth has been phenomenal worldwide, driven mainly by changing consumer preferences and behaviors, and technological innovations and regulations. Being at the confluence of different technologies, fintechs offer well-personalized and interactive services to consumers by allowing them to conduct transactions over their phone, boosting customer experience. On a broader level, fintechs have the capacity to promote financial inclusion by enabling the provision of new products and services to groups who were previously deprived of access to traditional financial services.

Pakistan, being a developing economy with high banking infrastructure costs acting as a barrier to diffusion of financial services, has

a large percentage of the population which remains underbanked. Poor financial inclusion, along with growing mobile phone and internet penetration, changing consumer needs in favor of digitization and online commerce, biometric verification of mobile SIMs and a supportive regulatory environment serve as opportunities for fintechs to step in and provide financial products at low costs. At present, a few traditional and emergent fintechs operate in Pakistan, primarily in areas of banking and insurance. The regulatory framework for financial services is fairly strong and supportive in Pakistan, with laws such as Payment System Operators (PSOs), Payment Service Providers (PSPs) and Branchless banking regulations by the State Bank of Pakistan acting as platforms for Fintech-led growth.

However, fintechs in Pakistan are also faced with a number of challenges such as regulatory uncertainty, limited investment raised solely from local investors, a dearth of partnership platforms for fintech incumbents and investors, an unwelcoming attitude of incumbent organizations towards partnerships with fintech firms, and threats to data privacy and security.

The SBP has made efforts to promote and outline regulations for the fintech sector as it has a role to play in improving financial inclusion, which is viewed as a key driver of economic growth. However, the proliferation of fintechs is accompanied by threats of cybercrime, money laundering, terror financing, and privacy breach of customer data for which SBP and other regulatory bodies have outlined guidelines, so as to be cautious toward these perceived risks, as public security cannot be compromised.

It is important to understand that aside from being providers of mobile payment systems and other financial services, fintech companies create an ecosystem that fosters the collection of a vast amount of data and builds trusted relationships with clients. Financial institutions and banks in Pakistan have realized the importance of these ecosystems and are attempting to innovate within their companies through partnerships with fintech companies. These partnerships will benefit both parties. Incumbent banks will be able to outsource part of their R&D and bring solutions to market quickly, while fintech firms will have access to the large and existing customer base of banks. This is further emphasized by fintech segments that are starting to transition from purely B2C to B2B. We believe that, going forward, adopting effective growth strategies and integrating with fintechs will be essential for innovation. The government should also

support the growing fintech sector by formulating regional development plans where they would identify regions on the basis of current capabilities and infrastructure as potential hubs and would offer incentives (such as funding) to boost their growth.

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