Essays on International Trade and Firm Performance

By

Muhammad Luqman Khan
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Supervisor

Dr. Karim Khan
Associate Professor
PIDE, Islamabad

Co-Supervisor

Dr. Mirajul Haq
Assistant Professor
IIIE, International Islamic University, Islamabad

Department of Economics and Econometrics

Pakistan Institute of Development Economics (PIDE), Islamabad

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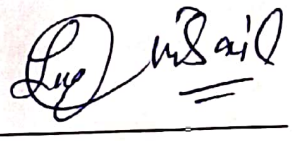
Students/Author Signature: 

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Student Name: Mr. Muhammad Luqman Khan
03/PhD-Eco/PIDE/2014

Signature: _____

Examination Committee:

a) **External Examiner: Dr. Abdul Sattar**
Associate Professor
Bahria University, Islamabad

Signature: _____

b) **Internal Examiner: Dr. Nasir Iqbal**
Associate Professor/Dean FSS
PIDE, Islamabad

Signature: _____

Supervisor: Dr. Karim Khan
Associate Professor
PIDE, Islamabad

Signature: _____

Co-Supervisor: Dr. Miraj ul Haq
Assistant Professor
International Islamic University, Islamabad

Signature: _____

Dr. Shujaat Farooq
Head, Department of Economics & Econometrics
PIDE, Islamabad

Signature: _____

DEDICATION

This work is dedicated to my parents who are the

greatest source of inspiration and encouragement for me throughout my life.

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ABSTRACT

In the light of the vast and still growing body of literature on the firm heterogeneity in international trade theory, this thesis explores the performance of manufacturing firms operating in four largest South Asian countries. The dissertation consists of three essays, although interrelated, but each essay is independent self-contained study

In the first essay, we explore the response of extensive and intensive margins of trade to corruption in selected south Asian countries. Although, both margins of trade are important for explaining the rapid growth and development, the extensive margin of trade plays a major role in export growth and diversification besides circumventing volatility in export earnings. In this context, we develop a theoretical framework which links corruption with extensive and intensive margins of trade and guides our empirical analysis. Based on our theoretical underpinning, we hypothesize that corruption would oppositely affects the intensive and extensive margins of trade. By using cross sectional data of manufacturing firms from four South Asian economies, we find that corruption reduces the probability of new firm to enter into export market and act as 'sand in the wheels' for extensive margin of trade. Conversely, the results also confirm that corruption has positive effects on the volume of export of incumbent firms and promotes the intensive margin of trade. These results suggest that pervasive corruption in selected south Asian countries has been one of the most detrimental factors for export growth and volatility in exports earnings. Moreover, corruption prevents inter-industrial reallocation in favor of most productive firms and averts the additional channel of overall productivity growth predicted by the New-New trade theory

Trade facilitation through improving access to imported inputs is relatively more important for developing countries that were seeking productivity growth in

inward-looking import substitution policies. South Asian economies has exercised inward looking policies from the early 1950s to mid-1980s in order to replace its major imports with indigenous productivity. In this context, second essay intends to examine the impact of imported inputs on the productivity of firms operating in selected South Asian countries. In addition, to come across profoundly, the study also tests complementarity between firms' capabilities and imported inputs in augmenting productivity performance. The empirical analyses carried out at cross sectional data set of manufacturing firms of the four largest South Asian economies. To cope with the nature of data and empirical models, the empirical estimations carried out with stochastic frontier model, ordinary least square, and instrumental variable estimation techniques. At large, findings of the study reveal that imported inputs positively and significantly contributes to firms' productivity of the sample countries. Moreover, we came with the findings that firms 'capabilities play a complementary role in the expansion of firms' production frontier. Findings of the study put forward that sample countries should reduce tariff on imported inputs in order to amplify the firms' productivity growth. Furthermore, findings of the study suggest that the potential gain of imported inputs is conditional to the firms' capabilities, hence, these countries should allocate more resources to the education and encourage firms to invest in trainings, management capabilities and internal R&D effort.

Economic globalization has put pressure on firms for competitiveness in domestic as well as international market. Certainly, innovation and continuous upgradation of product is an important driver for international competitiveness. Third essay uncover the effects of global linkages of firms on innovations decision using the cross-sectional data of manufacturing firms operating in four largest South Asian economies. Moreover, this study also explores the moderating role of institutional quality in interlinked relationship

between global engagement and firm-level innovations. To this end, we construct a composite index of institutional quality by using its three different dimensions the regulatory quality, rule of law and control of corruption. The overall results substantiate the claim that firms' global linkages strongly affect their innovation decisions. The probe further reveals that institutional environment in which firms are embedded positively moderates the effects of global linkages on firms' level innovations. These results are robust across the different estimation techniques. These results suggest that selected South Asian countries can magnify the gain from global linkages of firms by improving their institutional quality.

CHAPTER 1

INTRODUCTION

1.1 Background

The interdependency of global economies that got pace from the last two decades of the 20th century has reshaped the global economic landscape. Consequently, firm competitiveness is considered a driving forced to cope into the international market, resulting in reformation of both trade theories and policies. Unlike, traditional trade theory that mostly deals with inter-industry trade and emphasizes on the country as a basic unit of trade, the new trade theory deals with intra-industry trade and focuses on industries as a basic unit of trade[1]. However, over the past two decades research in international trade has shifted its emphasis from the industries as basic unit of trade to the firms and products. This development is attributed to the empirical facts based on plants and micro data sets about the heterogeneous nature of outcomes and traits of firms operating even in narrowly define industries. An initial wave of empirical research on the subject came with the findings that firms of an industry that are operating in global market is relatively more productive, paying more wages to their workers, and provide a larger share of employment than their counterparts producing for the domestic market (see, for instances, Roberts & Tybout, 1997; Bernard & Jensen,

[1] Traditional trade theory pioneered by Smith (1776), Ricardo (1817), Heckscher (1919), and Ohlin (1933), argues that absolute advantage, comparative advantage and factor endowments provides basis for the mutually beneficial trade while new trade theory argues that economies of scale or increasing return in large scale manufacturing provide strong incentive to specialize and trade even for countries with similar factor endowments. Along with pioneer work of Krugman (1979, 1980) some other work on new trade theory includes Helpman (1981), Ethier(1982), and Lancaster (1980).

Inter-industry trade implies that country specialize and export from one set of industry for example cloth and import from another set of industry for example wine while intra-industry trade implies that country simultaneously import and export in similar industries— export one brand of car while import another brand of car.

1999; Clerides et al., 1998). Moreover, firms involve in internationalization are more capital and skills intensive than firms producing for the domestic market[2]. Despite the fact that firms are heterogeneous even in the narrowly define industry, the traditional and new trade theory assume that all firms operating in an industry are homogeneous and single firm can represent the whole industry. Although, assumption of the representative firm is more suitable for the general equilibrium analysis, yet it is inconsistent with the empirical facts about the heterogeneity of firms operating in an industry. Trade models based on the heterogeneity of firms predict that trade liberalization encourage most productive firms to enter in the international market through export while the least productive firms choose to exit from the market[3], however, firms with moderate productivity continue to produce for the domestic market. This whole process led to the reallocation in output and employment in favor of most productive firms that in turn increases the average productivity of industry and the economy[4]. The link between trade liberalization and aggregate productivity growth through reallocation in favor of most productive firms is well documented in the existing empirical literature. For instance, Pavcnik (2002), Trefler (2004), Bernard et al (2006) find similar patterns of reallocation in favor of most productive firms in Chile, Canada, and the United States respectively. This new theoretical prediction generated

[2] Although, this fact supports the traditional theory based on comparative advantage but surprisingly studies on developing countries also reveals that exporters are more capital and skills intensive despite the abundance of unskilled labor in developing countries (see Alvarez and Lo´pez, 2005)

[3] The reduction in trade cost reduces the threshold level of productivity necessary to enter into the export market which increases the profit of existing firms and encourage others firm to enter into export market. This led to the increase in demand for labor and inflated the factor prices which in turn deteriorate the profit of the firms producing for the domestic market. Hence, trade liberalization put pressure on the firms operating on the lower bond or least productive to leave the industry.

[4] Bernard et al. (2003) also introduced firms' heterogeneity in the Ricardian framework, however Melitz (2003) model has proved to be more successful in explaining real world trade patterns and successfully predicts many issues related to international trade.

additional empirical insights, which in turn led to a further wave of an ongoing dialogue between theory and evidence.

1.2 Motivation

In the light of the vast and still growing body of literature on the firm heterogeneity in international trade theory, this thesis explores the performance of manufacturing firms operating in four largest South Asian countries. The trade models based on heterogeneity of firms has important implication for the developing South Asian economies. South Asian countries are at the crossroads in their history where confluence of positive internal and external factors provides an opportunity to take-off from lower middle-income trap. Major economies of the region such as India, Pakistan, Bangladesh, and Sri Lanka have been spending on physical infrastructure and education for the last twenty-five years. Similarly, labor cost is low as each month more than one million new workers enter into the labor market because of demographic transition in the region (World Bank, 2018). Hence, human capital accumulation, quality of physical infrastructure, and demographic dividend provide strong incentive to the foreign investors for investment and job creation. Moreover, external factors such as rising labor cost in China and others East Asian countries steering foreign investment toward the south Asian countries as untapped cheaper alternative. South Asia is fastest growing region in global landscape with growth rate of 6.3 percent in first quarter of 2017-18, 7.2 in second quarter, and expected to fastest growing region in 2019-20 with projected growth rate of 7.1 percent (World Bank, 2019).

Despite these positive features and untapped potential, export competitiveness remains relatively lower throughout the region, hence growth process mainly driving

through domestic demand.[5] South Asia ranks below from East Asian countries and global standard in attracting foreign investors, penetrating tough markets, diversifying and upgrading their exports. Normally trade policy emphasize on the existing products and markets through traditional market access negotiations while the model with heterogeneous firms suggest that national competitiveness should invoked as a policy objective in these countries. Porter (1990) argues that firms' productivity growth is the most crucial factor for sustaining competitiveness over long run. Additionally, competitiveness also depends on the firm ability to innovate and upgrade its products.

Hence, in the light of large and growing body of literature on role firm in international trade, this dissertation investigates the performance — trade margins, productivity and innovation — of south Asian manufacturing firms engage in international trade. The dissertation consists of three essays, although interrelated, but each essay is independent self-contained study. These studies are based on the data of manufacturing firms of four largest South Asian economies namely Pakistan, India, Bangladesh and Sri Lanka. In selected countries, the manufacturing sector is vibrant and plays an important role in the growth and development as compare to other South Asian economies such as Afghanistan, Bhutan, Nepal, and Maldives. These studies based on the firm engaged in international trade would provide useful insights for designing trade policy for the South Asian economies.

[5] All the countries of region perform poorly on the Global Competitiveness Index and Doing Business report prepared by the world Economic Forum and World Bank respectively. For instance, Global Competitiveness Index ranks India on 58th, Sri Lanka on 85th, Bangladesh on 103th and Pakistan on 107th number in 140 countries (World Economic Forum, 2018). Similarly, World Bank's Doing Business report ranks India on the 100th, Sri Lanka 111th, Pakistan 147th, Bangladesh 177th position.

1.3 Objectives of the study

The dissertation consists of three essays, although interrelated, but each essay is independent self-contained study. The first easy investigate the effect of corruption on the trade margins and realize the first objective of the study. The second easy deal with productive impact of the imported while considering the role of firm capabilities and achieve the second and third objectives. Similarly, the third easy deal with the effect of global linkages of firms while considering the role of regional institutional quality fourth and fifth objectives. Hence, followings are the overall objectives of this dissertation

Hence, followings are the overall objectives of this dissertation

1. To examine trade margins of firms, especially exploring their response to corruption.
2. To investigate that how much imported inputs prove beneficial for productivity performance of firms engaged in international trade.
3. To test the complementarity between firms' capabilities and imported inputs in augmenting productivity performance.
4. To explore that how firm's exposure to global market prove beneficial in terms of introduction of innovation in their production process.
5. To explore that how local institutional structure in which firm is operating respond to the innovation capacity of globally engaged firm.

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CHAPTER 2

CORRUPTION AND MARGINS OF INTERNATIONAL TRADE: EVIDENCE WITH FIRM-LEVEL DATA OF SOUTH ASIAN ECONOMIES

Abstract

The extensive margin of trade plays an important role in export growth and diversification besides circumventing volatility in export earnings. In this study, we explore the response of extensive and intensive margins of trade to corruption in selected south Asian countries. We develop a theoretical framework which links corruption with extensive and intensive margins of trade and guides our empirical analysis. Based on our theoretical underpinning, we hypothesize that corruption would oppositely affects the intensive and extensive margins of trade. By using cross sectional data of manufacturing firms from four South Asian economies, we find that corruption reduces the probability of new firm to enter into export market and act as 'sand in the wheels' for extensive margin of trade. Conversely, the results also confirm that corruption has positive effects on the volume of export of incumbent firms and promotes the intensive margin of trade.

These results suggest that pervasive corruption in selected south Asian countries has been one of the most detrimental factors for export growth and volatility in exports earnings. Moreover, corruption prevents inter-industrial reallocation in favor of most productive firms and averts the additional channel of overall productivity growth predicted by the New-New trade theory

2.1 Introduction

In recent decades, the research in international trade has shift its emphasis from industries to firm as a unit of analysis. This phenomenal change rotates research towards productivity differential across firms and consequently its ramifications for their decision to export (Aw et al., 2000; Bernard & Jensin, 1999; Clirides et al., 1998). The firm level studies document that exporting firms are on average more skills intensive, paying more wages to their workers, and provide a larger share of employment than their counterparts producing for the domestic market. Based on firms' heterogeneity, New-New trade theory (Melitz, 2003) predicts that international trade and economic globalization encouraged more productive firm to enter into the export market while it simultaneously exerts pressure on least productive firms to leave the industry. This reallocation process across the industry resulted in aggregate productivity growth and overall welfare gain for whole country. Paradoxical to the predictions of New-New trade theory, South Asian countries still face small, inefficient and slow growing firms that capture major share of the market. Although these countries have been implementing the trade liberalization policies for last three decades, yet inter-industrial reallocation in favor of most productive firms is not observable (World Bank, 2018). Moreover, in these countries export competitiveness remains low and domestic demand drive overall growth process. Resource misallocation in India, one of the largest South Asian economy is so high that efficient allocation of resources would increase the productivity up to level of 40 to 60 percent (Hsieh and Klenow, 2009). This implies that South Asian countries can experience substantial productivity growth in allocation of resources to the more efficient firms. Consequently, a question should be tapped 'Why trade liberalization regime in South Asian economies does not potentially worked for the inter-industrial reallocation in

favor of most productive firms as predicted by New-New trade theory'. The question should be answered in the implicit but crucial assumption of Melitz (2003) model of trade 'optimal functioning of the state apparatus across trading countries.' But, functioning of state apparatus and institutional environment in which firms are embedded vary across countries. Malfunctioning of state apparatus including bureaucratic delay and customs-related red tape is attributed to pervasive corruption which affects firms' behavior (Sequeira & Djankov, 2014). The fundamental question address in this paper is to how trade margins response to corruption in selected south Asian countries.

The complex interconnection between corruption and economic performance is central to the execution of public policies in developing countries. Hence, the link between corruption and economic performance is well documented in the existing literature (Leff, 1964; Lui, 1985; Sheifer & Vishny, 1993: Mauro, 1995 Globerman & Shapiro, 2003). However, there has been long- standing controversy on the obvious consequences of corruption. For instance, earlier studies on the subject justified their claims in the 'greasing the wheels' premise, and argue that corruption strengthen the development process in developing countries (Leff, 1964; Leys, 1965). Supporting, the 'grease the wheels' hypothesis studies carried out in mid 1980s (Beck & Maher, 1986; Lui, 1985) postulates that corruption circumvents the inefficiency on the part of state apparatus by providing incentives for efficient use of time and speedy services of government[6]. In contrast, some studies argue that corruption 'sand the wheels' of trade and commerce by raising the transaction cost, creating inefficiency, uncertainty and market distortions which in turn retard overall economic performance (Sheifer &

[6] Many studies find empirical support for the 'greasing the wheels' hypothesis (See for instance, Klapper et al., 2006; Dreher & Gassebner, 2013; Meon & weill, 2010; kato & Sato, 2015)

Vishny, 1993: Mauro, 1995; Campose et al., 1999; Myint, 2000; Mo, 2001; Globerman & Shapiro, 2003; Li et al., 2000; Meon & Sekkat, 2005; Hodge et al, 2011)[7].

More recently, the availability of firm level data encourage researchers to explore the knot between corruption and firms' export performance. However, empirical results remain inconclusive for corruption-trade nexus at the micro level[8]. For example, Lee & Weng (2013) find that corruption in home country impedes firms' export performance measured as the intensive margin of exports. However, Sharma & Mitra (2015) document the evidence that corruption amplifies the intensive margin of exports. These studies are based on simple empirical analysis without any theoretical framework. Based on the theoretical underpinning of trade model with firm heterogeneity, Olney (2016) investigate the effect of corruption in the home country on firm level export performance. Overall results reveal that corruption increases the role of intermediaries in international trade where firm prefers to export indirectly through intermediaries. Ahsan (2017) investigate the effect of corruption in home country on firm level export performance using micro data of 25 European and Central Asian countries. The results of the study reveal that overall effect of corruption prevalence is negative for the extensive margin of trade. Though, received literature on the subject try to uncover the corruption-exports nexus, yet it is highly insufficient and does not

[7] These findings are also consistent with micro studies on firms which are also inconclusive. Many studies find evidence for 'greasing the wheels' hypothesis using firm-level data (Wang & You, 2012; Dreher & Gassebner, 2013; Goedhuys et al., 2016; Williams et al., 2016). However, few micro level studies also support the claim that corruption increases uncertainty, create market distortion and facilitate entry and survival of inefficient firms, discourage innovative activities and act as sand in wheels of trade and commerce (Batra et al., 2003; Fisman & Svenssson, 2007; Asiedu & Freeman, 2009; De Waldemar, 2012; Zhou & Peng, 2012; Beekman et al., 2013)

[8] In similar vein, empirical evidence on corruption-trade nexus on macro level is mixed and adds to the confusion. For instance, Anderson and Marcouiller (2002) argue that corruption shrink volume of aggregate trade by increasing transaction cost, creating inefficiencies and weak contract enforcement. Many studies document the evidence for the 'sanding the wheels' hypothesis in international trade arena (for example see, Anderson & Marcouiller,2002; Musila & Sigue,2010; De Jong & Bogmans, 2011; Thede & Gustafson, 2012; Ali & Mdhillat, 2015; Liu, et al., 2015), while others support 'greasing the wheels' hypothesis (Lambsdorff,1998).

simultaneously explore the effects of corruption on intensive and extensive margins of trade.

This study is motivated by the fact that in all South Asian economies' exports are concentrated in a few products causing instability in exports earning and persistent deficit in balance of payments. For instance, nearly 80 percent export growth of the region during 2001-2013 came from the intensive margin: sale of the same set of goods to the same destinations. The remaining 20 percent came from the extensive margin, but almost entirely by selling the same set of goods to new markets (World Bank, 2017). Similarly, slow export growth give rise to huge trade deficit and balance of payment crises which limit overall economic growth process.[9] Existing literature document that extensive margin of trade play major role in export growth process (Hummels & Klenow, 2005). Hence, we argue that poor performance on exports front attributes to the pervasive corruption in South Asian developing countries which increases the market entry fixed cost and put limit on the extensive margins of international trade. Moreover, the extensive margin of trade is also more sensitive to the iceberg trade cost than the intensive margin of trade (Chaney, 2008). Based on trade models with firm heterogeneity (Melitz, 2003; Chaney, 2008), we hypothesize that corruption would have opposing effects on the intensive and extensive margins of trade. It always facilitates the status quo and act as 'grease in the wheels' for intensive margin of trade by expediting the process for the incumbent firms to increase their volume of exports. Conversely, it discourages the entry of firms in exports markets by simultaneously reducing the profitability of firms and increasing the market entry fixed cost. Moreover,

[9] This reflects in World Bank (2019) which proclaim it as "exports grew at rate of 4.6 percent in 2017 and 9.7 percent 2018 while import grew at rate of 14.9 percent in 2017 and 15.6 percent in 2018".

its place limit on the growth of extensive margins of trade and impede the export diversification process.

Hence, the key objective of this study is to test these alternative hypotheses 'grease the wheels' and 'sand the wheels' for the intensive and extensive margins of trade. As early mentioned, that corruption can place its inputs in either direction. We use data of manufacturing firms operating in four largest South Asian economies to test the hypotheses of study.[10]

The rest of study is organized as follow. Section 2 discusses the insights form existing literature on subject. Section 3 presents some stylized facts on trade related performance measures and corruption. Section 4 provides theoretical framework for the study. Section 5 discusses econometric framework. Section 6 presents the empirical findings and discussions while section 7 concludes.

2.2 Relevant Literature

Many studies investigated the effect of corruption on aggregate volume of international trade. For instance, Anderson and Marcouiller (2002) argue that corruption shrink volume of aggregate trade by increasing transaction cost, creating inefficiencies and weak contract enforcement. Using the aggregate trade data for cross section of fifty-eight countries study document statistically significant negative relationship between the level of corruption across trading countries and aggregate trade volume. In similar vein, many studies document the evidence for the 'sanding the wheels' hypothesis in international trade arena where corruption dampen aggregate trade volume (for example see, Anderson & Marcouiller, 2002; Musila & Sigue, 2010; De Jong & Bogmans, 2011; Thede & Gustafson, 2012; Ali & Mdhillat, 2015; Liu, et

[10] We have selected four South Asian countries namely India, Pakistan, Bangladesh, and Sri Lanka where manufacturing sector is relatively vibrant as compare to others South Asian countries.

al., 2015), while few studies also support 'greasing the wheels' hypothesis where corruption facilitates the international trade among trading partners (Lambsdorff, 1998).

Another strand of literature on corruption and firms' performance argues that corruption circumvents government inefficiency, delays and red tape that deteriorate firms' competitiveness. Many studies find evidence for 'greasing the wheels' hypothesis using firm-level data on different outcomes of firm performance. For instances, government corruption is positively associated with firms entry in highly regulated market (Dreher & Gassebner, 2013), firm productivity (Wang & You, 2012; Mendoza et al., 2015; Williams et al., 2016), and firm level innovation (Goedhuys et al., 2016; Nguyen et al., 2016). However, few micro level studies also support the claim that corruption increases uncertainty, create market distortion, facilitate entry and survival of inefficient firms, discourage innovative activities, and act as sand in wheels of trade and commerce (Batra et al., 2003; Smarzynska & Wei, 2002; Fisman & Svenssson, 2007; Asiedu & Freeman, 2009; Waldemar, 2012; Zhou & Peng, 2012).

Many firm level studies investigate the effect of corruption on firm export performance. For example, Lee & Weng (2013) examine the impact of corruption on extensive margins of trade using firm level cross sectional data of a sample of twenty-three counties and find that corruption in the home country is negative related with an intensive margin of trade. Similarly, Olney (2016) investigate the effect of corruption in home country on firm export performance. Study use cross sectional data of firms operating in eighty developing countries for empirical analyses. Overall results reveal that corruption increases the role of intermediaries in international trade where firm prefer to export indirectly through intermediaries. Ahsan (2017) investigate the effect of corruption in the home country on the firm level export performance using firm level

data of 25 European and Central Asian countries. The results of the study reveal that corruption in the home country acts as sand in the wheels of trade and commerce by decreasing the export performance of firms.

In contrast, some studies support the claim that corruption acts as grease in the wheels and promote the export performance of firms. For example, Sharma & Mitra (2015) investigate the impact of home country government corruption on the performance of the firm using cross sectional plant level data of India. The results of the study corroborate the 'grease the wheels' hypothesis which implies that corruption is positively associated with the export performance measured in term of intensive margin. This controversy in existing literature motivated us to investigate the effect of corruption on both extensive and intensive margin of trade in South Asian economies. This study is also relevant with the Chaney (2008) that analyze the effect of trade cost on the intensive and extensive margins of trade with theoretical underpinnings of trade model based on firms' heterogeneity. Model predicts that extensive margins of trade are more sensitive with trade cost as compared to the intensive margin of trade. This study is also relevant to the literature that document major role of extensive margin in exports growth process and diversification of exports. In the seminal work, Hummels and Klenow (2005) find that extensive margin of trade explains exports growth in large exporting economies. Evenett and Venables (2002) document similar findings for the major role of extensive margin in developing countries.

2.3 Some Stylized Facts of South Asian Countries about Trade related Performance Measures and Corruption

Currently, South Asia is one of the fastest growing regions in the global landscape with the growth rate of 6.3 percent in first quarter of 2017-18, 7.2 in second quarter, and expected to declare the fastest growing region in the fiscal year 2019-20

with projected growth rate of 7.1 percent (World Bank, 2019). Despite impressive growth prospects, export competitiveness remains low in all over the region and domestic demand remains the main driver force in the process of economic growth. All the countries of region perform poorly on the Global Competitiveness Index and Doing Business report prepared by the World Economic Forum and World Bank respectively. For instance, Global Competitiveness Index ranks India on 58th, Sri Lanka on 85th, Bangladesh on 103th and Pakistan on 107th number in 140 countries (World Economic Forum, 2018). Following table 1 presents economic growth trade performance, and corruption profile of selected South and East Asian economies in the year 2017 in order to make comparison of the two nearby regions.

Table 1: Some stylized facts of trade related performance measures and corruption in 2017

	South Asia				Southeast Asia		
	Bangladesh	India	Pakistan	Sri Lanka	Malaysia	Indonesia	South Korea
GDP Growth	7.28	6.68	5.70	3.31	5.90	5.07	3.06
Exports % of GDP	15.04	19.05	8.24	21.89	71.39	20.37	43.09
Import % of GDP	20.27	22.03	17.55	29.08	64.45	19.17	37.69
Import growth	2.88	12.38	21.02	19.33	10.89	8.06	7.03
Trade Balance (% of GDP)	-5.23	-3.20	-9.32	-7.19	6.94	1.21	5.40
Manufacturing Exports	92	70.6	77.2	67.9	67.9	43.63	90.06
Export Complexity	-1.71	0.36	-0.86	-0.90	0.97	-0.31	1.77
Corruption	28	40	33	38	47	37	54

Sources: World Bank (2018), and Transparency International (2018). Note: 0=highly corrupt while 100= very clean country

Above table show that growth rates in South Asian countries are on average higher than their Southeast Asian counterparts. However, instead of exports this growth is mainly derived by domestic demand. Table 1 depict that exports are 15.04 % of GDP in Bangladesh, 19.05% of GDP in India, 8.24 % of GDP in Pakistan, and 21.89% of

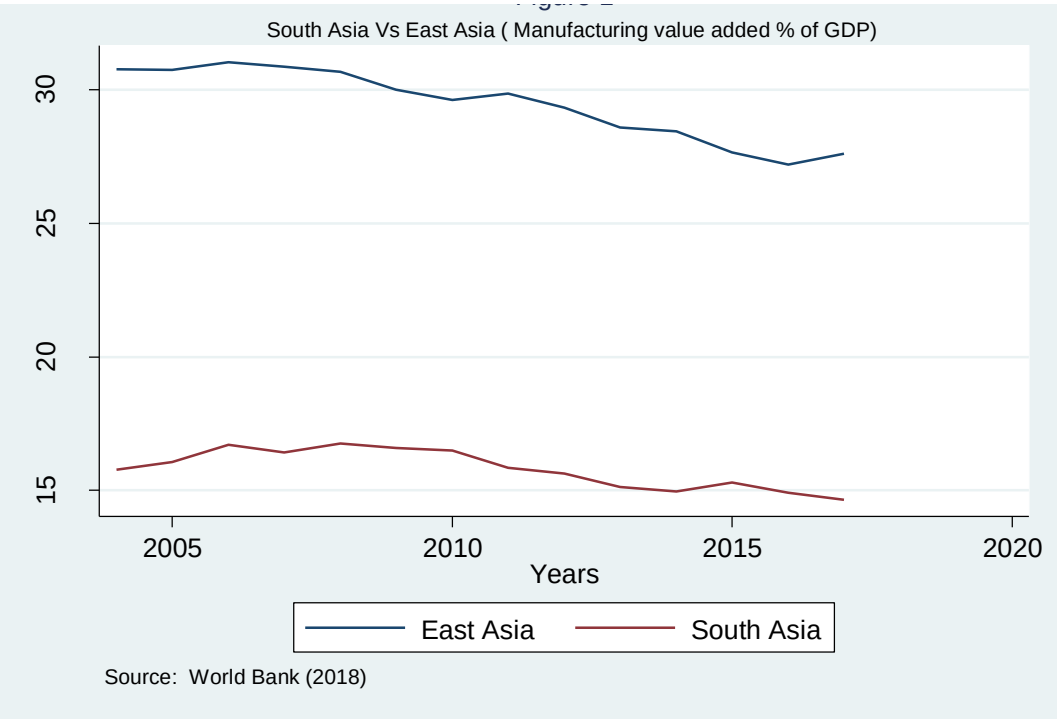
GDP in Sri Lanka while in Southeast Asian countries exports are 71.39 % of GDP in Malaysia, 20.37 % in Indonesia and 43.09 % in South Korea. Aggregate economic activity primarily derived by the domestic demand has amplified the demand and growth of imports in South Asian countries. The imports of goods and services grow at the rate of 12.88 % in South Asia as results these countries are facing huge trade deficit. Trade deficit is 5.23 % of GDP in Bangladesh, 3.20 % in India, 9.32 % in Pakistan, and 7.19 % in Sri Lanka while their Southeast Asian counterpart successful overcome the issue of trade deficit because of the primary role of export in long run growth process in these countries. All South Asian countries are parallel with their Southeast Asian counterpart in exports of manufacturing product. However, knowledge intensity of exports product measure by the export complexity index is negative across the south Asian economies except the India where export complexity index is positive with 0.36 value. But India is also for behind from the South Korea with the score of 1.77 and Malaysia with score of 0.97 on complexity index.

Statistics presented in the Table 1 show that corruption prevalence in South Asian countries are on average higher than their Southeast Asian counterparts. Bangladesh is highly corrupt country in south Asia while India is least corrupt in selected south Asian economies. However, if we compare the corruption prevalence, it is depicted from the table that East Asian economies have shown better performance compare to South Asian counterparts. For instance, data presented in the table depict that in case of South Asian India hold the lowest level of corruption prevalence, whereas in case of East Asia, Indonesia hold the lowest that is almost equal to India

Increases in economic globalization has expanded opportunities for the labor surplus developing south and emerged a global shift of manufacturing industry from the developed north to developing south. Many developing countries reap the benefit

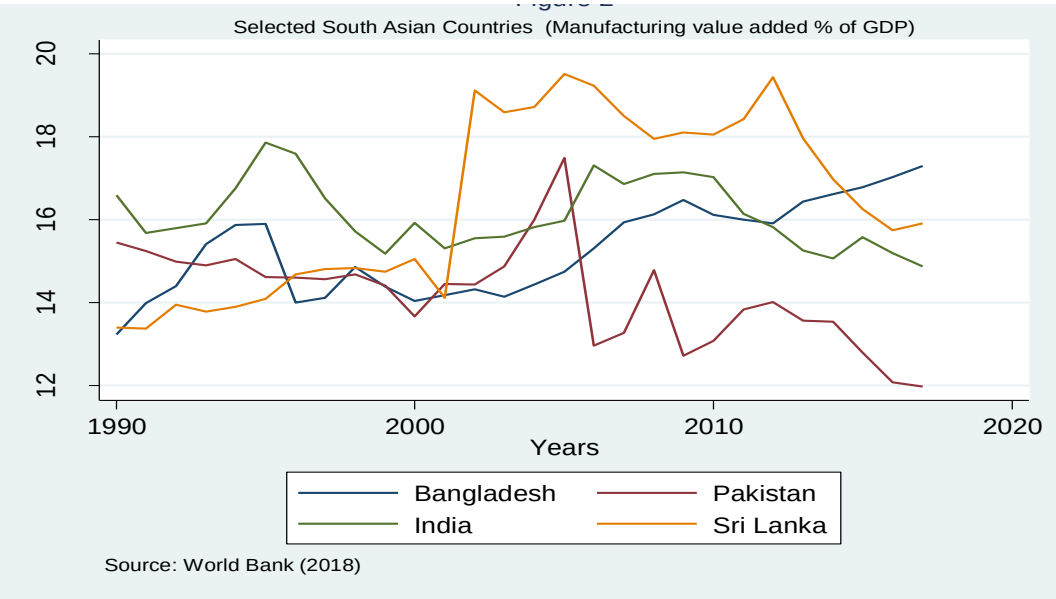
of economic globalization and successfully transform their economies form the low value-added agriculture sector to the vibrant manufacturing sector. These economies, for instance, some of East Asian countries create conducive business environment and attract foreign investment in manufacturing industry. This process magnified the growth of manufacturing industry which absorb the surplus labor. Figure 1 depict that manufacturing value added as % of GDP in south Asian region is lower than East Asian region.

Figure 1: South Asia Vs East Asia (Manufacturing value added % of GDP)



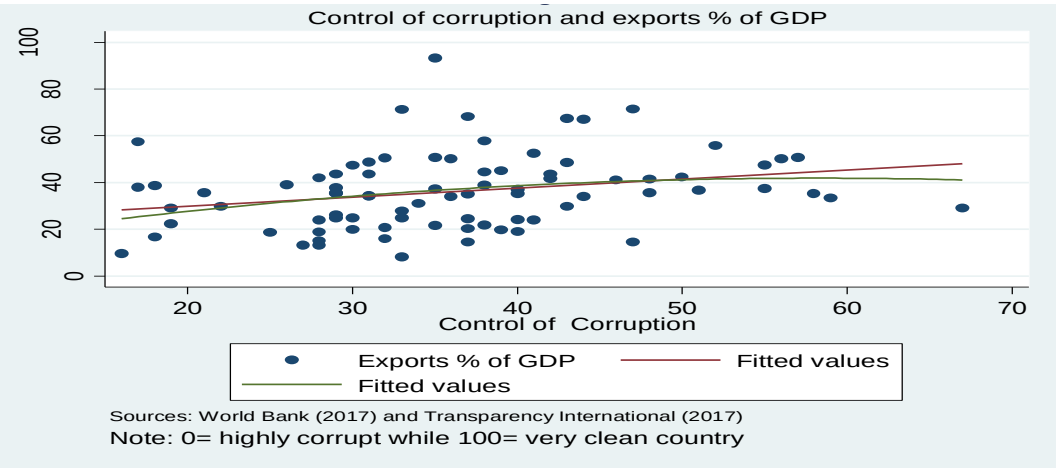
We also compare the performance of manufacturing sector across the selected South Asian countries. Figure 2 show that manufacturing value added in selected South Asian countries have started increasing in 1990 when most of the countries started trade liberalization measures. However, manufacturing sector have witnessed significant upsurge after 2000 and maintain it pace in some countries overtime. But, Pakistan have experienced sharp decline in share of manufacturing value added in GDP from 17.5 % of GDP in 2005 to 11.9 % in 2017.

Figure 2: Selected South Asian Countries (Manufacturing value added % of GDP)



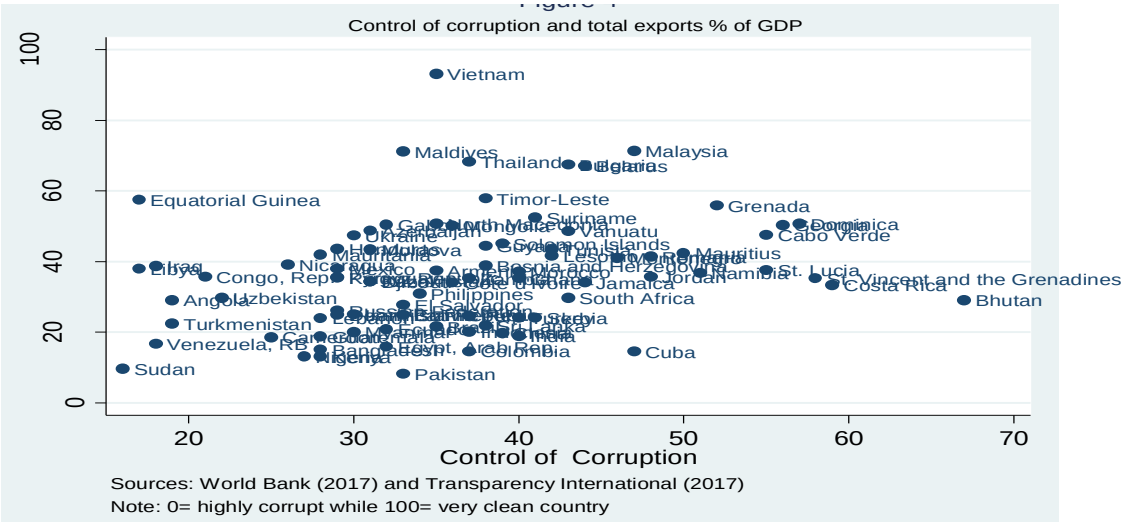
Normally, optimal functioning of state apparatus increases the efficiency of firms which in turn increases their export competitiveness in international market. Hence, control of corruption increases the ease of doing business and expected to positively associate with the exports performance of a country. This fact is depicted in figure 3 where scatter plot of control of corruption and exports performance of country (measure in term of export as % of GDP) in eighty four upper middle income and lower middle income countries show that on average control of corruption promote export performance of a country. The figure 3 also reflect nonlinear relationship between control of corruption and export performance in selected countries. In initial phase, control of corruption promotes export performance in selected developing countries but after attaining a threshold level of control of corruption it negatively associated with export performance.

Figure 3: Control of corruption and export % of GDP



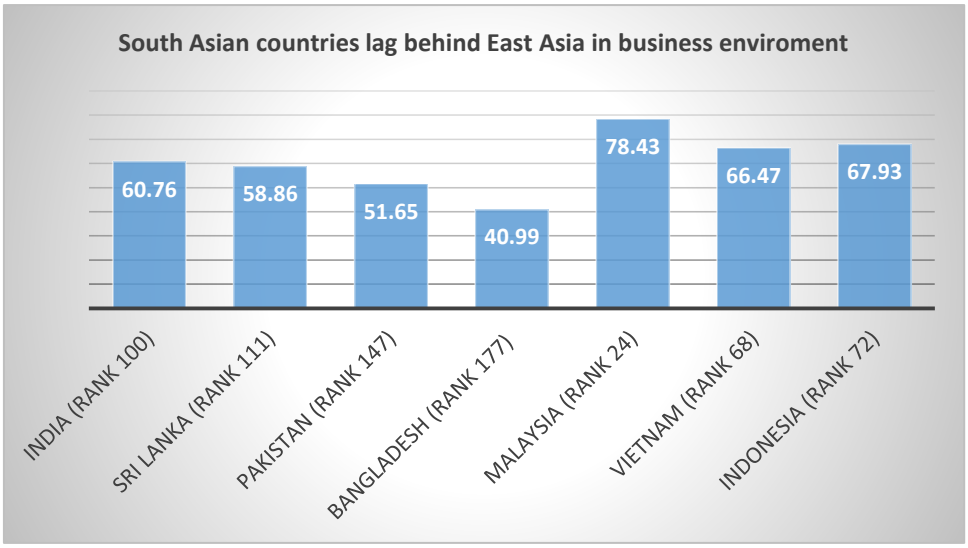
However, figure 4 identifies some outliers in the data of seceded developing countries. For instance, Vietnam, Maldives, and Thailand perform well on exports front despite moderate control on corruption. Quite oppositely, Pakistan perform poorly on exports front despite moderate control on corruption. Similarly, Figure 4 also show that Bhutan's export performance is not matching with its control of corruption. If we exclude these outliers from the data on average control of corruption is positively associated with exports performance in the selected developing countries.

Figure 4: Control of corruption and total exports % of GDP



There are set of complex factors which discourage entry of firms in export market and resultantly poor performance of country on the export front. However, key determinant of export performance of a firm is business environment or ease of doing business in a country. Figure 5 show that World Bank's Doing Business Report (2018) ranks India on the 100th position in 190 countries with distance to frontier score 60.76. Similarly, Sri Lanka is on 111th position with score of 58.86, Pakistan on 147th with score of 51.65, and Bangladesh is 177th position with score of 40.99. In contrast, East Asian countries such as Malaysia, Vietnam, and Indonesia perform well on the business environment ranking. For instance, Malaysia is on the 24th position with score of 78.43, Vietnam is on the 68th position with score of 66.47 and Indonesia is on 72th position with score of 67.93

Figure 5: South Asian countries lag behind East Asia in business environment



Source: World Bank Doing Business Report (2018)
Note: An economy's distance to frontier score is range from 0 to 100 where 0 represent worst business environment.

World Bank enterprise level surveys further highlight the pervasiveness of challenges for the firms embedded in the South Asian business environment. Table 2 depicts the different investment climate constraints in selected south Asian countries

emerges from the recent round of World Bank enterprise level surveys. Overall these constraint are more binding for firms embedded in south Asian business environment than operating in the East Asian countries such as Malaysia, Indonesia and Vietnam.

Table 2: Comparison of South Asian firms with East Asia (% of firms view an obstacle as major constraint)

	Bangladesh (2013)	India (2014)	Pakistan (2013)	Sri Lanka (2011)	Malaysia (2015)	Indonesia (2015)	Vietnam (2015)
Access to finance	23	15	13	33	12	17	14
Taxes Administration	11	12	34	41	21	8	8
Corruption	50	36	64	15	12	14	5
Trade & custom	6	8	21	31	19	12	24

Source: Author's calculations based on World Bank enterprise level data

Table 2 shows that majority of South Asian firms consider corruption as major constrain than firms operating in selected East Asian countries. For instance, 50 percent of firms in Bangladesh, 36 percent in India, 64 percent in Pakistan, and 15 percent firms in Sri Lanka consider corruption as major constraint. However, only 5 percent firms in Vietnam, 12 percent in Malaysia, and 14 percent in Indonesia reports corruption as major constraint.

In south Asia, productivity growth of firm is low and resources are trapped in small firms with lower efficiency and productivity. Hsieh and Klenow (2009) compare resources misallocation in India and china with United States, and find that efficient allocation of resources would increase the productivity up to level of 40 to 60 percent in India. This implies that there is substantial scope of increasing productivity in south Asian countries by allocating resources to the more efficient firms. Table 3 shows the size distribution of firms by number of employees in selected South Asian countries.

Table 3: Size distribution of firms in South Asian countries by number of employees:

Country	Small (5-19)	Medium (20-99)	Large (100 or more)
Bangladesh	37	36	27
India	32	45	23
Pakistan	46	31	22
Sri Lanka	52	30	18

Source: Calculations based on World Bank enterprise level surveys

Above table indicates importance of small and medium firms in south Asian countries and reflect that small and medium firms capture the major share of goods produce for domestic and international markets. However, large firms are more productive than small firms on the grounds of economies of scale, better access to finance, and process innovation. The size distribution of firms in selected South Asian countries reflect that trade liberalization regime does not work for the inter-industrial reallocation in favor of most productive firms.

2.4 Theoretical Framework

This section of the study presents the theoretical framework to assess the impact of corruption on trade margins. We start with Dixit and Stiglitz (1977), a pioneered work assume internal economies of scale with fix set-up costs and developed mathematical technique for modeling the monopolistic competition which provides comprehensive solution for variety of market outcomes. Using the Dixit-Stiglitz framework, Krugman (1980) develop a formal model of international trade with internal economies of scale and monopolistic competitive market structure. Model explains the real-world trade patterns such as intra-industry trade, and trade between

the nation with similar factor endowments and production technologies[11]. This model predicts that comparative advantage is not the only source of specialization instead economies of scale or increasing return provide a strong incentive to specialize and trade even for countries with similar factor endowments[12]. Krugman (1980) assumes that all firms operating in an industry are homogeneous and the single firm can represent the whole industry. Although, assumption of representative firm is more suitable for the general equilibrium analysis, yet it is inconsistent with the empirical facts about the heterogeneity of firms operating in an industry. This inconsistency led to the development of trade models that incorporate the role of firm heterogeneity in explaining international trade and aggregate productivity growth. In this context, the most influential and tractable work is that of Melitz (2003), which incorporate the firm heterogeneity along with an increasing return and monopolistic competitive market structure in model of international trade that effectively explains real world trade pattern and aggregate productivity growth. This model predicts that trade liberalization encourages most productive firms to enter in international market through export while the least productive firms choose to exit from the market[13]. However, firms with moderate productivity continue to produce for the domestic market. This whole process led to the reallocation in output and employment in favor of most productive firms and increases the average productivity of industry and economy. This model has proven

[11] Krugman (1980) argues that internal economies of scale, product differentiation, and home market effects explain real world trade patterns such as intra-industry trade, and trade among developed north. Assuming transport cost for different differentiated products, study formally proved that countries will specialize and tend to export those products for which exporting countries have relatively large domestic markets.

[12] Along with pioneer work of Krugman (1979,1980) some other work on new trade theory includes Helpman (1981), Ethier(1982), and Lancaster (1980)

[13] The reduction in trade cost reduces the threshold level of productivity necessary to enter into the export market which increases the profit of existing firms and encourage others firm to enter into export market. This led to the increase in demand for labor and inflated the factor prices which in turn deteriorate the profit of the firms producing for the domestic market. Hence, trade liberalization put pressure on the firms operating on the lower bond or least productive to leave the industry.

overwhelmingly successful because of generating a large number of the extensions. This study extends the Melitz (2003) to assess the impact of corruption on margins of trade. This basic model makes a number of simplifying assumptions in order to focus more carefully on the key relationships of interest—corruption and exports margins. While the model is not the main contribution of this article, it is appealing because it is clear and tractable, it generates useful and testable predictions, and it helps motivate the empirical analysis that follows.

2.5 Model Set-up

Assume a compact set S of countries, where within the set i is an origin country and j is a destination country. Each country $i \in S$ is being populated by an exogenous measure L_i of workers/consumers where each worker supplies her unit of labor inelastically. Suppose that labor is the only factor of production.

2.5.1 Demand

As in the Krugman (1980) model, we assume that consumers have CES preferences over product varieties. Hence a representative consumer in country $j \in S$ gets utility U_j from the consumption of goods shipped by all other firms in all other countries, where

$$U_J = \left[\int q_j(\omega)^{\rho} d\omega\right]^{1/\rho} \quad 0 < \rho < 1$$

Where $q_j(\omega)$ is the quantity consumed in country j of variety ω. A consumer in country $j \in S$ has optimal quantity demanded of good $\omega \in \Omega$ is:

$$q_{ij}(\omega) = A_j p_j(\omega)^{-\sigma} \quad \sigma = \frac{1}{1-\rho} > 1 \qquad 1$$

Where A_j is an index of market demand which is exogenous for the individual firm, hence A_j is given for individual firm. A_j depends on the aggregate income of country j while p_j is dual price index

$$P_j = \left[\int p_j(\omega)^{1-\sigma} d\omega\right]^{\frac{1}{1-\sigma}} \quad \sigma = \frac{1}{1-\rho} > 1 \qquad 2$$

2.5.2 Supply

As in the Krugman (1980) model, suppose that there is a continuum Ω of possible varieties that the world can produce, and suppose that every firm in the world produces a distinct variety $\omega \in \Omega$. Let the set of varieties produced by firms located in country $i \in S$ be denoted by $\Omega_i \in \Omega$. Suppose that there is a mass M_i of firms from country $i \in S$ and that firms must incur a fixed cost f to export to each destination $j \in S$. To model the firms' heterogeneity, we assume that each firm in the country $i \in S$ has a productivity φ drawn from some cumulative distribution function. We also assume the iceberg trade cost τ_{ij}

2.5.3 Production Technology

We assume that labor is only factor of production and production technology appear as

$$l = f + \frac{q(\varphi)}{\varphi} \qquad 3$$

Where l is the labor used in producing the variety ω while f is the fixed production cost and constant marginal cost which depends on the productivity of firm φ and inversely related to the firm productivity. Now firm profit function can be written as

$$max_{q(\varphi)}\{p(\varphi)q(\varphi) - wl\}\, s.t.\, q_{ij}(\omega) = A_j p_j(\omega)^{-\sigma}$$

By substituting the value of l

$$max_{q(\varphi)}\{p(\varphi)q(\varphi) - w(f + q(\varphi)/\varphi\}\, s.t.\, q_{ij}(\omega) = A_j p_j(\omega)^{-\sigma}$$

$$max_{q(\varphi)}\left\{p(\varphi)q(\varphi) - \frac{w\tau_{ij}A_j p_j(\omega)^{-\sigma}}{\varphi} - f_{ij}\right\}=0$$

The first order condition implies that a firm from $i \in S$ with productivity φ condition to selling to destination $j \in S$ will charge price

$$p(\varphi) = \frac{\sigma}{\sigma - 1}(\frac{w_i}{\varphi})$$

We normalized wage rate to one

$$p(\varphi) = \left(\frac{1}{\rho\varphi}\right) \qquad 4$$

This shows that due to the assumption of the monopolistic competitive market structure and CES preferences the productivity premium is passed on fully to the consumers in the form of lower prices. Moreover, due to elastic demand the revenue of the productive firm is higher. Now the revenue of the firm can be calculated as

$$r_{ij}(\varphi) = p_{ij}(\varphi)q_{ij}(\varphi) = \left(\frac{1}{\rho\varphi}\right)\left(A_j p_j(\omega)^{-\sigma}\ \right)$$

$$r_{ij}(\varphi) = \left(\frac{1}{\rho\varphi}\right)^{1/1-\sigma}\left(A_j p_j(\omega)^{-\sigma}\ \right)$$

$$r_{ij}(\varphi) = (\rho\varphi)^{1-\sigma}\left(A_j p_j(\omega)^{-\sigma}\ \right) \qquad 5$$

Similarly, the profit of the firm can be calculated as

$$\pi(\varphi) = r_{ij}(\varphi) - l(\varphi)$$

By substituting the values from equation (3) and (5) we will get following equation for the profit of the firm

$$\pi(\varphi) = \frac{r_{ij}(\varphi)}{\sigma} - f_{ij} \qquad 6$$

2.5.4 Selection into exporting

The presence of upfront fixed cost which is sunk in nature implies a zero profit cut off productivity below which firm exit from the export markets.

$$\pi\left(\overset{*}{\varphi}\right) = 0 \quad which\ implies\ that\ \ \pi\left(\overset{*}{\varphi}\right) = \sigma f$$

Hence a firm from country $i \in S$ with productivity φ conditional on producing will export to country $j \in S$ if and only if:

$$\pi_{ij}(\varphi) \geq \sigma f_{ij} \qquad 7$$

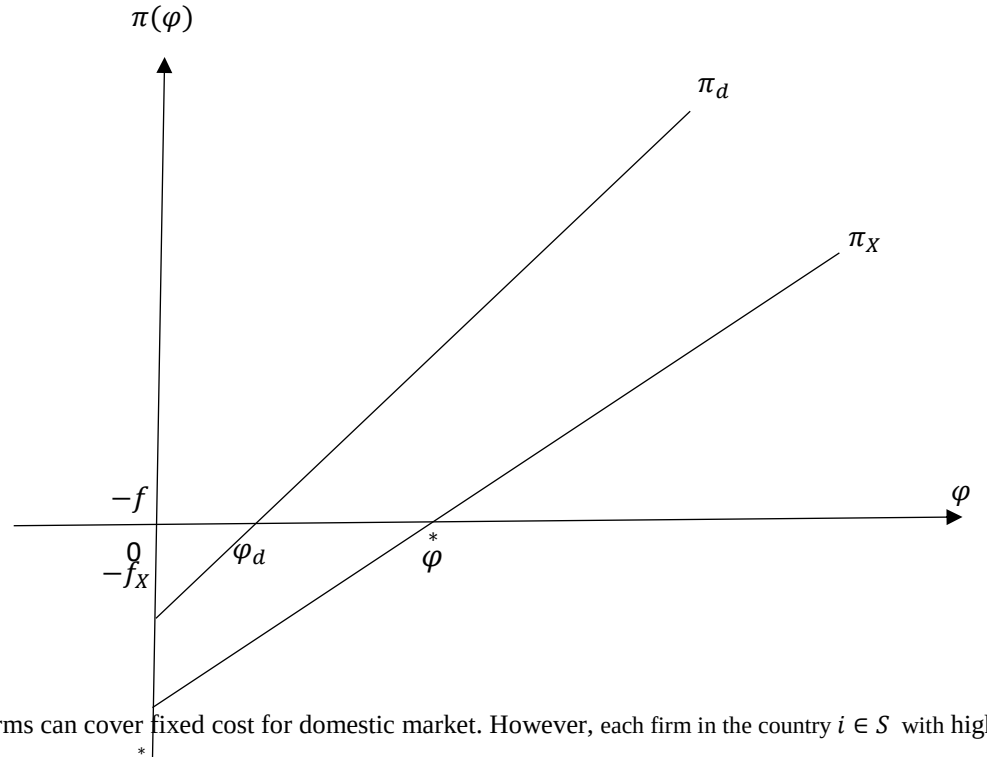
This can also express in terms of cut off productivity $\overset{*}{\varphi}$ of a firm

$$\varphi_{ij} \geq \overset{*}{\varphi}$$

If a firm operating in country $i \in S$ has productivity φ_{ij} greater than threshold level of productivity $\overset{*}{\varphi}$ will export to country $j \in S$.

The relationship between productivity and firms' entry into export market is depicted in figure 4.1. Figure shows that each firm in the country $i \in S$ with productivity lower than φ_d ($\varphi \leq \varphi_d$) would exit from market due to fact that these firm cannot cover their fixed cost. All firms with intermediate productivity $\varphi \in [\varphi_d, \overset{*}{\varphi})$ continue to produce only for the domestic market because

Figure 6: Firms' entry in export market in Melitz (2003) framework



these firms can cover fixed cost for domestic market. However, each firm in the country $i \in S$ with higher productivity ($\varphi_{ij} \geq \overset{*}{\varphi}$) can export to each destination $j \in S$.

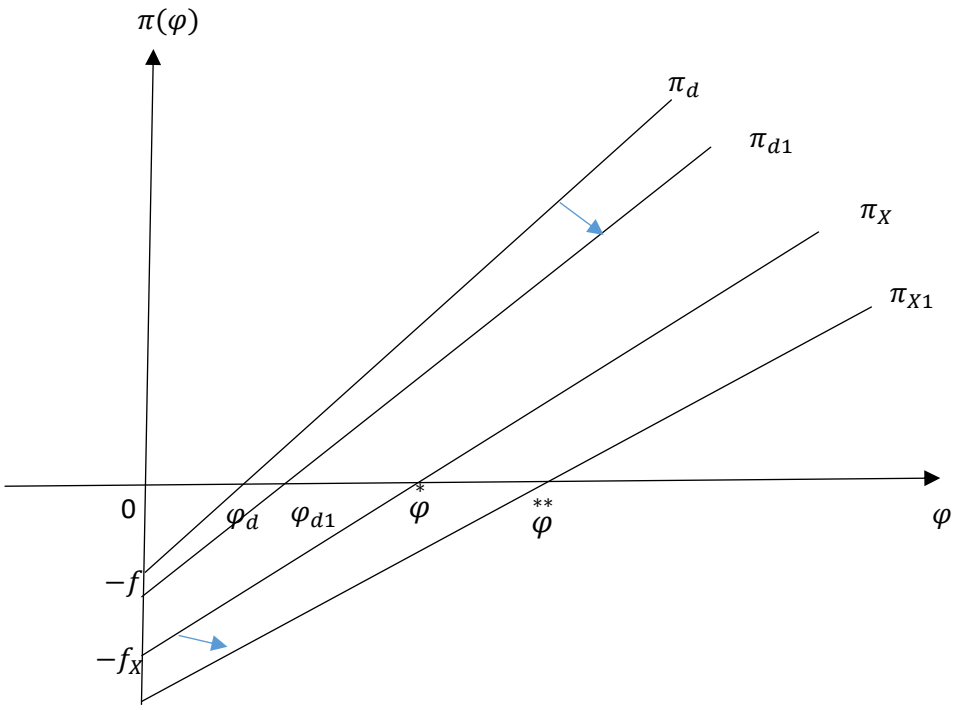
2.5.5 Corruption

The relationship between corruption and firm entry into exports market is depicted graphically in figure 6. The red tape, bribes and other form of corruption prevailing in developing countries increases variable cost (iceberg trade cost τ_{ij}) as well as market entry fixed cost which increases the threshold productivity level for firms' entry into export market from $\overset{*}{\varphi}$ to $\overset{**}{\varphi}$ (mathematical proof is available in Appendix C).

Hence a firm from country $i \in S$ with productivity φ conditional on producing will export to country $j \in S$ if and only if:

$$\varphi_{ij} \geq \overset{**}{\varphi} \qquad (8)$$

Figure 7: Corruption and firm entry into exports market



The iceberg trade cost (τ_{ij}) decreases profitability of firm (φ_{ij}) while market entry fixed cost increases threshold productivity level from $\overset{*}{\varphi}$ to $\overset{**}{\varphi}$.

Hence, this theoretical framework generates following testable propositions.

Proposition 1: Corruption in home country is negatively associative with the extensive margins of trade that is it discourage the entry of new firms in export market

The intuition of this proposition can easily predict from equation (8) which show that corruption increases the threshold level of productivity from $\overset{*}{\varphi}$ to $\overset{**}{\varphi}$ and discourage the entry of firms with productivity less than $\overset{**}{\varphi}$ into export market. The increase in iceberg trade cost τ_{ij} associated with corruption further reduce the profitability of firm and productivity (φ_{ij}).

Proposition 2: Corruption in home country is positively associated with the intensive margins of trade that is it increases the volume of exports of incumbent firms.

Corruption always facilitates the status quo, expedites process for incumbent firms and helps the incumbent firms to increase volume of their exports—intensive margin of trade. Moreover, it increases the threshold level of productivity from $\overset{*}{\varphi}$ to $\overset{**}{\varphi}$ and discourage the entry of new firms into export market which indirectly facilitate the incumbent firms. We test these alternative propositions using firm level data of South Asian economies

2.6 Econometric Methodology

The key objective of this study is to investigate the effect of government corruption on the extensive and intensive margins of international trade. In other word, this study seek to uncover the relationship between corruption and firms' exporting decision and export intensity using plant level data of selected South Asian economies.

2.7 Extensive margins of trade

Number of studies model the extensive margins of trade or firms binary exporting decision using firm level data. For instance, Wagner (2001), Bellone et al. (2010), Egger and Kesina (2014), Fakih and Ghazalian (2014) use firm level data for investigating the extensive margins of trade. Hence, based on the theoretical model and existing empirical literature, our baseline regression model appears as

$$Ex\_M_{jic} = \alpha + corrp_{jic}\beta + \sum_{l=1}^{L} \gamma_l X_{jic} + \delta_1 D_i + \delta_2 D_c + \varepsilon_{jic} \qquad (1)$$

Where j denotes the firms, i denotes the specific industry and c is one of the selected four South Asian countries. Ex_M_{jic} is extensive margin of trade or simply the exports propensity. X is the vector of firm specific and other control variables. $corrp_{jic}$ is corruption perceived by the firm j in industry i and country c. Moreover, D_i and D_c are the industry specific and country specific dummies that captures heterogeneity across industries and selected countries. ε_{jic} is stochastic random error term. The equations for alternative empirical specifications are available in appendix D1. We have modelled the extensive margins or likelihood of firms' participation in export market using the probit model. Let $\dot{Ex\_M_J}$ denote the benefits to firm j where j=1,…,j located in country c where c= 1,…,4 due to the export participation decisions. I can express the benchmark specification as

$$\dot{Ex\_M}_{Jic} = X_{jic}\beta + \varepsilon_{jic} \qquad (i)$$

Where X_{jic} is a vector of firm specific control variables, β is the corresponding coefficients and ε_j is stochastic error term. The variable $\dot{Ex\_M_J}$ is not directly observable as it is latent variable. Hence, we observe firms' binary exporting decision.

$$Ex\_M_{jic} = \begin{cases} E_d = 1 & for\ \dot{Ex\_P}_{Jic} \geq 0 \\ E_d = 0 & for\ \dot{Ex\_P}_{Jic} < 0 \end{cases}$$

Here Ex_M_j is the binary or dummy variable which equal 1 when specific firm j is exporting while it equal to 0 otherwise. Now we incorporate the role of corruption in our baseline specification observed by firm j in a specific country a

$$P\left(Ex\_M_{jic} \middle| X_{jic}, Crr\_p_{jic}\right) = \varphi\left(X_j\gamma + corrp_{jic} + \mu_{jic}\right) \qquad (ii)$$

Where Crr_p_jgovernment corruption is perceived by firm j and $\varphi(.)$ is the cumulative standard normal distribution function. Hence equation (ii) is Probit regression model for the extensive margin of trade. Heckman (1979) introduce two step procedure for binary dependent variable to avoid the sample selection bias. Heckman (1979) two steps procedure involves two stages estimation where first equation estimates binary decision of firms by using whole sample. The second equation estimates export performance through truncated regression that includes only the exporting firms. Wagner (2001) argue that two steps procedure is not appropriate for estimating exporting decision on theoretical grounds. The market entry fixed cost which is sunk in nature discourage firms to enter into international market. Moreover, focus of this research exercise is on the extensive margin of trade or firms' binary exports decision. Hence, instead of using Heckman (1979) two steps procedure, this study is based on single equation Probit regression.

The key objective of this study is to assess causal impact of corruption on firms' binary decisions for different modes of operation. Certainly, corruption is pervasive in business environment in developing countries while firms' entry into the exports market is firm specific decisions, hence there is little possibility of endogeneity in equation (2). Moreover, firm specific control variables further avoid any possibility of endogeneity. However, to address any small concern about the possibility of endogeneity, the study also uses the Probit model with an endogenous regressor. Moreover, study also uses the

complementary log-log model to estimate our baseline regression model specified in equation (1) for the robustness of our results across different estimation techniques.

2.8 Intensive Margin of trade

Existing empirical studies on the subject also model the intensive margin of trade or export intensity using firm level data of both developed and developing economies. For instance, Wagner (2001), Bellone et al. (2010), Egger and Kesina (2014), Fakih and Ghazalian (2014), Krammer et al., (2018) use firm level data for investigating the intensive margins of trade. Based on our theoretical model and existing empirical literature, the baseline regression equation appears as

$$In\_M_{jic} = \alpha + \beta corrp_{jic} + \sum_{l=1}^{L} \gamma_l X_{jic} + \delta_1 D_i + \delta_2 D_c + \varepsilon_{jic} \qquad (2)$$

Where In_M_{jic} is the intensive margin of trade and defined as the ratio of the total value of export to total sale of firm j. The equations for alternative empirical specifications are available in appendix D2. Let In_M_j denote the Intensive margin of trade or export intensity of firm j where $In\_M_j \in [0,1]$. Although, the dependent variable is continuous but bounded nature of variation and possibility of observing boundaries make OLS estimates biased and inconsistent (Pake and Wooldridge, 1996; Wooldridge, 2002). Moreover, Heckman (1979) two steps procedure is not suitable for estimating export performance on theoretical grounds (Wagner, 2001). Pake and Wooldridge (1996) use the concept of generalized linear models and quasi-likelihood estimation method for a single equation model with fractional regressand. Then the export intensity of the firm can be estimated by fractional Probit model proposed by Pake and Wooldridge (1996) which can be express as

$$E\left(In\_M_{jic} \middle| X_{jic}\right) = \varphi\left(X_{jic}\gamma\right) \qquad (i)$$

$Wher\ X_j$ is the firm specific control variables and γ is vector of corresponding parameters. Now we incorporate the role of corruption in our baseline specification observed by firm j in a specific country a

$$E\left(In\_M_{jic} \middle| X_{jic}, Crr\_p_{jic}\right) = \varphi\left(X_{jic}\gamma + \delta_{jic} corrp_{jic}\right) + \mu_{jic} \qquad (ii)$$

Pake and Wooldridge (1996) propose that equation (ii) can be estimated through Quasi-Maximum Likelihood estimation technique. Ramalho and da Silva (2009), Oberhofer and Pfaffermayr (2012), and Egger and Kesina (2014) argue that when there is mass point at zero in data then two parts fractional response model would provide better results. Hence, along with fractional response model, this study also estimates two stages fractional response model — where intensive margin is estimated using data with positive exports-sale ratio— for robustness of our results to different estimations techniques.

2.9 Data and Description of Variables

We test the proposed hypotheses of this study by using data of the World Bank's Enterprise level Survey of four south Asian economies namely Bangladesh, India, Pakistan and Sri Lanka. Enterprise Survey collects data on business environment indicators such as corruption, regulatory quality, trade, workforce, innovation, technology, and access to finance. The enterprise survey collects qualitative as well as quantitative data from approximately 130000 firm operating in 135 countries across the globe. World Bank collects data by using a stratified random sampling technique to ensure the true representation of the sample. The enterprise level survey of the World Bank provides suitable setting to test trade margins and corruption nexus. This is a unique data set that provides rich information intensive and extensive margins of trade, corruption, innovations, infrastructure, and firm specific characteristics. The survey data is available for Bangladesh and Pakistan in 2013, while it available for India in

2014, and for Sri Lanka in 2011. World Bank administers surveys from selected firms of the manufacturing, retail, and service sector. However, this study is based on the manufacturing sector of selected south Asian economies. The data consists of 1180 manufacturing firms of Bangladesh, 7165 firms of India, 1042 firms of Pakistani manufacturing sector, and 362 firms of Sri Lanka. After cleaning the data and deleting the missing observations for a specific variable, we left with 8423 firms. We assume that there are no structural and behavioral changes in four years across countries. This practice is consistent with existing literature (see, for instance, Krammer, Strange, and Lashitew, 2018; Barasa et al., 2017; *Ma, Qu, and Zhang, 2012;* Gorodnichenko, Svejnar, and Terrell, 2010). The industry wise statistics of firms for selected countries are available in Appendix B.

2.10 Variables of the Study

To meet the desired objectives, this study uses data of the World Bank's Enterprise Survey. Our dependent variables are the extensive and intensive margin of trade, we denote them by the Ex_M_j and In_M_j respectively. Here Ex_M_j is the binary or dummy variable which equal 1 when specific firm j is exporting while it equal to 0 otherwise while In_M_j is defined as the ratio of the total value of export to total sale of firm j. Chaney (2008), and Fontagne, et al. (2015) use the same definition for the intensive and extensive margins of trade. Moreover, Egger and Kesina (2014), Fakih and Ghazalian (2014), Krammer et al., (2018) also use a similar definition for the intensive and extensive margin in their empirical analyses. Our variable of interest is the level of corruption that firm face during its operational activities and it is denoted by $corrp_j$. To avoid the problem of endogenity and excluded variable bias, we also included the set of firms specific control variables. In line with the existing literature, these variables include R & D expenditure, size of a firm, age of a firm, foreign

ownership of firm, education of workers, use of ICT by firms. Many studies use these firm specific control variables, for instances, Lee & Weng (2013), Lee et al., (2015), Olney (2016), and Ahsan (2017) uses these firm specific controls variables in export-corruption nexus. In line with Olney (2016), we also include the country and industry dummies to control for heterogeneity across industries and selected countries. This study also uses the ratio of skilled workers to total workers, use of imported technology, innovation, manager experience, and power outages as alternative control variables. Table B1 provides a detailed description of variables taken from the survey for empirical analysis while descriptive statistics are available in Table B2 in Appendix B.

2.11 Empirical Findings

We intend a separate specification for extensive and intensive margins, therefore empirical findings for extensive and intensive margins are presented in separate subsection. Subsection 6.1 presents findings of our empirical model specified in equation (1) for extensive margin of trade. The 6.2 presents findings of empirical model specified in equation (2) for the intensive margin of trade.

2.12 Findings for the Extensive Margin of Trade

In the first instance, the extensive margin is estimated through the Probit Model. As in cross sectional data, potential bias arises because of hetroskedasticity which must be avoided for the precision of results. The LR test for hetroskedasticity reported in table 1 reflects that we cannot accept the null hypothesis of homoscedasticity at a 5 percent level of significance. Hence, Table 1 reports results for the extensive margin of trade specified in equation (1) for heteroskedastic probit models that adjust both coefficient and standard error for hetroskedasticity.

Table 4:Estimated results for the Extensive Margin of Trade

	Dependent Variable: Extensive Margin			
	(1)	**(2)**	**(3)**	**(4)**
Size	0.0521***	0.0506***	0.04899***	0.0461***
	(0.0051)	(0.0049)	(0.00558)	(0.00563)
Age	0.0290***	0.0287***	0.02284**	0.0229***
	(0.0123)	(0.00827)	(0.00859)	(0.0087)
imp_tech	0.0299*	0.0282**	0.0358**	0.0367**
	(0.0123)	(0.01215)	(0.01733)	(0.0168)
prod	0.01781***	0.01763***	0.0155***	0.0757***
	(0.00245)	(0.00433)	(0.00212)	(0.0209)
credit	0.18244***	0.1766***	0.1896***	0.1820***
	(0.01907)	(0.01854)	(0.0190)	(0.0185)
eco_zone	0.00059	0.00122	0.00305	0.00517
	(0.01429)	(0.01372)	(0.0143)	(0.0138)
manag_exp	0.00441***	0.00436***	0.00431***	0.00426***
	(0.00071)	(0.000677)	(0.00070)	(0.00067)
power_outages	-0.0917	-0.0809	-0.0669	-0.0544
	(0.07708)	(0.07472)	(0.0719)	(0.06933)
f_own	0.18626**	0.1949**	0.1815**	0.1884**
	(0.08172)	(0.08029)	(0.0810)	(0.0792)
ICT	0.2286***	0.2246***	0.1293***	0.1287***
	(0.02964)	(0.02861)	(0.014)	(0.0142)
w_skills	0.0228**	0.0132**		
	(0.0098)	(0.00548)		
RD	0.04620**	0.0475***		
	(0.01331)	(0.01300)		
w_edu			0.0765***	0.0630***
			(0.0234)	(0.0225)
train_emp			0.0345**	0.0405**
			(0.01327)	(0.01286)
innov_proc			0.02976*	0.0319**
			(0.01307)	(0.0126)
corrupt_1	-0.6743**		-0.3569**	
	(0.2982)		(0.1058)	
corrupt_2		-0.0224**		-0.0245**
		(0.01003)		(0.0113)
_cons	-3.870***	-3.773***	-3.965***	-3.854***
	(0.383)	(0.376)	(0.374)	(0.367)
N	8423	8423	8423	8423
LR test for	35.12	26.16	32.16	23.28
hetroskedasticity	(0.010)	(0.018)	(0.013)	(0.020)
CFE	Yes	Yes	Yes	Yes
IFE	Yes	Yes	Yes	Yes

Robust standard errors in parentheses. Average marginal effects are reported except for constant. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

The first specification (column 1) of table 1 shows that our first measure of corruption(corrupt_1) is negatively associated with a firm extensive margin of trade that is also statistically significant. In specification two (column (2)), we used other proxy of corruption (corrupt_2) that enters the model with statistically significant negative sign. These results indicates that corruption prevalence reduces the probability of firms' entry into export market. This finding also substantiates the claim that corruption in the home country increases the upfront fixed cost as well as iceberg trade cost and discourages the entry of firms in the export market. These results are consistent with the earlier empirical literature. For instance, Ahsan (2017) came with findings that corruption reduces the adverse effects of red tape for both extensive and intensive margins of exports, however overall corruption posing negative effects on extensive margin. Similarly, Chaney (2008) develop a model of trade with firms' heterogeneity which predicts that extensive margin is more sensitive to trade cost than intensive margin of trade. Our firm specific control variable size, age, imported technology (imp_tech), manager experience (mang_exp), use of ICT, R&D expenditure(RD), foreign ownership(f_own), share of skilled workers (w_skills) are significant with expected positive sign. These findings are consistent with existing empirical literature. Most of empirical studies on the subject document the evidence for the positive impact of firm specific control on extensive margins. For instances, studies use size (Wagner, 2001; Wagner, 2003; Berman & Hericourt, 2010; Olney; 2016; Regis, 2018; Krammer et al.,2018; Mulliqi et al, 2019), age (Wagner, 1996; Wagner, 2015; Bernard and Jensen, 2004; Martincus & Carballo, 2008; Olney, 2016; Krammer et al.2018; Kapri, 2019), imported technology (Navaretti et al., 2004; Bas, 2012; Sharma, 2018; Brakman et al., 2019), manager experience (Love et al., 2016: Qi et al., 2018; Mulliqi et al, 2019), ICT (Lendle and Vezina, 2015; Yadav, 2014; Visser, 2019), R & D

expenditure(Wagner, 2001; Mulliqi et al, 2019), foreign ownership(Regis, 2018; Berman & Hericourt, 2010; Egger and Kesina, 2014; Olney; 2016; Brakman et al., 2019); and share of skilled workers (Mulliqi et al, 2019; Brakman et al., 2019) as control variables and document positive effects on the extensive margin of trade.

Among the control variables, the firm's location in the special economic zone or an industrial park is statistically insignificant while holding an expected positive sign. The one possible justification for the insignificant response of special economic zone is the selection of few firms in our sample from the special economic zones and industrial parks. Similarly, power outages cannot signify its role in the exports margin of firms, whereas in both specifications firm productivity enters into model with a statistically significant expected positive sign. This finding validates the Melitz (2003) prediction that only more productive firms enter into exports market due to the upfront market entry fixed cost. Similarly, the availability of credit is highly significant with expected positive sign in both specifications. This result is also consistent with existing literature, for instance, Gashi, Hashi, and Pugh (2014), Regis (2018), and Mulliqi et al (2019) provide empirical evidence for the hypothesis that availability of credit encourages the entry of firms in export market. Third and fourth specification in column (3) and column (4) replace workers' skills with workers education and training to employees while R&D expenditure replaces with process innovation. The justification for these alternative specifications is that we replace one measure of human capital that is workers skills with others measures such as workers education and training to employees. Similarly, innovation input such as R&D expenditure is replaced with innovation output. The results reported in column (3) and column (4) show that both measure of corruption(corrupt_1 and corrupt_2) are statistically significant with a negative sign. These results again suggest that corruption in home country discourage

the entry of firms in the export market as predicted by our theoretical model. The coefficient of traditional control variables for the extensive margin of trade are significant with the expected signs. Specific control variables for these specifications such as workers education(w_edu), training to the employees(train_emp), and process innovation(proc_inno)are statistically significant at 1 and 5 percent level of significance. However, the firm's location in the special economic zone or an industrial park and power outages remain insignificant. To capture the unexplained heterogeneity across countries and industries, country specific (D_c) and industry specific (D_i) dummies included in all four specifications.

We employ two alternative estimation techniques in order to check the robustness of our results. Our results are robust across alternative estimation techniques. First, the results of the complementary log-log model are reported in Table A1 of Appendix A. The results reported in column (1) and column (2) of Appendix Table 1 show that our first measure of corruption (corrupt_1) is statistically significant at a 10 percent level of significance while the second measure of corruption (corrupt_2) is statistically significant at a 5 percent. Similarly, the results reported in column (3) and column (4) also reflect that both measures of corruption enter in the model with a statistically significant negative sign. Second, to avoid any possibility of endogeneity, we also estimate our empirical model with IV probit for endogenious explanatory variables. We use malfunctioning tax administration and the quality of courts as instruments for corruption (corrupt_1). However, we cannot reject null hypothesis of no endogeneity using Wald test with p value of 0.788 and 0.837 for both models in column (1) and column (2). These results suggest that there is no issue of endogeneity in our estimated models. Table A2 in Appendix A reports the results of IV probit for the extensive margin of trade. The results are robust across alternative estimation techniques.

2.13 Findings for the Intensive Margin of Trade

Table 5 reports results for the intensive margin of trade specified in eq. (2). These results are based on the fractional probit model with robust standard error for hetroskedasticity.

Table 5: Estimation results of Fractional Probit for the intensive margin of trade

	Dependent variable: Intensive margin			
	(1)	**(2)**	**(3)**	**(4)**
size	0.176***	0.185***	0.179***	0.187***
	(0.0241)	(0.0240)	(0.0253)	(0.0253)
age	0.0433	0.0460	0.0455	0.0512
	(0.0422)	(0.0421)	(0.0424)	(0.0425)
prod	0.0792***	0.0771***	0.0795***	0.0772***
	(0.0233)	(0.0230)	(0.0232)	(0.0227)
imp_tech	0.0815*	0.0705*	0.0886*	0.0731*
	(0.0428)	(0.0427)	(0.0437)	(0.0433)
credit_avail	0.564***	0.579***	0.583***	0.600***
	(0.0952)	(0.0950)	(0.0945)	(0.0945)
eco_zone	0.161**	0.148**	0.133**	0.128**
	(0.0655)	(0.0650)	(0.0673)	(0.0670)
manag_exp	0.00702*	0.00710*	0.00652	0.00668*
	(0.00342)	(0.00332)	(0.00340)	(0.00331)
power_outage	-0.367	-0.326	-0.211	-0.198
	(0.408)	(0.402)	(0.395)	(0.390)
f_own	0.936*	0.909*	1.015**	0.971*
	(0.378)	(0.376)	(0.382)	(0.378)
ICT_2	0.621***	0.608***	0.635***	0.625***
	(0.0882)	(0.0865)	(0.0884)	(0.0867)
w_skills	0.417**	0.376**		
	(0.132)	(0.130)		
RD	0.366***	0.332***		
	(0.0647)	(0.0642)		
train_emp			0.1475**	0.1252**
			(0.0657)	(0.0652)
w_edu			0.127	0.140
			(0.114)	(0.111)
innovat_proc			0.138**	0.133**
			(0.0621)	(0.0614)
corrupt_1	0.659*		0.713**	
	(0.363)		(0.383)	
corrupt_2		0.191**		0.236***
		(0.0680)		(0.0676)
N	8423	8423	8423	8423
Pseudo R^2	0.288	0.293	0.274	0.283
CFE	Yes	Yes	Yes	Yes
IFE	Yes	Yes	Yes	Yes

Robust standard errors for hetroskedasticiy in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Average marginal effects are reported except for constant which is omitted in STATA command

The results reported in column (1) and column (2) reveal that first ($corrupt\_1$) and second ($corrupt\_2$) measure of corruption is statistically significant at 10 percent and 5 percent respectively. In contrast with the extensive margin, both measures of corruption ($corrupt\_1\ and\ corrupt\_2$) are positively related with intensive margin of trade. These results suggest that corruption facilitates the incumbent firms to increase the volume of their exports and act as grease in wheels of dysfunction state apparatus in selected developing countries. This finding is consistent with existing empirical literature. For instance, Sharma & Mitra (2015) finds positive effect of corruption on intensive margin of trade. Similarly, Ahsan (2017) argue that corruption reduces the custom related red tape and promotes the intensive margin of trade. The results in Table 2 reflect that all traditional firm specific control variables are statistically significant with expected sign. The firm specific control variable size, imported technology(imp_tech), manager experience(manag_exp), use of ICT, location in economic zone or an industrial park(eco_zone), R&D expenditure (RD), foreign ownership(f_own), share of skilled workers (w_skills) are significant with expected positive sign. These results are consistent with existing literature on subject. For instance, studies that use size (Wagner, 2001;Mulliqi et al, 2019), imported technology ((Bhaduri & Ray, 2004; Krammer et al.2018), manager experience (Qi et al., 2018;Mulliqi et al, 2019; Krammer et al.2018),), ICT (Lendle and Vezina, 2015; Yadav, 2014; Osnago and Tan 2016; Visser, 2019), R & D expenditure(Wagner, 2001; Mulliqi et al, 2019), foreign ownership(Berman & Hericourt, 2010; Egger and Kesina, 2014; Regis, 2018), share of skilled workers (Mulliqi et al, 2019), and credit (Gashi, Hashi, and Pugh,2014: Regis, 2018; Mulliqi et al.,2019) as control for the intensive margin of trade and document statistically significant positive impact on exports intensity. However, age of the firm is statistically insignificant with expect positive

sign. Similarly, power outages a proxy for the state physical infrastructure also statistically insignificant with expected negative sign. However, firm productivity(prod) is highly significant with expected positive signs. The column (3) and column (4) in table 2 reports the results with some alternative control variables. We replace firm level R&D expenditure with process innovation while workers' skills with the education of workers and training to employees. The results reported in column (3) and column (4) again confirm that both measures of corruption ($corrupt\_1\ and\ corrupt\_2$) are statistically significant at 5 percent and 1 percent respectively. Moreover, control variables are also statistically significant with the expected sign. However, age of the firm remains insignificant in these alternative specifications for intensive margin of trade. Similarly, workers' education(w_edu) in column (3) and column (4) also statistically insignificant with the expected positive sign. However, training to employees (train_emp), process innovation (innov_proc) are statistically significant at 5 percent level of significance.

We also check the robustness of our results with alternative estimation techniques and additional measures of corruption. We estimate the intensive margin of trade specified in equation (2) by two parts fractional response model (see, Ramalho and da Silva,2009, Egger and Kesina, 2014). Table A2 (Appendix A) reports the results of two parts fractional response model for the intensive margin of trade with robust standard errors for hetroskedasticity. Overall results are robust for alternative estimation technique and additional measures of corruption. The results reported in the first three empirical specifications in columns (1-3) reflect all three measures of corruption are statistically significant with the positive signs. These results again support the claim that corruption facilitates the incumbent firms and act as grease in wheels of dysfunctional state apparatus in selected developing countries. In column (4)

and column (5), we include some additional control variables such as imported technology (imp_tech), firm location in economic zone (eco_zone), foreign ownership (f_own), use of ICT, and firm level R&D expenditure(RD) along with first and second measure of corruption ($corrupt\_1\ and\ corrupt\_2$). The results for the effects of corruption on intensive margin remain robust for alternative specifications. Similarly, in column (6) and column (7), we replace R&D expenditure with process innovation(p_innov) (P-innov) and share of skilled workers (w_skills) with the workers education(w_edu) and training to employees(train_emp). Our key findings remain robust for these alternative specifications. However, workers education is statistically significant with positive sign.

2.14 Conclusions

Although, South Asia is the fastest growing region in the world. Yet, exports growth is low and long run growth process is majorly derived by the domestic demand. As a result, these countries are facing persistent trade deficit. Existing literature document that extensive margin of trade play a major role in the sustainable exports growth process (see for instance, Hummels & Klenow, 2005). In this context, this study is intended to explore the response of extensive and intensive margins of trade to pervasive corruption in selected South Asian countries. Based on theoretical underpinnings of New-New trade theory (Melitz, 2003; Chaney, 2008), we hypothesize that corruption would have opposing effects on the intensive and extensive margins of trade. By simultaneously increasing the market entry fixed cost and iceberg trade cost, it discourage entry of firms in exports market and act as 'sand in the wheels' for the extensive margins of trade. Paradoxically, it facilitates the status quo, directly and indirectly expedites the process for the incumbent firms and act as 'grease in the wheels' for intensive margin of trade. The purposed hypotheses are tested with firm level data

set of the sample countries. We estimate separate empirical specification for extensive and intensive margins with alternative estimation techniques. The extensive margin of trade is estimated through the probit model while intensive margin is estimated by employing the fractional response model.

The empirical findings of study reveal that corruption has a statistically significant negative effects on the extensive margin of trade. This finding confirms that corruption reduce the probability for new firms to enter into exports market and act as 'sand in the wheels' for extensive margin of trade. On the other hand, our empirical results also reveal that corruption has statistically significant positive effects on the volume of exports of incumbent firms and hence promotes the intensive margin of trade. These results suggest that corruption attenuates the adverse impact of malfunctioning state apparatus and act as 'grease in the wheels' for intensive margin of trade. Our results are robust to different measures of corruption, alternative controls, and estimation techniques.

These results have important implication for the selected south Asian developing countries. These countries primarily derive their economic growth process by domestic demand and face persist trade deficit due negligible growth in exports. The extensive margin of trade play major role in export growth process and also important for the diversification of exports which in turn circumvent external shock and instability in export earnings. Hence, pervasive corruption in these countries has been one of the major detrimental factors for export growth and instability in exports earnings. Additionally, there is massive misallocation of resources due to the inefficient and slow growing firms that capture major share of market in South Asian countries (Hsieh and Klenow, 2009). Despite the trade liberalization regime in selected south Asian countries, corruption prevalence limits the scope of inter-industrial reallocation in favor

of most productive firms. Its facilities the incumbent firms and discourages the entry of new firms in exports market and impedes the additional channel of productivity growth and catch-up as suggested by the trade models based on firms' heterogeneity.

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Appendix A

Table A1:Estimation results of Complementary log-log regression for the extensive margin of trade

	Dependent Variable: extensive margin			
	(1)	(2)	(3)	(4)
size	0.278***	0.278***	0.298***	0.289***
	(0.0348)	(0.0343)	(0.0362)	(0.0356)
age	0.197***	0.193***	0.188**	0.185**
	(0.0591)	(0.0581)	(0.0594)	(0.0583)
prod	0.0929**	0.103**	0.0974**	0.104**
	(0.0322)	(0.0323)	(0.0323)	(0.0322)
imp_tech	0.283*	0.295**	0.273*	0.286*
	(0.111)	(0.111)	(0.111)	(0.111)
credit	1.199***	1.187***	1.210***	1.193***
	(0.131)	(0.131)	(0.131)	(0.130)
eco_zone	0.0468	0.0370	0.0253	0.00885
	(0.0948)	(0.0940)	(0.0962)	(0.0955)
manag_exp	0.0265***	0.0277***	0.0249***	0.0262***
	(0.00457)	(0.00450)	(0.00460)	(0.00454)
power_outage	-0.862	-0.721	-0.722	-0.584
	(0.490)	(0.493)	(0.490)	(0.493)
f_own	0.991*	1.117*	0.982*	1.098*
	(0.466)	(0.463)	(0.472)	(0.468)
ICT	0.978***	0.992***	0.968***	0.985***
	(0.113)	(0.112)	(0.113)	(0.112)
w_skills	0.277*	0.239*		
	(0.152)	(0.142)		
RD	0.231**	0.259**		
	(0.0893)	(0.0893)		
w_edu			0.437**	0.356*
			(0.158)	(0.155)
train_emp			0.164	0.210*
			(0.0890)	(0.0885)
innov_proc			0.154*	0.176*
			(0.0869)	(0.0864)
corrupt_1	-2.728*		-2.096*	
	(1.541)		(1.174)	
corrupt_2		-0.205**		-0.202**
		(0.0911)		(0.0909)
_cons	-5.748***	-5.746***	-5.836***	-5.801***
	(0.578)	(0.573)	(0.564)	(0.560)
N	8423	8423	8423	8423
CFE	Yes	Yes	Yes	Yes
IFE	Yes	Yes	Yes	Yes

Table A2: Results of IV probit for extensive margin

	Dependent variable: Extensive margin	
	(1)	(2)
corrupt_1	-3.206**	-3.331**
	(1.089)	(1.120)
size	0.213***	0.208***
	(0.0384)	(0.0366)
prod	0.0627*	0.0611*
	(0.0263)	(0.0259)
age	0.111*	0.108*
	(0.0430)	(0.0425)
w_edu	0.448***	0.451***
	(0.111)	(0.111)
train_emp	0.151*	0.141*
	(0.0601)	(0.0610)
credit	0.811***	0.821***
	(0.122)	(0.120)
eco_zone	0.0234	0.0229
	(0.0643)	(0.0642)
manag_exp	0.0183***	0.0189***
	(0.00384)	(0.00387)
power_outage	-0.920*	-0.945*
	(0.404)	(0.406)
f_own	0.843*	0.829*
	(0.374)	(0.375)
ICT	0.536***	0.533***
	(0.119)	(0.116)
imp_tech	0.106	0.109
	(0.111)	(0.111)
innov_proc	0.116	
	(0.0639)	
RD		0.151*
		(0.0726)
_cons	-3.285***	-3.263***
	(0.961)	(0.936)
N	8423	8423
CFE	Yes	Yes
IFE	Yes	Yes
Wald test for exogeniety	0.7880	0.8376

Table A3: Results of intensive margin of trade base on the two steps fraction response model

	Dependent Variable: Intensive margin (exports intensity)						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
size	0.122**	0.563***	0.0150*	0.0229*	0.0107*	0.0634**	0.0583**
	(0.0575)	(0.0346)	(0.0075)	(0.0129)	(0.0059)	(0.0259)	(0.0291)
age	0.124**	2.125***	0.128**	0.108*	0.0941*	0.112**	0.0950**
	(0.0485)	(0.122)	(0.0485)	(0.0479)	(0.0485)	(0.0478)	(0.0483)
prod	0.159***	0.616***	0.0813***	0.0541**	0.0789**	0.0898**	0.0770**
	(0.0237)	(0.00557)	(0.0238)	(0.0186)	(0.0224)	(0.0229)	(0.0223)
credit	0.310**	2.825***	0.313**	0.354***	0.330***	0.366***	0.345***
	(0.122)	(0.160)	(0.124)	(0.125)	(0.126)	(0.125)	(0.126)
man_exp	0.0826**	0.317***	0.0791**	0.0635**	0.0682*	0.0580**	0.0613*
	(0.0414)	(0.000823)	(0.0414)	(0.0327)	(0.0398)	(0.0225)	(0.0429)
p_outages	-0.435	-1.73***	-0.508	-0.128	-0.0445	-0.150	-0.0710
	(0.476)	(0.513)	(0.471)	(0.507)	(0.499)	(0.500)	(0.488)
w_skills	0.466**	2.755***	0.446**	0.254**	0.233**		
	(0.165)	(0.102)	(0.162)	(0.122)	(0.126)		
imp_tech				0.0550**	0.0691**	0.0394**	0.0485**
				(0.0247)	(0.0289)	(0.0123)	(0.0233)
ec_zone				0.0717**	0.0740**	0.0524**	0.0652**
				(0.0277)	(0.0302)	(0.0270)	(0.0321)
f_own				0.413**	0.497**	0.367**	0.449**
				(0.201)	(0.216)	(0.184)	(0.206)
ICT				0.0653**	0.0265**	0.0868***	0.0408*
				(0.0218)	(0.0132)	(0.0162)	(0.0218)
RD				0.273***	0.252***		
				(0.0780)	(0.0773)		
w_edu						0.298**	0.307**
						(0.147)	(0.145)
train_emp						0.201***	0.230****
						(0.0765)	(0.0769)
inno_proc						0.0352*	0.0430**
						(0.0194)	(0.0188)
corrupt_1	1.354**			1.440**		1.547*	
	(0.624)			(.575)		(0.845)	
corrupt_2			0.132*		0.183**		0.235***
			(0.0720)		(0.0828)		(0.0837)
corrupt_3		0.743***					
		(0.00821)					
_cons	-0.891*	-2.81***	0.0123**	0.115**	0.225**	-0.132**	-0.108**
	(0.439)	(0.660)	(0.432)	(0.431)	(0.049)	(0.430)	(0.409)
CFE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
IFE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	8423	8423	8423	8423	8423	8423	8423
R^2	0.187	0.365	0.174	0.252	0.231	0.217	0.221

Appendix B

Table B 1 Variables and their description

Variables	Description
Intensive Margin (In_M)	Ratio of export sales to total annual sales.
Extensive Margin (Ex_ M)	Dummy variable equal to one if firm export either directly or indirectly
Research & Development (R D)	Dummy if an establishment spends on R&D activities.
Firm Size (F_Size)	Logarithm of number of full- time employees.
Productivity (prod)	Logarithm of value added per permanent employee
Age of firm	Logarithm age of an establishment in years
Access to Credit (credit)	Percentage of working capital financed by banks and non-bank borrowing
Power outages (p_outages)	Loss as percentage of total annual sales due to power outages.
Foreign Ownership (F_Own)	Percentage of firm is owned by private foreign individuals, companies or organization
Workers skills(w_skills)	Ratio of skilled production workers to unskilled production workers.
Education of Workers (w-edu)	Percentage of full time permanent workers who completed secondary school
Manager experience (Man_exp)	Logarithm of top manager experience in years
Economic zones (eco_zone)	Dummy variable if firm located in special economic zone or industrial park
Process innovation (p_innov)	Dummy variable equal one if firm introduced significantly improve process or method of production
Training (train_emp)	Dummy variable equal to one if firm have formal training programs for its permanent full time employees
Corruption (Corrup_1) Corruption (Corrup_2) Corruption (Corrup_3)	1) Percentage of total annual sales paid as informal payment 2) Dummy variable equal to one if firm identify corruption as major constraint 3) Logarithm of total annual informal payment
Firm use of ICT(F_ICT)	Dummy variable equal to one if firm using ICT
Imported technology	Dummy variable equal to one if firm use imported technology
Tax Administration	Dummy variable equal to one if tax administration is major constraint for operation of a firm
Court System	Dummy variable equal to one if court system is major constraint for operation of firm

Table B2: Descriptive Statistics

Variable	Obs	Mean	Standard Deviation
Extensive margin	8423	.102	.269
Imported technology	8423	.118	.323
Size	8423	3.588	1.302
Process Innovation	8423	.43	.495
Access to Credit	8423	.266	.322
Economic Zone	8423	.571	.495
Power Outages	8423	.078	.119
Manager Experience	8423	15.253	9.832
R & D	8423	.308	.462
Workers Skills	8423	.704	.257
Foreign ownership	8423	.007	.069
Workers Education	8423	.429	.3
Training to employee	8423	.367	.482
ICT	8423	.465	.499
corruption_1	8423	.003	.027
corruption_2	8423	10.888	1.671
corruption_3	8423	.672	.469
age	8423	2.742	.787
Extensive margin	8423	.208	.406
Tax Administration	8423	.747	.435
Productivity	8423	13.898	1.332

Table B2 Bangladesh

Industry Sampling Sector	Freq.	Percent	Cum.
Food	162	13.73	13.73
Textiles	119	10.08	23.81
Garments	198	16.78	40.59
Leather	105	8.90	49.49
Wood	18	1.53	51.02
Paper	24	2.03	53.05
Publishing, printing, and Recorded media	25	2.12	55.17
Refined petroleum product	1	0.08	55.25
Chemicals	118	10.00	65.25
Plastics & rubber	6	0.51	65.76
Non metallic mineral products	70	5.93	71.69
Basic metals	28	2.37	74.07
Fabricated metal products	56	4.75	78.81
Machinery and equipment (29 & 30)	26	2.20	81.02
Electronics (31 & 32)	19	1.61	82.63
Transport machines (34&35)	28	2.37	85.00
Transport machines (34&35)	3	0.25	85.25
Furniture	169	14.32	99.58
Others	1	0.08	99.66
Others	3	0.25	99.92
IT	1	0.08	100.00
Total		1180	100

Table B3: India

Industry Sampling Sector	Freq.	Percent	Cum.
Food	539	7.52	7.52
Tobacco	110	1.54	9.06
Textiles	621	8.67	17.73
Garments	209	2.92	20.64
Leather	97	1.35	22.00
Wood	140	1.95	23.95
Paper	166	2.32	26.27
Publishing, printing, and Recorded media	135	1.88	28.15
Refined petroleum product	33	0.46	28.61
Chemicals	599	8.36	36.97
Plastics & rubber	696	9.71	46.69
Non metallic mineral products	532	7.42	54.11
Basic metals	655	9.14	63.25
Fabricated metal products	651	9.09	72.34
Machinery and equipment	720	10.05	82.39
Electronics	586	8.18	90.57
Precision instruments	25	0.35	90.91
Transport machines	561	7.83	98.74
Furniture	79	1.10	99.85
Recycling	4	0.06	99.90
Construction Section F	3	0.04	99.94
Services of motor vehicles	1	0.01	99.96
Retail	1	0.01	99.97
it	2	0.03	100.00
Total	7165	100	

Table B4:Pakistan

Industry Sampling Sector	Freq.	Percent	Cum.
Food	199	19.10	19.10
Textiles	137	13.15	32.25
Garments	86	8.25	40.50
Chemicals	83	7.97	48.46
Non-metalic minerals	126	12.09	60.56
Motor vehicles, trailers and semi-trailers & Other transport equipment	30	2.88	63.44
Other Manufacturing	336	32.25	95.68
Other Manufacturing	24	2.30	97.98
Other Manufacturing	19	1.82	99.81
Retail and Other Services Combined	2	0.19	100.00
Total	1042	100	

Table B5: Sri Lanka

A4. Industry-SAMPLING SECTOR	Freq.	Percent	Cum.
Food	121	33.43	33.43
Tobacco	10	2.76	36.19
Textiles	12	3.31	39.50
Garments	120	33.15	72.65
Leather	1	0.28	72.93
Wood	26	7.18	80.11
Paper	3	0.83	80.94
Recorded media	2	0.55	81.49
Chemicals	6	1.66	83.15
Plastics & rubber	16	4.42	87.57
Non metallic mineral products	30	8.29	95.86
Basic metals	2	0.55	96.41
Medical and optical precision instruments	1	0.28	96.69
Transport machines (34&35)	4	1.10	97.79
Furniture	7	1.93	99.72
Recycling	1	0.28	100.00
Total	362	100	

Appendix C

Mathematic Proof

Corruption increases iceberg trade cost (τ_c_{ij}) as well as market entry fixed cost (f_c_{ij}) . We incorporate both types of corruption in firm profit maximization function.

$$max_{q(\varphi)}\left\{p(\varphi)q(\varphi) - \frac{\tau\_c_{ij} w \tau_{ij} A_j p_j(\omega)^{-\sigma}}{\varphi} - f_{ij} - f\_c_{ij}\right\} = 0 \qquad (C1)$$

The first order condition implies that a firm from $i \in S$ with productivity φ condition to selling to destination $j \in S$ will charge price

$$p(\varphi) = \frac{\sigma}{\sigma - 1}\left(\frac{w_i \tau\_c_{ij}}{\varphi}\right)$$

We normalized the wage rate to one.

$$p(\varphi) = \left(\frac{\tau\_c_{ij}}{\rho\varphi}\right) \qquad (C2)$$

Now the revenue of the firm can be calculated as

$$r_{ij}(\varphi) = p_{ij}(\varphi)q_{ij}(\varphi) = \left(\frac{\tau\_c_{ij}}{\rho\varphi}\right)^{1/1-\sigma}\left(A_j p_j(\omega)^{-\sigma}\right)$$

$$r_{ij}(\varphi) = \left(\frac{1}{\rho\varphi}\right)^{1/1-\sigma}\left(A_j p_j(\omega)^{-\sigma}\right)$$

$$r_{ij}(\varphi) = \left(\frac{\rho\varphi}{\tau\_c_{ij}}\right)^{1-\sigma}\left(A_j p_j(\omega)^{-\sigma}\right) \qquad (C3)$$

Similarly, the profit of the firm can be calculated as

$$\pi(\varphi) = r_{ij}(\varphi) - l(\varphi)$$

By substituting the values of $r_{ij}(\varphi)$ from equation (C#) and $l = f + \frac{q(\varphi)}{\varphi}$ from equation (1) we will get following equation for the profit of the firm

$$\pi(\varphi) = \frac{\tau\_c_{ij}^{1/1-\sigma} r_{ij}(\varphi)}{\sigma} - f_{ij} - f\_c_{ij} \qquad (C4)$$

Where f_c_{ij} is upfront fixed cost due to corruption which is also sunk in nature.

Selection into exporting

The presence of upfront fixed cost which is sunk in nature implies a zero profit cut off productivity below which firm exit from the export markets. The increases in the upfront fixed cost due to corruption prevalence in developing countries also increases the cut off productivity to $\overset{**}{\varphi}$

$$\pi\left(\overset{**}{\varphi}\right) = 0 \quad which\ implies\ that\ \ \pi\left(\overset{**}{\varphi}\right) = \sigma(f_{ij} + f_{c_{ij}})$$

Hence a firm from country $i \in S$ with productivity φ conditional on producing will export to country $j \in S$ if and only if:

$$\pi_{ij}(\varphi) \geq \sigma(f_{ij} + f_{c_{ij}}) \qquad (C5)$$

Hence, cut off productivity $\overset{*}{\varphi}$ of a firm increases to $\overset{**}{\varphi}$ due to pervasive corruption in developing countries.

$$\varphi_{ij} \geq \overset{**}{\varphi} \qquad (C6)$$

If a firm operating in country $i \in S$ has productivity φ_{ij} greater than threshold level of productivity ($\overset{**}{\varphi}$) will export to country $j \in S$. Equation (C6) reflect that corruption impedes the extensive margin of trade by increasing the threshold level of productivity to $\overset{**}{\varphi}$. The equation C4 depict that corruption prevalence in developing countries also increase variable trade cost ($\tau_{-c_{ij}}$) which decreases the profitability both new firms as well as incumbent firms. However, Chaney (2008) develop a model base on firm heterogeneity that predict sensitivity of extensive margin of trade with trade cost. The intensive margin remains unresponsive to change in variable trade cost. Hence, we argue that corruption encourage the intensive margin of trade directly by expediting process for the incumbent firms. Moreover, corruption promote the intensive margin indirectly by restricting the entry of firms in export market.

Appendix D1

Specifications for extensive margin of trade

$$Ex\_M_{jic} = \alpha + \beta corrp\_1_{jic} + \gamma_1 size + \gamma_2 age + \gamma_3 imp_t + \gamma_4 prod + \gamma_5 credit + \gamma_6 eco_{zone} + \gamma_7 manag_{exp} + \gamma_8 p_{outages} + \gamma_9 f_{own} + \gamma_{10} ICT + \gamma_{11} w_{skills} + \gamma_{12} RD + \delta_1 D_i + \delta_2 D_c + \varepsilon_{jic} \quad (1)$$

We replace first measure of corruption$(corrp_1)_{jic}$ with second measure$(corrp_2_{)jic}$ while keeping the same set of control variables in second specification. Hence following equation represent the second specification in table 4.

$$Ex\_M_{jic} = \alpha + \beta corrp\_2_{jic} + \gamma_1 size + \gamma_2 age + \gamma_3 imp_t + \gamma_4 prod + \gamma_5 credit + \gamma_6 eco_{zone} + \gamma_7 manag_{exp} + \gamma_8 p_{outages} + \gamma_9 f_{own} + \gamma_{10} ICT + \gamma_{11} w_{skills} + \gamma_{12} RD + \delta_1 D_i + \delta_2 D_c + \varepsilon_{jic} \quad (2)$$

Third and fourth specification in column (3) and column (4) replace workers' skills with workers education and training to employees while R&D expenditure replaces with process innovation

$$Ex\_M_{jic} = \alpha + \beta corrp\_1_{jic} + \gamma_1 size + \gamma_2 age + \gamma_3 imp_t + \gamma_4 prod + \gamma_5 credit + \gamma_6 eco_{zone} + \gamma_7 manag_{exp} + \gamma_8 p_{outages} + \gamma_9 f_{own} + \gamma_{10} ICT + \gamma_{11} w_{edu} + \gamma_{12} proc_{innov} + \gamma_{13} W_{training} + \delta_1 D_i + \delta_2 D_c + \varepsilon_{jic} \quad (3)$$

We replace first measure of corruption with second measure while keeping the same set of control variables in fourth specification. Hence following equation represent the fourth specification in table 4.

$$Ex\_M_{jic} = \alpha + \beta corrp\_2_{jic} + \gamma_1 size + \gamma_2 age + \gamma_3 imp_t + \gamma_4 prod + \gamma_5 credit + \gamma_6 eco_{zone} + \gamma_7 manag_{exp} + \gamma_8 p_{outages} + \gamma_9 f_{own} + \gamma_{10} ICT + \gamma_{11} w_{edu} + \gamma_{12} proc_{innov} + \gamma_{13} W_{training} + \delta_1 D_i + \delta_2 D_c + \varepsilon_{jic} \quad (4)$$

Appendix D2

Specifications for intensive margin of trade

$$Int\_M_{jic} = \alpha + \beta corrp\_1_{jic} + \gamma_1 size + \gamma_2 age + \gamma_3 imp_t + \gamma_4 prod + \gamma_5 credit + \gamma_6 eco_{zone} + \gamma_7 manag_{exp} + \gamma_8 p_{outages} + \gamma_9 f_{own} + \gamma_{10} ICT + \gamma_{11} w_{skills} + \gamma_{12} RD + \delta_1 D_i + \delta_2 D_c + \varepsilon_{jic} \quad (1)$$

We replace first measure of corruption with second measure while keeping the same set of control variables in second specification. Hence following equation represent the second specification in table 4.

$$Int\_M_{jic} = \alpha + \beta corrp\_2_{jic} + \gamma_1 size + \gamma_2 age + \gamma_3 imp_t + \gamma_4 prod + \gamma_5 credit + \gamma_6 eco_{zone} + \gamma_7 manag_{exp} + \gamma_8 p_{outages} + \gamma_9 f_{own} + \gamma_{10} ICT + \gamma_{11} w_{skills} + \gamma_{12} RD + \delta_1 D_i + \delta_2 D_c + \varepsilon_{jic} \quad (2)$$

Third and fourth specification in column (3) and column (4) replace workers' skills with workers education and training to employees while R&D expenditure replaces with process innovation

$$Int\_M_{jic} = \alpha + \beta corrp\_1_{jic} + \gamma_1 size + \gamma_2 age + \gamma_3 imp_t + \gamma_4 prod + \gamma_5 credit + \gamma_6 eco_{zone} + \gamma_7 manag_{exp} + \gamma_8 p_{outages} + \gamma_9 f_{own} + \gamma_{10} ICT + \gamma_{11} w_{edu} + \gamma_{12} proc_{innov} + \gamma_{13} W_{training} + \delta_1 D_i + \delta_2 D_c + \varepsilon_{jic} \quad (3)$$

We replace first measure of corruption with second measure while keeping the same set of control variables in fourth specification. Hence following equation represent the fourth specification in table 4.

$$Int\_M_{jic} = \alpha + \beta corrp\_2_{jic} + \gamma_1 size + \gamma_2 age + \gamma_3 imp_t + \gamma_4 prod + \gamma_5 credit + \gamma_6 eco_{zone} + \gamma_7 manag_{exp} + \gamma_8 p_{outages} + \gamma_9 f_{own} + \gamma_{10} ICT + \gamma_{11} w_{edu} + \gamma_{12} proc_{innov} + \gamma_{13} W_{training} + \delta_1 D_i + \delta_2 D_c + \varepsilon_{jic} \quad (4)$$

CHAPTER 3

IMPORTED INPUTS, FIRM CAPABILITIES AND PRODUCTIVITY

Abstract

Trade facilitation through improving access to imported inputs is relatively more important for developing countries that were seeking productivity growth in inward-looking import substitution policies. South Asian economies has exercised inward looking policies from the early 1950s to mid-1980s in order to replace its major imports with indigenous productivity. In this context, this study intends to examine the impact of imported inputs on the productivity of firms operating in selected South Asian countries. In addition, to come across profoundly, the study also tests complementarity between firms' capabilities and imported inputs in augmenting productivity performance. The empirical analyses carried out at cross sectional data set of manufacturing firms of the four largest South Asian economies. To cope with the nature of data and empirical models, the empirical estimations carried out with stochastic frontier model, ordinary least square, and instrumental variable estimation techniques.

At large, findings of the study reveal that imported inputs positively and significantly contributes to firms' productivity of the sample countries. Moreover, we came with the findings that firms 'capabilities play a complementary role in the expansion of firms' production frontier. Findings of the study put forward that sample countries should reduce tariff on imported inputs in order to amplify the firms' productivity growth. Furthermore, findings of the study suggest that the potential gain of imported inputs is conditional to the firms' capabilities, hence, these countries should allocate more resources to the education and encourage firms to invest in trainings, management capabilities and internal R&D effort.

3.1 Introduction

Both the exogenous and endogenous growth models reach the consensus that the large disparities in livings standards across countries are mainly attributed to the significant productivity differential between developed and developing countries.[14] These productivity differentials across countries, industries and firms are explained by variety of factors including technological knowledge. Endogenous growth theory emphasizes on the accumulation of knowledge, and knowledge spillover as important sources of aggregate productivity growth.[15] The second generation of endogenous growth models based on the Schumpeter's idea of creative destruction emphasize on industrial innovation as major source of accumulation of knowledge which in turn drive overall productivity[16]. One considerable implication of these models is that countries on the global technological frontier remain on the lead and the possibility of convergence between developing and developed countries is seemed to be trivial. Whereas, empirical studies on the neoclassical tradition augment human capital as separate factor of production and find that capital per worker successfully explains cross country income differences[17]. In this framework, less developed countries will successfully converge to the developed countries due to the diminishing marginal productivity of physical capital.

Paradoxical to these polar stands, economic historians argue that innovation in advance countries also derive growth to less develop periphery mainly due to the

[14] See, for instance, Caselli et al., (1996), and Hall & Jones (1999))

[15] For instance, Romer (1986), Lucas (1988), Lucas & Moll (2014) emphasize on the knowledge while Arrow (1962), Uzawa (1965), Nelson & Phelps (1966), and Shell (1966) argue that knowledge spillover is important source of productivity growth.

[16] For instance see, Segerstrom et al. (1990); Grossman & Helpman(1991), Aghion & Howitt (1992). Similarly, Romer (1990) introduced product variety as potential source of productivity growth and innovation improve productivity by generating the new variety of products.

[17] For instance, Mankiw et al (1992), Barro and Sala-i-Martin (1997) broadly define capital to incorporate the human capital in conventional capital stock.

diffusion of technical knowledge (Gerschenkron, 1962; Rosenberg, 1982). Similarly, open economy versions of endogenous growth models predict that technical knowledge diffuses to other industries and firms both locally and internationally. It is majorly embodied in intermediate inputs and international trade acts as a vehicle for the transmission and diffusion of knowledge across countries.[18]

Keeping in view theoretical underpinning of different economic growth frameworks, received literature on the subject highlighted different channels through the imports of capital goods affects productivity growth. First, imported inputs expand the varieties of intermediate inputs— with the assumption of imperfect substitution between foreign and domestic inputs— which in turn enables domestic firms to produce variety of products and amplify the domestic productivity growth (Ethier, 1982; Romer, 1990). Second, productivity of domestic firms also increases due to the quality effect that can arise because of the better quality of imported inputs than domestic ones (Grossman and Helpman, 1991; Aghion and Howitt, 1992). Third, transmission and diffusion of technical knowledge embedded in imported inputs indirectly contribute to the overall productivity growth (Eaton & Kortum, 2001; Chuang 1998; Goh & Olivier, 2002; Caselli & Wilson, 2004). This channel emphasizes the accumulation of knowledge through learning by doing, and extraction of technology embodied in capital goods being imported from the forefront of knowledge. Fourth, import competitions in the inputs market put pressure on the price of intermediate inputs which provides rents to the domestic producer in the final good sector (Helpman and Krugman 1985: Bernard et al., 2003).[19] However, from a theoretical perspective, the direction of causality runs

[18] Along with imported inputs, FDI, migration, and export also act as conduit for the transmission and diffusion of technological knowledge across countries (Keller, 2004). Open economy version of endogenous growth model includes work of Rivera-Batiz & Romer (1991), Devereux & Lapham (1994) and Keller (2002) among others.

[19] Generally, trade liberalization enlarges the market for local products and increases competition for domestic producers where market enlargement provide incentive to most efficient producers and

from either side or even simultaneously from both sides. In the presence of up-front fixed cost of importing which is sunk in nature, only more productive firms enter into international market for the purchase of capital goods from the forefront of knowledge and technology (Vogel and Wagner, 2010). This implies that causality run from productivity to importing—self-selection of more productive firms for importing. This controversy on theoretical front motivated many researchers to investigate this nexus empirically using firm level data.

With increasing recognition of heterogeneity of firms across industries and better availability of micro data, a growing body of plant level studies started investigation on the contribution of imported inputs in the productivity process of firms. Most studies document a positive and statistically significant relationship between capital goods imports and productivity of firms. However, the evidence on direction of causality remains inconclusive. For instance, Vogel and Wagner (2010), Castellani et al (2010), and Kugler and Verhoogen (2009) substantiate the fact that causality runs from productivity to importing—self-selection of more productive firms into importing. In contrast, vast majority of studies document evidence for the hypothesis that causality run from importing to productivity—learning effects of importing on productivity (see for example, Hasan, 2002; Amiti & Konings, 2007; Andersson et al., 2008; Kasahara & Lapham, 2013; Goldberg et al., 2010; Topalova & Khandelwal, 2011; Habiyaremye, 2013; Helpern et al., 2015; Nyantakyi & Munemo, 2017; Rijesh, 2015; Yu & Li, 2014). However, the magnitude of the productive impact of imported capital varies strongly in different studies on emerging and developing countries. This variation in results of

competition discourage the least productive firms, and force inefficient firms to quiet the market. This reallocation of firms in an industry is due to the heterogeneity of firms in term of productivity and international trade increases the average productivity of the industry. This is an additional channel through which trade liberalization contribute to the aggregate productivity growth assuming heterogeneity of firms in an industry (Melitz, 2003)

existing empirical literature gives a caveat for the generalization of the results and suggests further investigation.

The optimistic view about the contribution of imported inputs in the productivity performance of firms operating in developing countries has been challenged on the ground of scarcity of skills labor. It is argued that cross country productivity differentials are attributed to technology-skills mismatch. The shortage of skilled labor in developing countries put limit on the contribution of inputs trade liberalization to productivity growth (Acemoglu and Zilibotti, 2001). In the free trade regime, ideas, and technology embodied in imported capital goods can rapidly flow from technological developed north to under develop south. However, technology adaptation requires tacit knowledge, skill, and human capital which is scarce particularly in the least developed countries (Evenson and Westphal, 1995). Besides skills labor, firm ability to recognized, exploit and absorb knowledge from environment— known as absorptive capacity—depends upon in house R & D effort of a firm, and human capital accumulation (Cohen and Levinthal, 1989). Similarly, some studies argue that productivity differential across countries also reflects in managerial capabilities of firms which complemented productivity outcomes (Bloom et al., 2017).

With this background, this study investigates the effects of imported inputs on the productivity of firms in four largest South Asian economies. Despite the untapped potential in the form of cheap labor, export competitiveness remain low throughout the region and domestic demand remains the main driver for the growth. Received literature on the subject document that productivity growth is most viable source for sustaining competitiveness in the long run (Porter, 1990). Yet, only few studies investigate the impact of inputs trade liberalization measured in terms of reduction in tariff rate on firm level productivity in India. For instance, Goldberg et al. (2010), Topalova and

Khandelwal (2011) find the evidence for the positive effect of input trade liberalization on the productivity of Indian manufacturing firms. However, the issue is not examined with potential, which appeals for further investigation. In this context, this study tries to uncover the matter with its full length. The following reasons may justify why. First, instead of using tariff reduction, this study investigates the effect of imported inputs on the productivity of manufacturing firms in four largest South Asian economies namely Pakistan, India, Bangladesh and Seri Lanka[20]. Along with imported inputs, this study also investigates the effects of imported technology on the productivity of firms. Second, the study also explores the complementary role of firms' capabilities—firm level human capital accumulation and R & D expenditure, and managerial capability —in import-productivity nexus. According to the best of our knowledge, there is no study that investigates the complementary role of firms' capabilities in import-productivity nexus. Third, there is an issue of endogeneity due to the self-selection of more productive firm in importing. We use alternative estimation techniques to handle the potential endogeneity due to the self-selection

Hence, the study intends to extend literature on the following;

1 To assess the effects of imported inputs on the productivity of firms in the selected sample
2 To explore the complementary role firm capabilities in import-productivity nexus.

[20] In selected countries, the manufacturing sector is vibrant and plays an important role in the growth and development as compare to other South Asian economies such as Afghanistan, Bhutan, Nepal, and Maldives.

3.2 Review of the Relevant Literature

The idea that imported inputs variety contributes to productivity growth goes back to earlier trade models such as Ethier (1982), and Markusen (1989) which emphasize the higher quality, lower cost, and access to improved technology associated with the imported inputs. Another strand of literature provides additional channels such as transmission and diffusion of knowledge (Coe & Helpman, 1995; Coe et al., 1997; Keller, 2002), and inputs complementarity as a result of imperfect substitutions across intermediate inputs (Feenstra, 1994; Caselli & Wilson, 2004; Broda & Weinstein, 2006, Jones, 2011). Acharya and Keller (2009) assess the impact of technology transfer through the import of capital goods on productivity growth in industrialized countries using industry level data. Study finds the evidence for technological spillover across trading partners in advance industrialized countries. Similarly, the availability of plant level data has motivated many researchers to investigate the firms' decision to import intermediate inputs and machinery and resulted in the productivity variations across firms. Many studies document positive effects of imported inputs on the firm's productivity. For instance, Hassan (2002) finds the positive and statistically significant impact of capital goods imports on the firms' productivity in the Indian manufacturing sector. Moreover, the study also finds that the productive impact of technology adaptation through capital goods imports is higher than domestic R & D effort and new domestic capital goods. Amiti and Konings (2007) investigated the impact of inputs trade liberalization on the productivity of firms using the plant level data of Indonesia. Overall results of the study support the claim that input trade liberalization positively contributes to firm level productivity in Indonesia. Similarly, Topalova and Khandelwal (2011) find the evidence for the positive contribution of inputs trade liberalization to the productivity growth using firm level data of India. Vogel and Wagner (2010)

document the evidence for the productive impact of imported inputs using the firm level data of manufacturing sector in Germany. Hu et al. (2005) investigate the effects of imported technology, domestic R & D, FDI inflows on the productivity of Chinese firms using plant level data. Study find that domestic R & D effort complement the productive impact of imported technology in selected chines firms. Goldberg et al. (2010) examine the productive impact of imported inputs on firms' productivity by using the plant level data of India. The results of the study substantiate the fact that inputs trade liberalization positively contributes to firm-level productivity in case of the India. Halpern et al. (2015) investigate the effects of imported inputs on firm-level productivity by disentangling the distinct channels through which imported inputs contribute to productivity growth. Study use plant level data of Hungary and find that one third of productive impact is due to the imperfect substitution between domestic and foreign inputs. Moreover, one quarter of the productivity growth during the selected period is attributed to the imported inputs. Gopinath and Neiman (2014) developed a theoretical model of trade in intermediate inputs with heterogeneous firms, the fixed cost associated with imports, and predict that import price shock deteriorate the firms productivity. Caselli (2018) investigate the link between importing activities and productivity of firms using the plant-level data of the Mexican manufacturing sector. The study finds the evidence for learning through importing hypostasis. However, the productive impact of capital goods import is higher than the intermediate inputs import. Kugler and Verhoogen (2009) argue that the quality of imported inputs is higher than domestically produced inputs which in turn contribute to productivity growth especially in the developing countries like Colombia. Yahmed and Dougherty (2017) uncover the role of domestic market regulation in enhancing the positive contribution of import penetration in firm-level productivity growth in OECD economies. The study

documents the positive and statistically significant impact of import penetration on firm-level productivity growth in economies close to the technological frontier and practicing less stringent domestic regulation. Elliott et al. (2016) investigate the effects of importing on productivity growth using the plant-level data of Chinese firms. The findings of the study support the hypothesis of self-selection of productive into the international market but once a firm starts importing it experience learning by importing and significant productivity gain. Yasar and Paul (2008) investigate the impact of technology transfer through importing and exporting on firm level productivity in Turkey. The empirical findings of the study provide strong evidence for the technology transfer through importing and exporting and resulted in productivity growth in Turkish manufacturing firms. Forlani (2017) investigates the link between imported inputs and productivity growth using firm-level data of Ireland. Overall results support the claims that imported inputs contribute to the firm level productivity in Ireland. However, these results are sensitive to the initial level of productivity. Gibson and Graciano (2018) argue that along with self-selection of productive firm into importing, technology spillover associated with imported inputs also contributes to productivity growth. The theoretical model also predicts that imported input is associate with the technology efficiency along with the self-selection hypothesis. Habiyaremye (2013) examines the effects of capital goods import on the productivity growth using plant-level data of manufacturing firms in Botswana. The results of the study substantiate that capital goods import affect firm productivity with 1-2 years lag. Van den Berg and Van Marrewijk (2017) document the evidence that the productive impact of capital good import is higher than unskilled labor intensive import. Nyantakyi and Munemo (2017) investigate the effect of capital goods import on productivity growth using the firm-level data of three economies of Sub- Saharan Africa. Empirical findings of the study

support the claim that capital goods imports contribute to productivity growth by filling the technology gap in selected countries.

Although, the above studies document the evidence for the productive impact of imported inputs on firm-level productivity. However, the magnitude of the productive impact of imported capital varies strongly in different studies on different countries. This variation in the results of existing empirical literature gives a caveat for the generalization of results and suggests further investigation. In a seminal work, Cohen and Levinthal (1989) argue that R & D of the firm has a dual role, on one side it obviously generate invention and innovation but it simultaneously enhance the firms' ability to recognized, exploit and absorb knowledge from the environment—known as absorptive capacity of firm. Along with local R & D, human capital also increases the absorptive capacity and speed up the diffusion of technology (Nelson & Phelps, 1966; Abramovitz, 1986; Keller, 1996). Most recently, some studies extend the role of absorptive capacity to the firm level analyses of capital goods import and productivity growth. For example, Yasar (2013) find that absorptive capacity— measure in term of the share of the skilled workers in a firm— positively moderates the impact of imported goods on firms' productivity in China. Similarly, Augier et al. (2013) used the share of skilled labor and R&D of the firm to measure the absorptive capacity and find the evidence for complementary role of absorptive capacity in Import- productivity nexus in Spain. Similar findings are documented by the Foster-McGregor, Isaksson, and Kaulich (2016), and Okafor et al. (2017) for nineteen sub-Saharan African and Ghanaian firms respectively. However, there is hardly any study that explores the complementary role of the capabilities of firms in Import- productivity nexus in selected South Asian economies. Hence, this consequent study explores the

complementary role of absorptive capacity of firms in Import- productivity nexus in selected South Asian economies.

3.3 Methodology

3.3.1 Theoretical Framework

As stated earlier, the key objective of this study is to investigate the effects of imported inputs on firm-level productivity. This section of study presents the theoretical underpinning for the role of imported inputs in firm-level productivity. To this end, Griliches (1979) provides a framework that can be used both at a micro and macro level in which production function is given as[21]

$$y_j = A(r\_d_j)F(k_i, l_i) \qquad (1)$$

Where $y_j$is output of firm j, A is total factor productivity, r_d_j is research and development expenditure by firm, k_i and l_i are the conventional inputs. In line with the Lucas (1988), equation (1) can be written as

$$y_j = A(r\_d_j\, h_j)F(k_i, l_i) \qquad (2)$$

Where $h_j$is the firm level human capital accumulation of firm j. Rivera-batiz and Romer (1991) developed a model in endogenous growth framework that predicts productivity growth in trade partner on account of flows of ideas along with traded goods. Co & Helpman (1995) document the evidence for the knowledge spillover and resulted aggregate productivity growth across trading partners in OECD economies. Co

[21] Arrow (1962) emphasize on role of learning by doing through physical capital accumulation in productivity growth. In his model output of firm j appears as $y_j = A(K)F(k_j\, l_j)$ where K is aggregate physical capital accumulation. Lucas (1988) constructs a model on similar lines where knowledge spillover through human capital accumulation instead of physical capital accumulation contributes to productivity growth. In his framework, output of firm j appears as $y_j = A(H)F(k_j\, l_j)$ where H is aggregate human capital accumulation. Romer (1986) by borrowing the idea from Griliches (1979), and Arrow (1962) construct a model as $y_j = A(R)F(k_j\, l_j\, R_j)$ where R is aggregate R & D expenditure and R_j is R & D expenditure by firm j

et al (1997) document similar evidence for the north-south trade. Similarly, Eaton and Kortum (2001) find the evidence for the knowledge spillover through capital goods imports and resulted productivity growth in developing countries. Ethier (1982), and Markusen (1989) provides another channel by arguing that imported inputs are associated with higher quality and improved technology which in turn contribute to productivity growth. Another strand of literature emphasizes on inputs complementarity due to imperfect substitutions across intermediate inputs as a result imported inputs amplify productivity growth especially in developing countries (see for instance, Feenstra, 1994; Caselli & Wilson,2004; Broda & Weinstein, 2006, Jones, 2011). Hence, by incorporating the role of imported inputs in equation (2), production function appears as

$$y_j = A(r\_d_j\ h_j\ imp_j)F(k_i, l_i) \qquad (3)$$

Where imp_j is imported inputs of firm j . Now we can disentangle total factor productivity as

$$\theta_j = (r\_d_j\ h_j\ imp_j) \qquad (4)$$

Where $\theta_i$is the total factor productivity of firm j. In Cobb-Douglas specification equation (4) appear as

$$\theta_j = \quad r\_d^{\alpha}\ h^{\beta}\ imp^{\gamma} \qquad (5)$$

We can transform the equation (5) into log linear form by taking natural log on both sides

$$ln\theta_j = \quad \alpha \ln r\_d + \ \beta lnh + \ \gamma\ lnimp \qquad (6)$$

Differentiating the above equation with respect to time give us the growth rate of total factor productivity of firm j

$$\frac{\dot{\theta}}{\theta} = \ \alpha \frac{\dot{r\_d}}{r\_d} + \beta \frac{\dot{h}}{h} + \gamma \frac{\dot{imp}}{imp} \qquad (7)$$

Where, γ is the elasticity of output with respect to imported capital (imported technology) i.e.

$$\gamma = \frac{\partial \log Y}{\partial \log imp} = \frac{\partial Y}{\partial imp} . \frac{imp}{Y}$$

Eq. (7) implies that the imported capital acquires holistic approach, which postulates that apart from conventional factors, growth of TFP also explained by imported capital. Its elasticity magnitude depends on its type and firms' absorptive capacity.

3.3.2 Complementarities between imported inputs and firms' capabilities

Nelson and Phelps (1996) argue that human capital accumulation increases ease and speed of the technology adaptation process which amplify aggregate productivity growth. Benhabib and Spiegel (1994) use similar approach for the cross-country convergence in which human capital facilitates diffusion of knowledge form the developed north to the developing south. Similarly, Cohen and Levinthal (1989) argue that R & D of firm has dual role, on one side it obviously generate invention and innovation but it simultaneously enhance the firms' ability to recognized, exploit and absorb knowledge from environment—known as absorptive capacity of firm. Hence, by incorporating the role of absorptive capacity the firm productivity can be expressed as

$$\theta_j = g_j\left(r\_d_j\ h_j\ Imp_j\right) + \varphi_j(r\_d_j\ h_j\ )Imp_j \qquad g'(.) > 0, \quad \varphi'(.) > 0 \qquad (8)$$

Where $g\left(r\_d_j\ h_j\ Imp_j\right)$ is endogenous productivity growth while $\varphi_j(r\_d_j\ h_j\ )$ is the absorptive capacity of firms' that depends on the internal R & D effort of firm and firm-level human capital accumulation. Eq. (8) indicates that both the coefficient of absorptive capacity φ_j and the endogenous productivity growth $g(r\_d_j\ h_j)$ are a non-decreasing function of $'h'$ and 'r_d'. Therefore, an increase in the level of firm-level human capital and internal R & D of firms will not only directly contribute to productivity growth but also indirectly contributes to total factor productivity by increasing the firms' ability to recognized, exploit and the absorb knowledge that embodies in imported inputs.

3.4 Econometric Methodology

In order to estimate the effects of imported inputs on firm level productivity, I assume that the production process follows the Cobb-Douglas technology. Hence, log linear transform model appear as

$$y_j = x_j\beta + v_j - \mu_j \quad j = 1,2,\dots,N \qquad (1)$$

Where $y_i$is the log of output, x_j is the vector of inputs and β is a vector of unknown parameters and N is the total number of firms in the sample. The v_j is the purely random error term while μ_j is the unobserved total factor productivity or technical inefficiency. The $\mu_j$represent some factors that affect the productivity of firms and can observable to firms while making decisions regarding the choice of inputs. This productivity shock (μ_j) in the model creates an issue of endogeneity and make least square estimates biased and inconsistent. Hence, to avoid the problem of endogeneity, two alternative techniques are implemented

3.4.1 Stochastic Frontier Estimation

The stochastic frontier approach to estimate total factor productivity use separate distributional assumption for the observable productivity ω_i to disentangle it from the deterministic part and stochastic shock μ_j (Biesebroeck, 2007). Stochastic frontier literature uses the negative of half-normal distribution and truncated normal distribution for the unobserved productivity shock (See, Aigner et al., 1977; Meeusen and van den Broeck, 1977; Stevenson, 1980). This method is based on the maximum likelihood estimation and primarily devised for the cross-sectional data. In line with Kumbhakar & Wang (2015), and Parmeter et al. (2019), we can specify equation (1) as stochastic frontier production function

$$y_j = x_j\beta + v_j - s\mu_j \quad j = 1,2,\dots,N \qquad (1)$$

$$where\ s = \begin{cases} 1, & for\ production\ functions \\ -1, & for\ cost\ fucntions \end{cases}$$

The v_j the random error term which is normally distributed. However, μ_j is unobserved productivity shock or technical efficiency and stochastic frontier models mostly use the half normal distribution ($N^+(0, {\sigma^2}_\mu)$), and truncated normal distribution ($N^+(\mu, {\sigma^2}_\mu)$) for μ_j.

The log-likelihood function for half-normal model can be written as

$$lnL = \sum_{i=1}^{N} \left\{ \frac{1}{2} ln \frac{2}{\pi} - ln\sigma s + ln\Phi\left(-\frac{s\epsilon_j \lambda}{\sigma s}\right) - \frac{{\epsilon^2}_j}{2\sigma^2 s} \right\}$$

and truncated-normal model

$$lnL = \sum_{i=1}^{N} \left\{ -\frac{1}{2}\ln(2\pi) - ln\sigma_s - ln\Phi\left(-\frac{\mu}{\sigma s\sqrt{\gamma}}\right) + ln\Phi\left[\frac{(1-\gamma)\mu - s\gamma\epsilon_j}{\{\sigma^2 s\gamma(1-\gamma)\}^{1/2}}\right] - \frac{1}{2}\left(\frac{\epsilon_j + s\mu}{\sigma s}\right)^2 \right\}$$

$where\ \sigma_s = ({\sigma^2}_\mu + {\sigma^2}_v\ )^{\frac{1}{2}}, \lambda = \frac{\sigma_\mu}{\sigma_v}, \gamma = \frac{{\sigma^2}_\mu}{{\sigma^2}_s}, \epsilon_j = v_j - \mu_j, and\ \Phi()$ is the cumulative distribution function.

Traditionally, empirical work follow two steps approach where first stage estimate stochastic frontier model while in second stage total factor productivity is regressed on the exogenous factors. However, Wang and Schmidt (2002), Chapelle and Plane (2005), Schmidt (2011) argue that one step approach can provide unbiased and consistent results. Hence, for robustness of our analyses, we also use one step stochastic frontier model.

3.4.2 Non-parametric Approach

In line with the Hall (1990), and Seker and Saliola (2018), we also use the non-parametric approach to calculate the total productivity of firms. In non-parametric approach, we separately calculate the elasticity of each input as ratio of each input cost to the total cost of all factors. Hence, elasticity of each input is calculates as follow

$$\widehat{\gamma_1} = \frac{\mathrm{rK}}{\mathrm{rK+wL+pM}}, \widehat{\gamma_2} = \frac{\mathrm{wL}}{\mathrm{rK+wL+pM}}, \widehat{\gamma_3} = \frac{\mathrm{pM}}{\mathrm{rK+wL+pM}} \qquad (2)$$

Where $\widehat{\gamma_1}$, $\widehat{\gamma_2}$, and $\widehat{\gamma_3}$ basically the output elasticity of capital, labor and intermediate material while rK, wL, and pM are the total annual cost of capital, labor and intermediate material. We estimate the output elasticity of each factor as specified in equation (4) and then estimate total factor productivity as residual.

3.4.3 Second Stage Estimation

We estimate the plant level total factor productivity (θ_j) with above mention techniques and in second step estimate the effect of imported inputs on the total factor productivity.

$$tfp_j = \beta_0 + \beta_1 r\_d_j + \beta_2 h_j + \beta_3 m_j + \sum_{i=1}^{n} \alpha_i x + \mu_j \qquad (3)$$

Where $\theta_j$is total factor productivity of firm j, r_d_j is the research and development expenditure, h_j is human capital and $m_j$is the imported capital of firm j. The summation term $\sum_{i=1}^{n} \alpha_i x$ reflects the set of firms specific and others control variables. To disentangle the indirect effect of firm-level human capital, firms' management capability, and internal R & D on productivity of firms, I incorporate the interactive term of firm capabilities (F_C) and imported inputs (m) in equation (3)

$$tfp_j = \beta_0 + \beta_1 IMP_j + \beta_2 F\_C_j * IMP_j + \sum_{i=1}^{n} \alpha_i x + \mu_j \quad (4)$$

Where tfp_j is the total factor productivity of the firm j is, is the log of labor and capital while IMP_j is the imported inputs used by firm j. The term $F\_C_j * IMP_j$ represent the interaction of firm capability of firm j with imported inputs. X is set of firm specific control variables which include age of the firm and firms' access to credit. The equations for alternative empirical specifications are available in appendix B

3.4.4 Problem of Endogeneity

There is a possibility that more productive firm self-select into importing or more productive firm use imported inputs as results imported inputs are endogenous and OLS estimates of firms' total factor productivity provides biased and inconsistent results. Hence, to avoid any potential endogeneity, this study use two stages least square, and endogenous treatment based on the control-function approach. However, Bun and Harrison (2019) argue that in the presence endogenous interactive term, OLS estimates are unbiased and consistent and standard inference is applicable to the parameter of interest. The empirical model for total factor productivity includes many interactive terms of firm capabilities and imported inputs, hence OLS is also appropriate strategy estimation strategy. In order to control for the potential endogeneity, we also employ the two stages least square for the estimation of the productive impact of imported inputs. We use the foreign ownership (F_OWN), exporting status, and experience of the manger in the industrialized country as instruments (M_EXP). For the robustness of our analyses, we also employ the endogenous treatment with control function to estimate the productive impact of importing on total factor productivity.

3.4.5 Data and Description of Variables

This study is based on the data of Enterprise Survey of World Bank for manufacturing firms of four largest South Asian economies. The enterprise level survey of World Bank provides suitable setting to test the productive impact of imported inputs and imported technology while simultaneously exploring the role of firms' capabilities. This is a unique data set that provides rich information on firms' sale, conventional inputs, imported inputs and firm capabilities such as R & D expenditure, human capital accumulation and manager experience at enterprise level. The survey data is available for year 2013 in case of Pakistan and Bangladesh while in case of India it is available

for 2014 and for Sri Lanka data is available for 2011. We assume that there are no structural and behavioral changes in four years across countries.

3.4.6 Variables of the study

Our dependent variable is total factor productivity, and we estimate it using three alternative techniques. We also use the log of value added as proxy for the productivity of firms. The main variable of interest in this study is imported inputs, and it is measured as the ratio of imported inputs in total annual purchase of material inputs and supplies. We also use dummy variable equal to one if firm import either directly or indirectly. Along with imported input, this study also use the dummy variable to capture the effect of imported technology on total factor productivity. Second important aspect of this study is the use of firms' capabilities to capture the interactive effect of imported inputs on the total factor productivity. The firms' capabilities are captured through R & D expenditure and human capital accumulation at firm level. We use skills labor, education level of workers, and formal training to employees as proxies for the human capital. Similarly, managerial capabilities of firms is captured by using the proxy of managers' experience. In addition to these variables, this study also use some firm specific control variables such as size, age, and foreign ownership of firms. Table B1 in appendix B provides detailed description of variables taken from the survey for empirical analysis.

3.4.7 Empirical Findings and Discussions

Table 1 reports the results of the stochastic frontier model based on one step approach. The first specification in column (1) shows the results of baseline regression where both conventional inputs labor and capital are significant at a one percent level

of significance with a positive sign. However, the ratio of variance (λ) shows that the productivity of firms is explained by μ_j which is assumed to account for technical inefficiency. We cannot accept the null hypothesis of no technical efficiency at 10 percent level of significance of the likelihood ratio test proposed by Kumbhakar and Wang (2015) which also confirm technically inefficiency in our model. The second speciation of our empirical model in column (2) includes imported inputs along with conventional inputs in our baseline regression equation. The results show that labor, capital, and imported inputs enter into model significantly with a positive sign. The ratio of variance (λ) reflects the higher share of μ_j which is assumed to account for the technical inefficiency. Moreover, the likelihood ratio test confirms technical inefficiency in our model. In column (3), we include the share of skilled labor (SH) as additional variable and add an interactive term of share of skilled labor and imported inputs (IMP*SH) to explore the role of firms' capabilities in import productivity nexus. The results reveal that share of skills labor (SH) and its interaction with imported inputs (IMP*SH) are both statistically significant with a positive sign. These results support the hypothesis that firms' capabilities in term of higher the share of skilled labor increases the productive impact of imported inputs.

Table 6: Stochastic Frontier Model

	Dependent Variable: Firms' Output						
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**
Frontier							
L	0.883***	0.887***	0.886***	0.874***	0.869***	0.877***	0.887***
	(0.0163)	(0.0165)	(0.0166)	(0.0166)	(0.0168)	(0.0167)	(0.0166)
K	0.301***	0.280***	0.280***	0.269***	0.272***	0.279***	0.280***
	(0.0102)	(0.0109)	(0.0110)	(0.0109)	(0.0110)	(0.0109)	(0.0110)
IMP		0.0042***	0.00723**	0.0112**	0.00526***	0.00423***	0.00444***
		(0.00733)	(0.00236)	(0.00388)	(0.000968)	(0.000834)	(0.00096)
WS			0.150**				
			(0.0658)				
IMP*SH			0.0460**				
			(0.0208)				
ED				0.465***			
				(0.0578)			
IMP*ED				0.0430**			
				(0.0185)			
TR					0.189***		
					(0.0383)		
IMP*TR					0.0295*		
					(0.140)		
RD						0.147***	
						(0.0393)	
IMP*RD						0.0171	
						(0.00160)	
MN							0.0816**
							(0.0365)
IMP*MN							0.0973***
							(0.0141)
_cons	9.71***	7.933***	4.03***	3.151***	3.05***	3.941***	3.944***
	(.1585)	(0.164)	(0.171)	(0.198)	(0.165)	(0.164)	(0.165)
efficiency							
size			0.775***	0.751***	0.766***	0.785***	0.804***
			(0.0765)	(0.0781)	(0.0762)	(0.0764)	(0.0756)
age			0.0241*	0.0450	0.0127	0.0286	0.0219
			(0.0130)	(0.0298)	(0.0290)	(0.0306)	(0.0297)
credit			0.532***	0.529***	0.499***	0.540***	0.539***
			(0.0945)	(0.0921)	(0.0914)	(0.0922)	(0.0915)
$\lambda = \frac{\sigma^2_u}{\sigma^2}$	0.71	0.65	0.325	0.375	0.378	0.372	0.376
Test for inefficiency	4.427***	3.687***	1.12	0.982	1.32	1.54	1.34
N	7496	7496	7496	7496	7496	7496	7496

Standard errors in parentheses while * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

This result is consistent with predictions of Acemoglu and Zilibotti (2001), who claim that despite the import trade liberalization skills technology mismatch impedes productivity growth in developing countries. This is evident from the fact that the coefficient of an interactive term is higher than the coefficient of imported inputs that implies complementarity between the imported input and skills labor in explaining firm productivity. We also include some exogenous explanatory variables size, age and access to credit as a function of total factor productivity or efficiency in the third specification of the stochastic frontier model in column (3). All three variables enter in model with expecting positive sign and statistically significant at 1 percent level of significance except age that is significant at a 10 percent level of significance. In column (4), we replace the share of skills workers (SH) with another proxy of human capital the education of workers (ED) and also includes an interactive term of education of workers and imported inputs (IMP*ED). The results reported in column (4) show that education of workers (ED) is statistically significant at 1 percent level of significance with positive sign. However, the interactive term of imported input and education of workers (IMP*ED) is statistically significant at 10 percent level of significance. The coefficient of the interactive term (IMP*ED) is higher than the coefficient of imported inputs (IMP) which again support the claim that firms' capabilities in term of education of workers (ED) increase the productive impact of imported inputs. All control variables such as labor and capital, size and access to credit are statistically significant except the age of firm that is statistically insignificant. In column (5), we replace the education of workers (ED) with training to workers (TR). The training to the workers (TR) is statistically significant at 1 percent level while the interactive term of training to workers and imported inputs (IMP*TR) is statistically insignificant even at 10 percent level with a positive sign. This result is unexpected

because formal training to workers increases firm level human capital which increases the firm capabilities. This insignificant result might be due to the selection of firms in our sample that do not engage in formal training to workers. The column (6) and column (7) of table 1 include the R&D expenditure of firms (RD) and management capability of firms (MN) with their respective interactive terms with imported inputs. The results show that both R& D expenditure (RD) and management capability (MN) of firms are statistically significant. The interactive term of R& D expenditure and management capability with imported inputs also statistically significant. This result also provides evidence for the complementarity between imported inputs and firms' capabilities.

We also employ two step approach for the estimation of the effects of imported inputs on total factor productivity. In the first step, we estimate the total factor productivity by using the stochastic frontier approach, and non-parametric approach while the second step links imported inputs and exogenous variables with the total factor productivity. Bun and Harrison (2019) argue that in the presence interactive term of the endogenous variable with some exogenous covariate in the regression equation, OLS estimates are unbiased and consistent and standard inference is applicable to the parameter of interest. Hence, we estimate the effects of imported input (IMP) on total factor productivity using OLS. Table 2 reports the results of OLS estimates of the effect of imported inputs on total factor productivity.

Table 7: OLS estimates of effects of imported inputs on total factor productivity

Dependent variable: Total Factor Productivity (stochastic frontier approach)					
	(1)	**(2)**	**(3)**	**(4)**	**(5)**
age	0.0840*	0.0631	0.0514	0.0878*	0.0841*
	(0.0419)	(0.0409)	(0.0407)	(0.0416)	(0.0414)
credit	0.350***	0.204***	0.244***	0.295***	0.249***
	(0.0947)	(0.0931)	(0.0922)	(0.0945)	(0.0942)
IMP	0.224***	0.110***	0.281***	0.622***	0.613***
	(0.055)	(0.079)	(0.033)	(0.018)	(0.012)
SH	0.0476**				
	(0.024)	-------	-------	--------	---------
IMP*SH	0.614**				
	(0.325)		--------	--------	
EDU		0.370***	---------	---------	--------
	--------	(0.020)	---------	---------	---------
IMP*EDU	---------	0.619**			---------
	---------	(0.217)	------		
W_TR			0.772***	--------	--------
	--------	--------	(0.0683)	---------	---------
IMP*W_TR	---------	---------	0.438**	---------	---------
	---------	---------	(0.166)		
MN				0.320***	--------
	--------	--------	--------	(0.0699)	---------
IMP*MN	---------	---------	---------	0.519**	---------
	---------	---------	---------	(0.160)	
RD				--------	0.419***
	--------	--------	--------	---------	(0.0747)
IMP*RD	---------	---------	---------	---------	0.570**
	---------	---------	---------		(0.161)
_cons	3.00***	4.03***	6.78***	6.85***	6.35***
	(0.148)	(0.288)	(0.123)	(0.127)	(0.126)
N	7496	7496	7496	7496	7496
R^2	0.517	0.464	0.458	0.528	0.559

Heteroskedasticity-robust standard errors in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

The results reported in column (1) of table 2 show that imported inputs (IMP) positively explain the total factor productivity and statistically significant at 1 percent level of significance. In order to investigate the role of skills workers, we incorporate the interactive term of the share of skills workers and imported input (IMP*SH) in our regression equation. The result shows that the share of skills workers increases the productive impact of imported inputs. This is evident from the fact that the coefficient

of the interactive term (IMP*SH) is higher than the coefficient of imported inputs. This result substantiates the complementarities between share of skills workers and imported inputs. These results are consistent with the existing literature (Acemoglu and Zilibotti, 2001; Yasar, 2013). The control variables in the empirical model such as the age of the firm, access to credit, and share of skills workers (SH) are statically significant with a positive sign. In specification (2) of table 2, we add the interactive term of imported input and education of workers (IMP*EDU) to test the complementarity between firm level human capital accumulation and imported inputs. The interactive term of imported inputs and education of workers (IMP*EDU) is statistically significant with a positive sign. This result substantiates the claim that there exists a complementarity between firm level human capital accumulation and imported inputs. This result is also consistent with existing theoretical and empirical literature. For instance, Nelson and Phelps (1996) argue that human capital accumulation increases the ease and speed of the technology adaptation process which amplifies aggregate productivity growth. The imported inputs and education of workers are also statistically significant with a positive sign. The control variable of access to credit is statistically significant at 1 percent level of significance. However, the age of the firm is statistically insignificant with a positive sign. Foster-McGregor et al. (2016) document similar results where age is insignificant in some specifications. In column (3) to column (5) in table 2, we replace the interactive terms of imported inputs and workers training by firms (IMP*W_TR), imported inputs and management capability of the firm (IMP*MN), and imported inputs and R & D expenditure by firms (IMP*RD) respectively.

The results reported in table 2 show that these interactive terms are statistically significant with a positive sign. These results validate the argument that firms' capabilities in terms of workers' training, management, and R & D expenditure

complement the imported inputs. These results are consistent with existing literature. For instance, Cohen and Levinthal (1989) argue that R & D expenditure and human capital accumulation through education and formal training enhance the firms' ability to recognized, exploit and absorb knowledge from the environment and increases the overall productivity of firms. Similarly, Bloom et al. (2017) argue that managerial capability of the firm is complementary in supporting productivity outcomes. Along with the stochastic frontier model, this study also estimates the total factor productivity through non- parametric approach. Table A2 in Appendix A reports the results of the effect of imported inputs on total factor productivity estimated through the non-parametric approach. Overall results are qualitatively similar across all specifications (column (1) to column (5)) but quantitatively different in the sense that the magnitude of coefficients differ with the results of our previous estimation where the dependent variable is total factor productivity estimated through the stochastic frontier model.

For the robustness of our results, we also employ the Two Stages Least Square to estimate the effects of imported inputs on total factor productivity. The results of IV/2SLS are reported in Table A3 of Appendix A. We use the foreign ownership (F_OWN), and exporting the status of a firm as instruments for imported inputs. The over-identification restrictions are tested by using the Sargan's (1958) test. For all specifications from column (1) to column (5) p value of Sargan's test reflects the validity of instruments. The imported inputs enter in all empirical specifications from column (1) to column (5) with statistically significant positive signs. Similarly, interactive terms of imported inputs and firms' capabilities such as share of skills workers (SH), education of workers (EDU), training to the workers (TR), management capability of firms (MN), and internal R & D expenditure of firms are statically significant with positive signs. These results confirm the complementarities between

imported inputs and firms' capabilities. Overall results are robust to the IV/2SLS estimation technique. We also investigate the productive impact of imported technology along with imported inputs. To avoid any possibility of endogeneity, we use the control function approach for endogenous treatment as the estimation technique. The results of endogenous treatments are reported in Table A4 in Appendix A. The results in column (1) and column (2) reflect that average treatment effect (ATE) of imported technology leads to an increase of 17 percent in total factor productivity while imported inputs increase total factor productivity by 6 percent. Similarly, average treatment effect on treated (ATET) also shows that the quantitative impact of imported technology is higher than imported inputs. In column (3) and column (4), we replace the total factor productivity estimated through the stochastic frontier model to total factor productivity estimated through the Non-parametric approach. Both the average treatment effect (ATE) and average treatment effect at treated (ATER) reflect that the quantitative impact of imported technology is higher than imported inputs in selected South Asian countries.

3.5 Conclusion

Firms operating in the four largest economies of the South Asia are relatively less competitive in the international market, despite untapped potential in the form of cheap labor. Certainly, productivity growth is the most viable source for sustaining competitiveness in the long run. In this context, the study investigates that how much imported inputs prove beneficial to the productivity performance of firms operating in these four South Asian economies. Moreover, the study also tests the complementarity between firms' capabilities and imported inputs in augmenting productivity performance. To come across objectives of the study, we use the data of manufacturing firms operating in four largest South Asian countries. The empirical estimation is

carried out with the Stochastic Frontier Model, Ordinary Least Square and Instrument Variable approach for estimation of the productive impact of imported inputs on total factor productivity.

The findings of the study reveal that imported inputs have the positive and statistically significant impact on the productivity of firms operating in selected South Asian countries. This result is robust across different specifications of the empirical models and different estimation techniques. We further consider the role of firms' capabilities such as skills the workers, education of the workers, training to the workers, management capability of firms, and internal R&D expenditure of firms in augmenting import productivity nexus. Overall results reveal that there exists a complementarity between imported inputs and firms' capabilities in augmenting total factor productivity of firms operating in selected South Asian countries. We also find that productivity gain form imported technology is higher than imported inputs. These results have important implications particularly for South Asian countries and generally for all developing countries. First, these countries should reduce tariffs on imported inputs to increase access to higher quality foreign inputs. Second, these countries should allocate more resources to education and encourage firms to invest in firms' capabilities such as training to workers, management capability of firm, and internal R &D effort.

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Appendix A

Table A1: Variables and their description

Variables	Description
output (y)	1) Log of the total annual sales of firms 2) Log value added of firm
$labor(l)$	Log of full-time workers. It includes both permanent and temporary workers
capital (k)	Logarithm of the establishment's net book value of machinery, vehicles, and equipment, and land and buildings
age	Logarithm of age of an establishment in a year
raw material and intermediate inputs (M)	Logarithm of total annual cost of raw material and intermediate inputs used in production in a year
R&D (RD)	Dummy if an Establishment spends on R&D activities. Log of ratio of R&D expenditures to employment.
Imported inputs (IMP)	Ratio of imported inputs in total annual purchase of material inputs and/or supplies Dummy variable equal to one if firm import either directly or indirectly
Imported Technology(imp_tech)	Dummy variable equal to one if firm use imported technology
Human Capital (HC)	1) Ratio of skilled production workers to the unskilled production workers 2) Percentage of full-time permanent workers who completed secondary school 3) Dummy variable equal to one if firm have formal training program for it permanent full time employees
Foreign Ownership	Dummy variable equal to unity for establishments that are owned more than 50% by the foreign private sector
Managerial Capability (MN)	1) Experience of top manager in years. 2) Dummy variable equal to one if firm introduces improve management practice
Cost of capital (rK)	Total rental cost of machinery, vehicles, and equipment
Cost of labor (wL)	Total annual cost of labor including wages, salaries and bonuses
Cost of material (pM)	Total annual cost of raw material, and intermediate goods used in production

Table A2: Results of effects of imported inputs on total factor productivity(non-parametric)

	Dependent Variable: Total Factor Productivity(non-parametric approach)				
	(1)	(2)	(3)	(4)	(5)
age	0.117***	0.109**	0.0933**	0.125***	0.119***
	(0.0351)	(0.0347)	(0.0342)	(0.0348)	(0.0348)
credit	0.881***	0.784***	0.780***	0.815***	0.799***
	(0.0795)	(0.0790)	(0.0775)	(0.0790)	(0.0791)
IMP	0.451***	0.145***	0.545***	0.713***	0.700***
	(0.213)	(0.406)	(0.112)	(0.0982)	(0.0851)
SH	0.0622				
	(0.104)				
IMP*SH	0.455*				
	(0.282)				
EDU		0.848***			
		(0.102)			
IMP*EDU		0.600**			
		(0.184)			
W_TR			0.642***		
			(0.0574)		
IMP*W_TR			0.0788		
			(0.139)		
MN				0.334***	
				(0.0585)	
IMP*MN				0.0206	
				(0.133)	
RD					0.362***
					(0.0628)
IMP*RD					0.0896
					(0.135)
_cons	6.87***	5.08***	6.75***	6.78***	6.82***
	(0.124)	(0.244)	(0.103)	(0.107)	(0.106)
N	7496	7496	7496	7496	7496
R^2	0.428	0.446	0.466	0.437	0.439

Heteroskedasticity-robust standard errors in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table A3: IV estimates of effects of imported inputs on total factor productivity

	Dependent variable: Total Factor Productivity(Stochastic Frontier Approach)				
	(1)	(2)	(3)	(4)	(5)
age	-0.411	0.267**	0.0203	0.239***	0.203***
	(0.389)	(0.0837)	(0.0677)	(0.0540)	(0.0457)
credit	0.874**	0.619***	0.641***	0.754***	0.812***
	(0.631)	(0.168)	(0.174)	(0.121)	(0.0996)
IMP	1.288**	1.387**	1.0305**	1.099***	1.056***
	(0.809)	(0.231)	(0.0112)	(0.0246)	(0.0152)
SH	1.072**				
	(0.457)				
IMP*SH	2.213*				
	(0.956)				
EDU		0.768***			
		(0.023)			
IMP*ED		5.314**			
		(1.108)			
TR			0.129		
			(0.0685)		
IMP*TR			2.880***		
			(0.506)		
MN				0.0488	
				(0.102)	
IMP*MN				1.118***	
				(0.245)	
RD					0.392***
					(0.0913)
IMP*RD					1.0692***
					(0.151)
_cons	7.50***	3.459***	7.30***	6.69***	6.71***
	(1.317)	(0.968)	(0.237)	(0.148)	(0.130)
N	7496	7496	7496	7496	7496
R^2	.	.	0.025	.	.
CFI	Yes	Yes	Yes	Yes	Yes
IFE	Yes	Yes	Yes	Yes	Yes
Sargan (p-vaue)	0.314	0.185	0.364	0.271	0.154

Standard errors in parentheses. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table A4: Results of endogenous treatment with control function approach

	Outcome variable: total factor productivity			
	Treatments			
	(1) imported technology	(2) imported inputs	(3) imported technology	(4) imported inputs
ATE	0.1704***	0.0659***	0.1546***	0.0675***
	(0.0374)	(0.0163)	(0.0542)	(0.00962)
ATET	0.1304***	0.0570***	0.1178***	0.0388***
	(0.0474)	(0.00757)	(0.0242)	(0.0091)
N	7496	7496	7496	7496

Robust standard errors in parenthesis. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Appendix B

Equations for different empirical specifications in table 2.

$$tfp_j = \beta_0 + \beta_1 age_j + \beta_2 credit_j + \beta_3 IMP_j + \beta_4 SH_j + \beta_5 SH_j * IMP_j + \mu_j \quad Specefication\ (1)$$

$$tfp_j = \beta_0 + \beta_1 age_j + \beta_2 credit_j + \beta_3 IMP_j + \beta_1 SH_j + \beta_2 EDU_j * IMP_j + \mu_j \quad Specefication\ (2)$$

$$tfp_j = \beta_0 + \beta_1 age_j + \beta_2 credit_j + \beta_3 IMP_j + \beta_1 SH_j + \beta_2 W\_T_j * IMP_j + \mu_j \quad Specefication\ (3)$$

$$tfp_j = \beta_0 + \beta_1 age_j + \beta_2 credit_j + \beta_3 IMP_j + \beta_1 SH_j + \beta_2 W\_TR_j * IMP_j + \mu_j \quad Specefication\ (4)$$

$$tfp_j = \beta_0 + \beta_1 age_j + \beta_2 credit_j + \beta_3 IMP_j + \beta_1 SH_j + \beta_2 MN_j * IMP_j + \mu_j\ Specefication \quad (5)$$

$$tfp_j = \beta_0 + \beta_1 age_j + \beta_2 credit_j + \beta_3 IMP_j + \beta_1 SH_j + \beta_2 RD_j * IMP_j + \mu_j\ Specefication \quad (6)$$

Equations for different empirical specifications in table 1.

$$Output_{jic} = \alpha + \gamma_1 labor + \gamma_2 capital + \delta_1 D_i + \delta_2 D_c + \varepsilon_{jic} \quad (1)$$

$$Output_{jic} = \alpha + \gamma_1 labor_{jic} + \gamma_2 capital_{jic} + \gamma_3 IMP_{jic} + \delta_1 D_i + \delta_2 D_c + \varepsilon_{jic} \quad (2)$$

$$Output_{jic} = \alpha + \gamma_1 labor_{jic} + \gamma_2 capital_{jic} + \gamma_3 IMP_{jic} + \gamma_3 WS_{jic} + \ + \gamma_3 IMP * WS_{jic} + \ \delta_1 D_i + \delta_2 D_c + \varepsilon_{jic} \quad (3)$$

$$Output_{jic} = \alpha + \gamma_1 labor_{jic} + \gamma_2 capital_{jic} + \gamma_3 IMP_{jic} + \gamma_3 EDU_{jic} + \ + \gamma_3 IMP * EDU_{jic} + \ \delta_1 D_i + \delta_2 D_c + \varepsilon_{jic} \quad (4)$$

$$Output_{jic} = \alpha + \gamma_1 labor_{jic} + \gamma_2 capital_{jic} + \gamma_3 IMP_{jic} + \gamma_3 TR_{jic} + \ + \gamma_3 IMP * TR_{jic} + \ \delta_1 D_i + \delta_2 D_c + \varepsilon_{jic} \quad (5)$$

$$Output_{jic} = \alpha + \gamma_1 labor_{jic} + \gamma_2 capital_{jic} + \gamma_3 IMP_{jic} + \gamma_3 RD_{jic} + \ + \gamma_3 IMP * RD_{jic} + \ \delta_1 D_i + \delta_2 D_c + \varepsilon_{jic} \quad (6)$$

$$Output_{jic} = \alpha + \gamma_1 labor_{jic} + \gamma_2 capital_{jic} + \gamma_3 IMP_{jic} + \gamma_3 MN_{jic} + \ + \gamma_3 IMP * MN_{jic} + \ \delta_1 D_i + \delta_2 D_c + \varepsilon_{jic} \quad (7)$$

CHAPTER 4

GLOBAL LINKAGES, INSTITUTIONAL QUALITY AND FIRM-LEVEL INNOVATION

Abstract

Economic globalization has put pressure on firms for competitiveness in domestic as well as international market. Certainly, innovation and continuous upgradation of product is an important driver for international competitiveness. This study uncovers the effects of global linkages of firms on innovations decision using the cross-sectional data of manufacturing firms operating in four largest South Asian economies. Moreover, this study also explores the moderating role of institutional quality in interlinked relationship between global engagement and firm-level innovations. To this end, we construct a composite index of institutional quality by using its three different dimensions the regulatory quality, rule of law and control of corruption.

The overall results substantiate the claim that firms' global linkages strongly affect their innovation decisions. The probe further reveals that institutional environment in which firms are embedded positively moderates the effects of global linkages on firms' level innovations. These results are robust across the different estimation techniques. These results suggest that selected South Asian countries can magnify the gain from global linkages of firms by improving their institutional quality.

4.1 Introduction

Innovation has been recognized as primary driver for the long run growth process and important source of cross-country income differences (Aghion & Howitt, 1992; Howitt, 2000). Industrial innovation provides the main channel through which economies accumulate knowledge which in turn primary source of long run growth

process[22]. Mostly, cross country income differences are attributed to the differences in productivity growth which are largely explained by the innovation. Innovation led growth also embody the Schumpeter's notion of creative destruction—the process by which new innovative products replace older ones— that plays central role in a capitalist economy[23]. In creative destruction process, firms have an incentive to innovate the existing product made by other firms and gain monopoly rent at expense of their competitors. In existing literature, this effect of innovation is known as business-stealing which negatively affects the firms' performance (Aghion & Howitt, 1992; Aghion & Jaravel, 2015; Bloom et al., 2013; Tirole, 1988). However, there is also countervailing knowledge spillover effect associated with innovations which positively affect the firm performance and long run growth process[24].

The link between innovation and international trade is well documented in existing literature. The product cycle model of trade predicts that developed north due to its advantage in human capital accumulation, external economies of scale and social infrastructure always take lead in the introduction of new product and export it to the developing countries. While developing south due it surplus labor force imitate same product with some time lag and export the product to the developed north[25] (Dollar, 1986; Krugman, 1979; Vernon, 1966). Hence, literature based on the product cycle model argues that innovations explain the trade patterns and also major force for the

[22] Romer (1986) and Lucas (1988) argue that knowledge accumulation is underlying source of long run growth process which is endogenous in senses that it is function of the expenditure on R&D, formal and informal education, and spillover from the investment on physical capital as well as human capital. Aghion and Howitt (1992) further argue that formal education, learning by doing, trainings, and industrial innovations are important channels through which economies accumulate the knowledge.

[23] See Schumpeter (1942)

[24] This positive externality of knowledge spillover is generated primary due to the fact that firms build on the each other innovations. Recently, Bloom et al., (2013) proves that knowledge spillover effect quantitatively dominates the business stealing effect by using plant level data of U.S firms.

[25] Krugman (1979) argue that higher real wage, per capita income, and living standard in developed south is primarily attributed to its monopoly rent on innovation. It implies that innovation is important factor that explain cross country income differences.

exports of advance industrialized economies. In contrast, economic growth models with endogenous innovation predict that international trade affects the firms' decision to innovate (Grossman & Helpman, 1991b; Segerstrom et al, 1990). The more liberalize international trade regime enlarges the opportunities for domestic firms by providing access to the international markets which is known as scale effect. This market enlargement makes the investment on innovation more profitable and provides strong incentive for firms to invest in productivity enhancing activities—product and process innovation (Lileeva & Trefler, 2010; Pires, 2012; Schmookler, 1954). However, trade simultaneously increases competition for domestic firms as domestic producers have to share market with foreign firms. Endogenous growth models based on the Schumpeterian idea of creative destruction predict that competition reduces monopoly rent associated with innovations thereby rate of innovations also diminish with increasing competition from other firms (Grossman & Helpman, 1991b; Aghion and Howitt, 1992). In contrast, some studies argue that competition put pressure on the firms to invest in the productivity enhancement activities—product and process innovation—to remain competitive in the market[26] (Autor et al 2016; Amiti & Khandelwal, 2013; Bloom et al., 2017; Bustos, 2011). Competition may foster innovation especially in neck-and-neck sectors where firms are operating with similar capabilities and it provide strong incentive to invest in innovating ideas for escaping

[26] Arrow (1962) argues that incumbent monopolist has no incentive to replace his own profitable investment with another investment for innovation of product which is known as replacement effect. In contrast, Dasgupta and Stieglitz (1980) argue that monopoly rent is important for the innovative activities and increasing competition diminish the rate of innovations. Aghion et al. (2005) combine the replacement effect with argument of monopoly rent and find the evidence of nonlinear relationship between the product market competition and innovations. More recently, trade models with heterogeneous firms predict that trade liberalization encourage the most productive firms to enter in foreign market while simultaneously exert pressure on least productive firm for exit (Meltz, 2003; Bernard et al, 2003). Based on the assumption of firm heterogeneity , Agion et at (2018) finds that competition effect inversely related with innovative activity for the least productive firm while it either enhance the product and process innovation or dissipates in case of productive firms.

the competition (Aghion et al., 2005). Additionally, international trade also works as conduit for the transmission and diffusion of new ideas across countries. Hence, knowledge spillover provides another channel through which international trade and economic integration affect innovation and growth[27] (Grossman & Helpman, 1990; Rivera-Batiz & Romer, 1991; Devereux & Lapham, 1994).

The transmission and diffusion of ideas is important for the developing countries where exist an idea gap— deficiency of knowledge to create economic value— that impede their successful catch-up with developed countries (Romer, 1993). The existence of idea gap suggests that global linkages of firms through international trade and investment inflows can work as conduits for transmission of ideas across countries. In this context, this study investigates the effects of global linkages such as exporting, importing, foreign technology licensing, and share of foreign ownership on firm level innovations in South Asian economies namely Pakistan, India, Bangladesh, and Sri Lanka.[28]

More recently, the role of conducive institutional environment for innovation and international competitiveness has received much attention (Aidis et al., 2008; Barasa et al., 2017; Chadee & Roxas, 2013). It is argued that transformation of raw idea into economic value also depends upon the institutional environment in which firms are embedded. Properly devised institutions provide strong incentives for the productive

[27] Coe and Helpman (1995) argue that in an open economy framework where international trade and foreign direct investment work as conduit of knowledge flow, R & D activities of trade partners also contribute to productivity growth. They find the evidence of positive effects of foreign R & D activities on the domestic productivity in trade among OECD member economies. Similarly, Coe et al. (1997) find the evidence of knowledge spillover and resulted productivity growth in north-south trade.

[28] All countries of South Asian region perform poorly on the Global Competitiveness Index reported by the world Economic Forum. For instance, Index ranks India on 58th, Seri Lanka on 85th, Bangladesh on 103th and Pakistan on 107th number in 140 countries (World Economic Forum, 2018). As a result, these countries are for away from their East Asian counterpart in attracting foreign investment and export performance. Innovation and continuous improvement of products is not only main driver for the long-term competitiveness but also defining feature of economic success for the firms, industries and countries.

behavior—inventions and innovations —in an economy while poorly devised institutions encourage rents seeking in the economy (North, 1990, 1993; Acemoglu & Robinson, 2008; Silve & Plekhanov, 2018). Hence, this study also explores the moderating role of regional institutional quality in interlinked relationship between global engagement and firm-level innovations.

This is study is relevant to few studies that investigate the different aspects of global linkages of firms on innovation in emerging economies. Seker (2012) examine the effects of importing and exporting on the firm level innovation using plant level data of 43 developing countries. The sample consists of the developing and emerging economies from the Eastern Europe, Latin America, Central Asia, and Caribbean region. The study document that global linkages through importing and exporting positively contribute to the innovation in selected countries. Similarly, Fritsch and Gorg (2015) examine the effects of global engagement of firm through outsourcing and importing on the innovations in 28 emerging market economies. The sample consists of the countries from central and Eastern Europe, the Baltic and Central Asia. The results reveal that firms engage in outsourcing allocate more resources for the research and development. However, instead of using innovation output these studies used R & D expenditure as proxy for the innovation. Unlike received literature on the subject, this research exercise is new for several reasons. First, this study uses explicit information on different type of innovations collected through formal survey. We also us additional measures of innovative activity such as introduction of new management practice and new marketing method. Similarly, we use some additional indicators of global linkages of the firms such as foreign technology licensing, and share of foreign ownership. Moreover, the results of the Latin America, and Eastern Europe cannot be generalized to the South Asian region because of different economic and industrial

orientation. Second, this study explores the moderating role of regional institutional quality in interlinked relationship between global engagement and firm-level innovations. According to the best of our knowledge there is hardly any study that explores the moderating role of institutional quality in interlinked relationship between global engagement and firm-level innovations. Third, existing literature does not account for the problem of endogeneity due to self-selection. This study takes into account the issue of self-selection and use alternative estimation strategy based on the treatment effect approach to check the robustness of our results. Hence, following are the objectives of this study

1 To explore that how firm's exposure to global market prove beneficial in terms of introduction of innovation in their production process.
2 To explore the moderating role of institutional quality in interlinked relationship between global linkages and firm-level innovations

4.2 Review of Relevant Literature

Developing countries usually face the idea gap—deficiency of knowledge to create economic value— which played central role in growth and development of advanced industrialized nation (Romer, 1993). International trade, economic integration, and liberalization of FDI can work as vehicle for transformation of ideas across countries. Grossman and Helman (2015) argue that international trade in goods and services also affect the incentives for knowledge acquisition, innovations and diffusion of ideas. There are several mechanisms which are highlighted by the existing literature where trade and investment liberalization induce innovation in developing countries. For instance, international trade and investment liberalization facilitates the flow of knowledge and productive ideas across borders which in turn useful for the

invention, innovations, and producing at lower cost to remain competitive in international market. The notion of knowledge spillover through economic integration and international trade is well documents in the theoretical and empirical literature. For instance, Rivera-Batiz and Romer (1991) argue that knowledge spillover and flows of ideas embody in goods and services can expedite the long run growth process in trading countries. Coe and Helpman (1995) document the evidence for the transmission and diffusion of knowledge through international trade and resulted productivity gain across the advance industrial nations. Eaton and Kortum (1999) find the evidence that R&D perform abroad affect domestic productivity through spillover across different trading partners in OECD economies. Similarly, Eaton and Kortum (2001) support the claim that capital goods import work as conduit for transmission and diffusion of technology across trading countries.

A large and growing body of research documents the evidence that international trade and FDI inflows have substantial impact on the productivity of firms in developing countries. However, few studies investigate the effects of international trade and investment inflows on the firm level innovations. For example, MacGarvie (2006) find the evidence that imported inputs are positive related with patent citations by the using data set of the 2757 firm operating in the manufacturing sector of France. However, study finds that exporting is not significantly related with the firm level innovations. Sutton (2007) predicts that foreign direct investment inflows transfer capabilities from the developed counties to the emerging economies which in turn boost innovation in emerging economies. Criscuolo et al., (2010) investigate the effects of global engagement[29] on the firm level innovations in U.K using data set of 19625

[29] In literature the global engagement and internationalization are simultaneously used for the multinational firms and exporters. These firms normally operate in international market either through exports or through outward foreign direct investments.

business establishments. Overall results of study support the claim that globally engaged firms are more innovative than firms operated for domestic market. Study further argues that these results are due to vertical linkages which help in transmission and diffusion of tactic knowledge across countries. Seker (2102) examine the effects of importing and exporting on the firm level innovation using plant level data of 43 developing countries. The sample consists of the developing and emerging economies from the Eastern Europe, Latin America, Central Asia, and Caribbean region. The study support the claim that global linkages through importing and exporting positively contribute to the firm level innovation in selected countries. Study further reveals that firms involve in two way trade — simultaneously importing and exporting— are more innovative than firms firm engage in only importing or exporting. Moreover, study finds that exporter and importers are more likely to spare financial resources for research and development. Siedschlag and Zhang (2015) investigate the hypothesis that firms engage in internationalization through export and multinational operations are on average more innovative and more productive. Study use cross sectional data of the 2181 firms operating in different sectors of Ireland. Study find that firms engage in internationalization through export and multinational operations are more innovative than firms that serves only for domestic market. Fritsch and Gorg (2015) examine the effects of global engagement of firm through outsourcing and importing on the innovations in 28 emerging market economies. The sample consists of the 28 countries from central and Eastern Europe, the Baltic and Central Asia. The results reveal that firms engage in outsourcing allocate more resources for the research and development while importing is directly related with innovation output.

Another strand of literature explores the link between institutional quality and innovation. Tebaldi and Elmslie (2013) investigate the link between quality of

institutions and innovations measured as patent grant data of emerging economies. Overall results reveal that institutional quality explains cross country variations in innovations in term of patent production. Similarly, Oluwatobi et al., (2015) examines effects of institutional quality on innovation by suing the panel data of 44 African countries. Findings of the study reveal that government effectiveness and regulatory quality positively impact the innovations measured as no of article published in scientific journals, royalty payments, and patents granted. Starosta de Waldemar (2012) investigates the effects of corruption on the firm level innovation in India. Empirical findings of study substantiate the fact that corruption reduces the probability of product and process innovations. Silve & Plekhanov (2018) argues that institutional quality indirectly contributes to growth and development by encouraging the productive activities such product and process innovations. Findings of the study strongly support the claim that intuitional quality promotes the innovation intensive industries in selected countries. Similarly, Rodríguez-Pose and Di-Cataldo (2014) explore the link between quality of government and regional innovative capacity of different regions in Europe. Overall results substantiate the fact that government quality measure in term of government accountability, control of corruption, and government effectiveness is positively associated with innovative activities.

As aforementioned, there exist idea gap in developing countries and international trade and FDI inflows can work as conduit for the transmission and diffusion of ideas from the developed north to developing south. However, transformation of raw idea into economic value is also depends upon the capabilities of firms and institutional environment in which firms are embedded. Properly devised institutions provide strong incentives for the productive behavior—inventions and innovations —in an economy while poorly devised institutions encourage rents seeking

in the economy (North, 1990; Acemoglu & Robinson, 2008; Silve & Plekhanov, 2018). Barasa et al. (2017) explore the moderating role of regional institutional quality in interlinked relationship between the firm level resource and innovation output using plant level data of three economies of East Africa namely Uganda, Kenya, Tanzania. The results of study support the hypothesis that regional institutional quality positively moderates the effects of firm level resources such as human capital, internal R & D effort and managerial capacity of firms on innovative output. However, there is hardly any study that explores the moderating role of regional institutional quality in interlinked relationship between global engagement and firm-level innovations. Hence, this consequent study explores the moderating role of regional institutional quality in interlinked relationship between global linkages and firm-level innovations

4.3 Methodology

4.4 Model Specification

Global linkages of the firms enrich their sources of knowledge and work as conduit for transmission and diffusion of knowledge from developed north to developing south which in turn facilitates the firm level innovation in developing countries. As discussed in the opening part that the study is set out to add in the literature on the subject in two ways. First, how firms' global linkages affect their innovation decisions. Second, how institutional quality signifies its role as a moderator in firms' global linkages and their innovation decisions. To come across these objectives the following empirical models have been estimated. In order to achieve the first objective, we develop the following empirical model followed by received studies on the subject Gorodnichenko et al. (2010), Seker (2012), Fritsch and Gorg (2015), Siedschlag and Zhang (2015)

$$Prob(Innov_i) = \alpha + \beta_1 GL_i + \sum_{j=1}^{n} \gamma_j X_i + \delta_1 D_c + \delta_2 D_i + \varepsilon_i \quad (1)$$

Where Innov_i represents innovation that is binary in nature, which is taken as one if a firm introduced a product, process, organizational, or marketing innovation and zero otherwise. GL_i represents global linkages of firm in terms of its exporting, importing, foreign technology licensing, and share of foreign ownership. X_i represents a set of control variables which includes productivity, R & D expenditure, human capital measure through skills labor force, firm size, age of firm, and physical capital intensity. D_c and D_i are dummies that capture heterogeneity across industries and countries while ε_i is the stochastic random error term.

We also hypothesize that level of institutional quality positively moderates the effect of global linkages on innovative output. To capture the role of institutional quality, we incorporate interactive term of regional institutional quality and global linkages in equation (1). Hence equation (1) can be written as follows;

$$Prob(Innov_i) = \alpha + \beta_1 GL_i + \sum_{k=1}^{n} \beta_k \, (GL_i * INS_i) \; + \sum_{j=1}^{n} \gamma_j X_i + \delta_1 D_c + \delta_2 D_i + \varepsilon_i \quad (2)$$

Where GL_i is the global linkages of firms and INS_i is the institutional quality. and $(\text{GL}_\text{i} * \text{INS}_\text{i})$ is an interaction term that captures the moderating role of the institution in interlinked relationship of firms' innovation-decision and global linkages. The equations for alternative empirical specifications are available in appendix C

4.5 Estimation Strategy

As our dependent variable is binary outcomes, we use Probit model to estimates the effects of global linkages of firms on innovation output. There is possibility of endogeniety in our empirical model due to the fact that productivity of a firm might

influence both the innovation and foreign linkages of the firm. The more productive firms can allocate more funds for innovation and also overcome the market entry fixed cost to engage in global markets. The potential edogeneity due to the self-selection can be avoided if the variable that influence both dependent and independent variables is observable (Hamilton & Nickerson, 2003; Clougherty, Duso & Muck, 2016). Hence, to avoid the potential endogeneity, first we include the productivity of the firms as control variable. Second, more recently some studies argue that the interaction term of endogenous regressor with some exogenous variable can potentially partial out the issue of endogeneity (Brent, Cook, & Olsen, 2015; Benito, Rygh & Lunnan, 2016; Bun & Harrison, 2019). The inclusion of the interaction term of institutional quality and global linkages of firms in our regression equation further reduce the potential threat of endogeneity.

4.5.1 Treatment Effect and Self- Selection

The issue of endogeniety may also arise due to the fact that more productive firm can self-select for both global markets and innovation decisions. The potential endogeneity due to self-selection bias can also be avoided by using treatment effect approach. Average treatment effect (ATE) has become important to infer casual effect of binary intervention on an outcome. This method is equally important for the medical treatment, program participation or casual inference from observational data (Wooldridge, 2010). For the robustness of our results to alternative estimation strategy, we want to apply this treatment effect approach to our study where innovation is outcome and global linkages of firms are treatment. For instances, y_1 denotes the outcome when a firm engage in global market through importing, exporting, and foreign technology licensing and y_0 the outcome without any global linkages of firms. There is no assumption about the distribution of the outcomes (y_1, y_0), these may be

continuously distributed as well as binary outcomes (Wooldridge, 2010). The average treatment effect can be estimated as follows;

$$ATE = E(y_{i1}|D = 1) - E(y_{i0}|D = 1) \qquad (a)$$

Where D is the dummy to capture global linkages, while $E(y_{i1}|D = 1)$ is the mean value of outcome if firms engage in global market while $E(y_{i0}|D = 1)$ is the mean value of outcome that would have observe if firm that are in control group also engage in global market. However, $E(y_{i0}|D = 1)$ is not directly observable. More precisely, along with D, the observed outcome is

$$y = (1 - D)y_0 + Dy_1 = y_0 + D(y_1 - y_o) \qquad (b)$$

The average treatment effect can be easily estimated if cross-sectional units are randomly selected. In such a case sample mean difference of treatment group and the non-treatment group is measure as the average treatment effect. In our case, the average treatment effect can be estimated by the sample mean of firms' outcome engage in global market minus sample mean of outcome for firms that do not engage in global market$E(y_1 - y_0)$. However, random assignment is difficult in the observational studies due to heterogeneity of firms and possibility of self-selection of both outcome and treatment due to some others covariates. Hence, for casual inference from observational data, we can rely on the simplifying assumption of conditional ignorability {(y_0, y1) ⊥ D | X}. Given a set of observed covariates X, conditional ignorability states that D and y_0 and y_1 are independent (Wooldridge, 2010). It implies that with same set covariate X we can compare the outcome from different treatment status to estimate the casual effect of treatment.[30]

[30] Instead of using the ignorability assumption, we can also rely on the instrumental variable approach to avoid the potential endogeneity due to self-selection. However, in some cases credible instruments are not available especially in survey data.

$$ATE = E(y|X, D = 1) - E(y|X, D = 0) \qquad (c)$$

We can also use the regression analysis to estimate the casual effect of treatment. To control potential endogeneity due to self-selection, we use endogenous treatment based on control function approach.

$$E(y|D,\ X) = \gamma_0 + \alpha D + h_0(X)\beta_0 \qquad (d)$$

In equation (d) α is average treatment effect (ATE) and the term $h_0(X)\beta_0$ is the control function. The control function is basically fitted value of residual for treatment to partial out self-selection effect (Wooldridge, 2010).

4.5.2 Data Description

To test empirically the purposed hypotheses, we use the World Bank's Enterprise Survey data set of manufacturing firms operating in four largest South Asian economies namely India, Pakistan, Bangladesh and Sri Lanka. World Bank's Enterprise Survey used well-structure questionnaire with uniform design for 135 developing and transition economies. In order to ensure true representation of the sample, the surveys relied on the stratified random sampling technique to ensure that the sample is more representative of the population. Hence, the data set enables us to investigate the firms in cross country setting. World Bank's enterprise level survey provides unique dataset to test hypothesis that global linkages of a firm enhance the probability of introducing innovation in the production process. This data set provides rich information on various types of innovation activity. Keeping in view the available information, the innovation is defined broadly as whether firm introduce new or significantly improved product, new or significantly improve production process, new or significantly improve management practice, and new or significantly improve marketing method. Besides innovation output, data set also provides information on the innovation inputs such as

R & D expenditure. In addition, this survey also collected rich information on the firms' global linkages such as importing, exporting, use of foreign technology licensing, and share of foreign ownership. As the data set takes in information on control of corruption, rule of law and regulatory quality, therefore institutional quality index has been constructed using this information. Moreover, this data set also provides rich information on covariate that can be used as control to avoid the problem of endogeneity due to self-selection. The data set is available for the year 2013 in the case of Pakistan and Bangladesh while in case of India and Sri Lanka the data set is available for 2014 and 2011 respectively. We assume that there are no structural and behavioral changes in four years across countries. This practice is consistent with existing literature (see, for instance, Krammer, Strange, and Lashitew, 2018; Barasa et al., 2017; *Ma, Qu, and Zhang, 2012;* Gorodnichenko, Svejnar, and Terrell, 2010).

4.5.3 Variables of the Study

Our dependent variable (outcome in treatment effect approach) is various types of innovative activities such as introduction of new product, production process, management practice, or marketing method. Our variable of interest (treatment) is the different types of global linkages of the firm such as importing, exporting, foreign technology licensing, and share of foreign ownership. We use different firms specific control variable such as productivity of the firm, size of the firm, ratio of skilled workers to unskilled workers, use of ICT, time of labor for innovative activities and access to external finance. This study uses intuitional quality as moderate variable. The table A1 provides the detailed description of the variables taken from the survey for empirical analyses.

4.5.4 Institutional Quality Index

We construct an index of institutional quality based on the firm-level perceptions of corruption, rule of law, and regulatory quality. Even though it is a subjective measure of institutional quality, yet availability of rich information on corruption, rule of law, and regulatory quality allows the composite measures of institutional quality. Institutions are latent factors in a business environment and its challenging task to single out suitable proxy for the institutional quality (Kuncic, 2014). Hence, construction of the composite index using the different indicators of institutions from different dimensions such as corruption, rule of law, and regulatory quality offers a better solution for measuring institutional quality (Barasa et al., 2017; Kuncic, 2014). In line with existing literature (see, for instance, Barasa et al., 2017; Chadee and Roxas, 2013 among others), we use three items to measure the regulatory quality that capture the perception of firms regarding the regulatory quality in tax administration, business licensing & permits, and customs & trade regulations. Similarly, we use two items to construct the composite measure of rule of law that capture the perception of the firms regarding the court system, and crime, theft and disorder as constraint on their business operation. Finally, we measure corruption prevalence using one item that ask firms that to what extent they perceive corruption as obstacle to their business operation. We use five-point scale (0 = not an obstacle, to 4 = very severe obstacle) for the measurement of all items.

In the construction of the composite index, the assigning weights to different indicators reflect suitable balance among different indicators from different dimensions (Kararach et al.,2018). Existing literature (Nardo et al., 2005; Hoskins & Mascherini, 2009; Kararach et al.,2018) document different weighting methods such as explicit weighting (equal weighting, expert weighting), and statistical weighting (factor

analysis) suitable to assign different weights to different indicators. However, equal weighting is most suitable approach for the construction of the index (Nardo et al., 2005; Hoskins & Mascherini, 2009; Barasa et al., 2017; Kararach et al.,2018). In line with Hoskins & Mascherini (2009), Haq, Khan & Saddique (2015); Barasa et al., 2017; Kararach et al. (2018), the aggregated institutional quality index (AIQI) is weighted average of the indices computed for the three dimensions (regulatory quality, rule of law, and control of corruption).

$$AIQI = 1 - \sum_{i=1}^{3} w_i \, D_i$$

Where $AIQI$ is the aggregate institutional quality index, $w_i$is the corresponding weight to each dimension and D_i is the score in the each dimension of the index. In this study, we use an equal weighting method for assigning weight to each dimension of institutional quality. As each dimension measures the ineffectiveness of institutions, we revert it to get the aggregated institutional quality index.

Each dimension of aggregated institutional quality index (AIQI) is calculated as

$$D_i = \frac{\sum_{j=1}^{n}(a_j)}{\sum_{j=1}^{n}(b_j)} \times 100$$

Where D_i denotes the index of particular dimension and j = 1, 2…n (where 'j' indicates the number of indicators for particular dimension) and n are the total number of indicators in a particular index while a_j is the response score on the indicator j and b_j is the maximum score on the indicator j. This study uses data of World Bank's Enterprise Survey. Table 1 provides detailed description of variables taken from the survey for empirical analysis.

4.6 Findings and Discussions

This section presents estimates of different empirical specifications which test our key hypothesis — global linkages of the firms increase the probability of introduction of innovations in the production process. As discussed in section 3 that firms' global linkages are our variable of interest and it encompass exporting, importing, foreign technology licensing and foreign ownership of the firms. Therefore, we present the empirical findings in two different tables. Following table 1 and 2 presents our empirical results**.** Table 1 presents results whereas firms' global linkages are captured through firms' exporting and importing linkages. The specifications (1-4) in table 1 reports the baseline estimates using alternative dependent variables: introduction of new product, new process, new management technique, and new marketing method.

Table 8: Firms' Global Linkages (Importing and Exporting) and their Innovative Activities

	(1) Product	(2) Process	(3) Management	(4) Marketing	(5) Product	(6) Process	(7) Management	(8) Marketing
size	0.181**	0.113**	0.218***	0.465***	0.155*	0.1806**	0.1439**	0.1922**
	(0.0681)	(0.0423)	(0.0426)	(0.0425)	(0.0772)	(0.0472)	(0.0483)	(0.0419)
prod	0.364***	0.396***	0.270***	0.686***	0.244***	0.473**	0.336**	0.502***
	(0.0320)	(0.0148)	(0.0147)	(0.0148)	(0.0280)	(0.186)	(0.190)	(0.191)
ICT	0.231***	0.405***	0.206***	0.281***	0.195**	0.315***	0.117**	0.189***
	(0.0612)	(0.0391)	(0.0393)	(0.0393)	(0.0687)	(0.0436)	(0.0444)	(0.0445)
w_skills	0.0640**	0.0512**	0.0378	0.0472	0.0902**	0.0374**	0.0347	0.0415
	(0.0150)	(0.0131)	(0.0228)	(0.0274)	(0.0191)	(0.0176)	(0.0240)	(0.0290)
w_edu	0.0491**	0.0330*	0.0871***	0.0270**	0.0259*	0.0891***	0.0578***	0.0376***
	(0.0243)	(0.0174)	(0.0143)	(0.0121)	(0.0133)	(0.00101)	(0.00100)	(0.00099)
Finance	0.0107	0.0366***	0.0667***	0.0567***	0.0640	0.0442***	0.0840***	0.0745***
	(0.078)	(0.0095)	(0.0055)	(0.00560)	(0.0858)	(0.0061)	(0.0062)	(0.0064)
Exp_Sh	0.0115	0.0264**	0.00677***	0.00691***	0.0335	0.0188*	0.0835***	0.0823***
	(0.0189)	(0.0133)	(0.00131)	(0.00131)	(0.0252)	(0.0121)	(0.0177)	(0.0180)
Imp_Sh	0.0143***	0.0337**	0.0823	0.0118	0.0684***	0.0354*	0.0237	0.0524
	(0.00232)	(0.0148)	(0.146)	(0.147)	(0.00349)	(0.0212)	(0.0289)	(0.0294)
IQI					0.491**	0.278**	0.948***	0.840***
					(0.156)	(0.121)	(0.123)	(0.124)
Exp*IQ					0.0670	0.0563**	0.0749***	0.0632***
					(0.0734)	(0.0241)	(0.0362)	(0.0275)
Imp*IQ					0.621***	0.0146**	0.00267	0.00854
					(0.0111)	(0.00392)	(0.00879)	(0.00883)
_cons	0.350*	-0.633**	-0.973***	-1.255***	0.894*	-0.641**	-0.897***	-1.449***
	(0.190)	(0.195)	(0.194)	(0.196)	(0.370)	(0.247)	(0.253)	(0.254)
N	7117	7117	7117	7117	7117	7117	7117	7117
PseudoR^2	0.126	0.134	0.114	0.167	0.152	0.184	0.172	0.193
CFE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
IFE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Robust standard errors in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Average marginal effects are reported except for constant which is omitted in STATA command

As reported in column 2 (Specification (1)) of Table 1, the variable of interest the global linkages that capture with firms' export shares (Exp_sh) holds a positive sign, which is not statistically significant. This result validates the argument that exporting firms located in selected South Asian countries are disinclined to introduce new products. However, our second indicator of global linkages the share of imported inputs (Imp_sh) signifies its positive impact on the dependent variable that the introduction of the new product. The result validates the statement that the more the firm imports inputs from global economies the higher would be its innovation in terms of the introduction of new products. The result may be justified in terms of firm capacity, the South Asian located production units at general import inputs from technologically developed countries that improve their innovation capacity. Though, imported inputs contribute for the introduction of new product, yet mostly these products are designed for the domestic market in selected south Asian countries. The results in column 2 (Specification 1) show that our empirical estimation is in line with a priori expectations for control variables. For instance, the control variables size of a firm(size), productivity(Prod), use of information and communication technologies(ICT), the share of skilled workers(w_skills), and share of workers with higher education(w_edu) are statistically significant with positive signs. Among these, the positive and significant response of firm' size and productivity to its innovation (introduction of new products) should be explained in the economies of scale perspective. An increase in size and productivity provides space for firms to invest in R&D and adopt the latest and imported technology. Similarly, the use of information technology enhances a firm's exposure to domestic as well as international markets that creates motivation for new product discovery. In the same way, workers' skill and education posture positive impact on firms' innovation. The results may be justified in

the expansion of innovation capacity that skilled and educated workers increase firms' innovation capacity. The estimated coefficients of control variables are consistent with received studies on innovation (Fritsch and Gorg, 2015; Barasa et al., 2017; Seker, 2012). Yet, it is somewhat surprising that our control variable firm access to finance ($Finance$) is statistically insignificant with positive sign. One possible explanation of this unexpected result is that introduction of new product is more risky activity and bank and non-bank financial institutions avoid risk bearing business activities.

The column 3 (Specification 2) of Table 1, instead of the introduction of a new product, the firm's innovation is captured with the production process. The results show that both modes of global linkages, the exports share (Exp_sh) and imports share (Imp_sh) are positively associated with the process innovation in sampled countries. These results validate the claim that global linkages of firms work as conduit for the transmission and diffusion of ideas from the developed north to developing south which in turn helps firms to introduce new production process in developing south. Moreover, firm global linkages through exports placed pressure on firms to cope with an international standard that pushes firms for the innovation process. Similarly, to run into diverse market places around the globe, exported firms are bound to make vertical as well as horizontal diversification in their production process. As far as import linkages are considered, firms' import inputs and technology from technologically advanced countries enhance their innovation capacity that in turn increases the innovation process. South Asia which is relatively backward in technology, hence most of the firms located in this region depend on imported technology. Importing of technology from technology advanced countries comforts firms to introduce new production processes in their production lines. The firms specific control variables such as firms' size ($size$), productivity($prod$), use of information and commination

technologies (ICT), the share of skilled workers (w_skills), share of workers with higher education (w_edu), and access to finance ($Finance$) are statistically significant with expected positive sign.

The columns 4 and 5 (specifications 3 and 4) of Table 1 reports the results for the firms' management and marketing innovations. In both cases, firms' global linkages through exports (Exp_sh) holds a positive sign that is statistically significant. The results may be justified in the perspective of international market competition. Exporting to the global market pose pressure on firms to innovate their management and marketing in order to endure in the international market. Unlike exports, firms' global linkages through imports (Imp_sh) have no significant impact on firms' management and marketing innovation. The results reveal that the imports of firms located in the sample countries have no response to the management and marketing innovation of firms. The result may be explained in the nature of imports that most of the firms' imports are inputs and technology that cannot signify their role in the management and marketing innovation of firms. The results reported in column (3) and (4) also reveal some interesting findings related to our control variables. For instance, the firms' size ($size$), productivity ($prod$), use of information and communication technologies (ICT), access to finance ($Finance$), and share of workers with higher education (w_edu), increases the probability of introducing new management practices and marketing methods. Among these, size and productivity of firms should be explained in the economies of scale outlook, firms that are larger in size and production capacity have more space to invest in the innovation of management and marketing. Likewise, greater access to finance buoys up firms for management and marketing modifications. However, the share of skilled workers (w_skills) does not increase the probability of introducing the new management practice or marketing method. This

result may be justified that skilled workers are not strictly connected with the introduction of firms' new management practices and marketing methods but with the introduction of new products and processes of innovation. Our results also suggests that firms need highly qualified labor force for the improvement of management practices and marketing methods.

As discussed earlier that we are devoted to testing the hypothesis that the firm operating in an institutional framework with better quality can reap the potential gain of global linkages in the form of innovations. To explore the moderating role of institutional quality in the interlinked relationship between global linkages and firm-level innovations, we add two interaction terms in our empirical specifications. The specifications (5-8) present the results of interaction effects of institutional quality on the innovative activities of firms. The results reported in the column (5) show that institutional quality complemented the imported inputs to encourage firms for the introduction of new product. As the interaction term of imported inputs and institutional quality $(Imp * IQ)$ is statistically significant with positive sign. However, the interaction term of exports share and institutional quality $(Exp * IQ)$ remains insignificant. This result reflects that institutional structure in South Asian countries does not encourage the exporting firms to introduce new product for international market. From these results, it is safely predicted that institutional structure in south Asian countries encourage firm to introduce new product for domestic market[31]. The institutional quality index (IQI) is statistically significant with positive sign. This show that overall institutional quality encourages the introduction of new product in selected south Asian countries. The indicator of global linkages, the exports share (Exp_sh)

[31] This prediction is on based on our results. Our results reveal that in existing institutional structure, the exporting firms are reluctant to introduce new product while simultaneously importing firms are introducing new product. This implies that firms use imported inputs to introduce innovative product for domestic market.

remains statistically insignificant with positive sign. Yet, import share (Imp_sh) is statistically significant with positive sign. These results again reflect that trade structure in South Asian developing countries encourage the firms to introduce innovative products for the domestic market. One possible explanation of these results is that selected south Asian countries were following the inward-looking imports substitution policies in the past. These policies resulted in strong industries base that still continue to introduce new products for the domestic market. The control variables in our specifications such firms' size ($size$), productivity ($prod$), use of information and communication technologies (ICT), the share of skilled workers (w_skills), higher education of workers (w_edu) are statistically significant with expected signs. Yet, access to finance ($Finance$) remains statistically insignificant.

The columns (6) to (8) in Table 1 reports the results for process, management, and marketing innovations. The interaction term of institutional quality index with export share($Exp * IQ$) enters in all three specifications with statistically significant positive signs. These results validate the claim that institutional structure in south Asian developing countries complements the exporting in introduction of the new process, management practice, and marketing method. However, the interaction term of imported inputs and institutional quality index ($Imp * IQ$) statistically significant in specification for process innovation while remains insignificant in specification for the management and marketing innovations.

The empirical specifications in columns (6) to (8) show that our estimates for control variables are in line with a priori expectations except the share of skills worker(w_skills) that remain statistically insignificant in column (7) and (8). These results again confirm that share of highly educated workers (w_edu) is more important

than share of skills workers (w_skills) for introduction of the new management practices and marketing methods.

We use foreign technology licensing (Lic_tech), and share of foreign ownership (f_own) as alternative indicators for the global linkages. The Table 2 presents the results for the alternative indicators for the global linkages. The results reported in columns (1-2) reveal that foreign technology licensing (Lic_tech) is positively associated with product and process innovations and also statistically significant. However, share of foreign ownership (f_own) enters in both specifications with statistically insignificant coefficients. This result validates the claim that foreign investment in selected South Asian countries is either market seeking or looking for the low wage production base. Similarly, the control variables such as firms' size ($size$), productivity ($prod$), use of information and communication technologies (ICT), share of skilled workers(w_skills), share of highly educated workers(w_edu) are statistically significant positive signs. However, access to finance ($Finance$) remains statistically insignificant in empirical specification for product innovation in column (1).

On the other hand, results reported in columns (3-4) depict that that foreign technology licensing (Lic_tech) enters in both specifications with statistically insignificant positive signs while the share of foreign ownership (f_own) has statistically significant positive signs. These results reflect that foreign investment increases the probability of new management practices and marketing methods.

Table 9: Regression results for the effects of global linkages (foreign technology licensing and foreign ownership) on innovative activities of firms.

	(1) Product	(2) Process	(3) Management	(4) Marketing	(5) Product	(6) Process	(7) Management	(8) Marketing
size	0.159**	0.478****	0.504***	0.807***	0.113**	0.471***	0.447***	0.803***
	(0.0778)	(0.0478)	(0.0480)	(0.0478)	(0.0776)	(0.0479)	(0.0482)	(0.0481)
prod	0.325***	0.395****	0.201***	0.532**	0.202***	0.432***	0.362***	0.572***
	(0.0281)	(0.0189)	(0.0188)	(0.0188)	(0.0282)	(0.0189)	(0.0189)	(0.0189)
ICT	0.195**	0.237***	0.147***	0.221***	0.107***	0.231***	0.136**	0.206***
	(0.0697)	(0.0441)	(0.0441)	(0.0441)	(0.0169)	(0.0442)	(0.0444)	(0.0445)
w_skill	0.0109**	0.0240**	0.0537	0.0826*	0.0553**	0.0274**	0.0220	0.0290
	(0.00526)	(0.0124)	(0.0300)	(0.0758)	(0.0197)	(0.0155)	(0.0178)	(0.0252)
w_edu	0.0166***	0.0944***	0.0634***	0.0451***	0.0191***	0.0935***	0.0618***	0.0427***
	(0.00134)	(0.0102)	(0.00992)	(0.00979)	(0.00934)	(0.0102)	(0.00997)	(0.00987)
Finance	0.0177	0.0495***	0.0857***	0.0773***	0.0228	0.0485***	0.0820***	0.0728***
	(0.0883)	(0.00632)	(0.00622)	(0.00621)	(0.0885)	(0.00634)	(0.00629)	(0.00631)
Lic_tech	0.772***	0.913***	0.208	0.306	0.928***	0.939***	0.272	0.281
	(0.0935)	(0.0741)	(0.162)	(0.630)	(0.201)	(0.152)	(0.130)	(0.132)
f_own	0.216	0.464	0.336***	0.176**	0.211	0.379	0.320***	0.198***
	(0.305)	(0.361)	(0.0938)	(0.0642)	(0.214)	(0.171)	(0.0841)	(0.0708)
IQI					0.410*	0.269*	0.718***	1.107***
					(0.170)	(0.112)	(0.115)	(0.116)
LIC*IQ					0.746**	0.621**	0.217*	0.169*
					(0.373)	(0.239)	(0.221)	(0.0431)
FOWN*IQ					-0.841	-0.0907	0.944	0.0107
					(0.523)	(0.344)	(1.279)	(1.253)
_cons	0.911*	-0.518*	-0.660**	-1.063***	0.770*	-0.614*	-0.927***	-1.474***
	(0.367)	(0.247)	(0.246)	(0.246)	(0.373)	(0.250)	(0.250)	(0.251)
N	7117	7117	7117	7117	7117	7117	7117	7117
Pseudo R^2	0.133	0.156	0.175	0.148	0.213	0.238	0.219	0.229

Robust standard errors in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Industry fixed effects (IFE) and country fixed effects (CFI) included in all specifications. Average marginal effects are reported except for constant which is omitted in STATA command

To explore the role of institution quality, we add interactive term of institutional quality and global linkages of firms in our empirical specifications in columns (5-8) of Table 2. The interaction terms of foreign technology licensing and institutional quality ($Lic * IQ$) are statistically significant with positive sign in all four specifications in columns (5-8). The results show that institutional quality complements the foreign technology licensing (Lic_tech) for all types of innovative activities. Yet, the interaction terms of institutional quality and foreign ownership ($f\_own * IQ$) enters in all four specifications with the statistically insignificant coefficient. The negative signs of the coefficient of interactive terms ($f\_own * IQ$) in the column (2) and (3) reflect that institutions in selected south Asian countries discourage foreign investment in innovative activities.

The technology licensing is statistically significant at 1 percent level of significance in specifications for the product and process innovations in columns (5) and (6) while it remains statistically insignificant in specifications for management and marketing innovations. However, the coefficient of foreign ownership (f_own) remains statistically insignificant for product and process innovations in columns (5) and (6). These results again validate the claim that foreign investment in selected south Asian countries is either market seeking or looking for the low wage production base. Our results for the control variables are in line with the a priori expectations except the share of skilled workers (w_skills) that remains statistically insignificant for the management and marketing innovations specified in columns (5) and (6).

To test the response of innovation to the global linkages of firms, few studies also use innovation inputs as proxy for the innovations. For instance, Fritsch and Gorg (2015), Seker (2012) use R&D expenditure as proxy for innovations. Hence, we also investigate response of innovations inputs— the R&D expenditure and employees' time for R&D— to the global linages of firms.

Table 10: Results for the effects of global linkages on innovation inputs (R & D expenditure and employees' time for R&D)

	(1) RD	(2) RD_Time	(3) RD	(4) RD_Time	(5) RD	(6) RD_Time	(7) RD	(8) Rd_Time
size	0.253***	0.0763**	0.276***	0.0828**	0.259***	0.0692*	0.281***	0.0864*
	(0.0505)	(0.0381)	(0.0505)	(0.0412)	(0.0511)	(0.0359)	(0.0508)	(0.0437)
prod	0.0632**	0.0518**	0.0733***	0.0405*	0.0714***	0.0432*	0.0834***	0.0533**
	(0.0194)	(0.0190)	(0.0192)	(0.0189)	(0.0197)	(0.0193)	(0.0194)	(0.0191)
ICT	0.286***	0.193***	0.332***	0.235***	0.281***	0.179***	0.321***	0.216***
	(0.0452)	(0.0441)	(0.0452)	(0.0442)	(0.0458)	(0.0450)	(0.0455)	(0.0449)
w_skills	0.0415	0.0489	0.0841	0.0525	0.013	0.0127	0.0132	0.0106
	(0.0143)	(0.00271)	(0.0153)	(0.0279)	(0.014)	(0.0153)	(0.0139)	(0.0135)
w_edu	0.0829***	0.0111***	0.0875***	0.0114***	0.0782***	0.0177***	0.0854***	0.0111***
	(0.00102)	(0.00106)	(0.0101)	(0.00106)	(0.0103)	(0.00108)	(0.0102)	(0.00108)
credit	0.0501***	0.0280**	0.0547**	0.0725**	0.0483***	0.0703***	0.0501***	0.0684***
	(0.0064)	(0.0123)	(0.0168)	(0.01624)	(0.00638)	(0.00635)	(0.00632)	(0.00832)
Exp_sh	0.0518***	0.0806**			0.0420***	0.0884***		
	(0.0109)	(0.0219)			(0.0121)	(0.0189)		
Imp_sh	0.0379*	0.0451			0.0125***	0.0804*		
	(0.0158)	(0.0263)			(0.00313)	(0.0326)		
Lic_tech			0.0684**	0.237***			0.0849**	0.268**
			(0.0347)	(0.0634)			(0.0358)	(0.128)
f_own			0.0770	0.0585			0.0807	0.0335
			(0.242)	(0.255)			(0.327)	(0.144)
Exp*IQ					0.0407***	0.0834***		
					(0.00895)	(0.00964)		
Imp*IQ					0.0218***	0.0257***		
					(0.00484)	(0.00488)		
IQ					0.848***	0.547***	0.865***	0.313**
					(0.126)	(0.125)	(0.117)	(0.118)
LIC*IQ							0.119*	0.314*
							(0.063)	(0.159)
FOW*IQ							-0.0985	-0.0287
							(0.271)	(0.329)
_cons	-1.886***	-1.112***	-2.052***	-1.251***	-2.314***	-1.675***	-2.443***	-1.762***
	(0.257)	(0.250)	(0.253)	(0.248)	(0.264)	(0.257)	(0.259)	(0.253)
N	7117	7117	7117	7117	7117	7117	7117	7117
Pseudo R^2	0.158	0.163	0.152	0.165	0.218	0.209	0.213	0.211

Robust standard errors in parentheses. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. Average marginal effects are reported except for constant which is omitted in STATA

Columns (1-4) in Table 3 present the baseline results using alternative dependent variables: R&D expenditure and allocation of time to employees for R&D activities. Results reported in first two columns (1-2) show that exports share (exp_sh) is positively associated with the both R&D expenditure and time to employees for R&D activities. This result reflects that exporting firms allocate the more funds and employees time to R&D activities. Hence, probability of R&D activities increases with exporting. Yet, share of imported inputs (imp_sh) is statistically significant at 10 percent level for the R&D expenditure while remain insignificant with the time to employees for R&D activities. In columns (3-4), we find that coefficients of foreign technology licensing(Lic_tech) are positive and statistically significant. These findings reflects that foreign technology licensing(Lic_tech) positively affect the both types of innovation inputs — R&D expenditure and time to employees for R&D activities. However, foreign ownership (f_own) remains statistically insignificant in both specifications. All specification in columns (1-4) performs in line with theoretical expectations for control variables. However, share of skilled workers (w_skills) enters in both specifications with the statistically insignificant coefficient while another measure of human capital the share of highly educated workers (w_edu) enters in both specifications with statistically significant positive signs. These results again confirm that higher share of highly educated workers (w_edu) increases the probability of R&D activities.

To explore the moderating role of institutional quality(IQ), we add an interactive term of global linkages of firms and institutional quality in empirical models specified in columns (4-8). The results in column (3-4) show that interaction terms of institutional quality and global linkages in terms of export ($Exp * IQ$) and imports($Imp * IQ$) enters in the models with statistically significant and positive signs.

These results corroborate the claim that local institutional quality positively moderates the role of global linkages and encourage the firms to allocate more resources for R&D activities. Similarly, the interactive term of foreign technology licensing and institutional quality ($Lic * IQ$) enters in both specifications with positive coefficients and statistically significant at 10 percent level. However, the interaction term of another indicator of global linkages, the foreign ownership and the institutional quality of host country ($f\_own * IQ$) remains statistically insignificant and enter in both specifications (7-8) with negative signs. These results again confirm that foreign investment in selected south Asian countries is either market seeking or looking for the low wage production base. Moreover, institutional structure in selected south Asian countries does not encourage the foreign investors to allocate resources for R&D activities.

4.7 Robustness Check

There is possibility of potential endogeneity due to the fact that there might be a possibility of self-selection of more productive firms in innovations and exporting. Hence, to avoid any potential endogeneity threat and robustness of our empirical analyses, we use the endogenous treatment with control function approach devise specifically for binary outcomes. The control function approach for endogenous treatment provides excellent tool to deal with endogeneity in observational studies (Wooldridge,2010; Wooldridge,2015). The results of endogenous treatment with control function approach for product innovation are reported in the table B1 in the appendix B. we control for some potential covariates with both treatment and outcome. These include productivity of firms, use of ICT, share of highly educated workers. The results in the column (1) in table B1 reflect that there is no evidence for role of firms' exporting in introduction of the new product and it is evident from both the average treatment effects (ATE) and average treatment effect on treated (ATET). Both ATE and

ATET are statistically insignificant even at 10 percent level. The results reported in column (2) show that is ATE and ATET both are statistically significant with expected positive sign. This result supports the claim that imported inputs increases the probability for introduction of the new product. Similarly, results reported in column (3) reveal that foreign technology licensing increases the probability of introduction of new product. It is evident from both the ATE and ATET which are statistically significant with positive signs. However, ATE and ATET are statistically insignificant for the foreign ownership of the firms.

The representative results for the process innovation are reported in the table B2 of the appendix B. The results reported in columns (1-4) in the table B2 show that regardless of types, the global linkages increase the probability of introduction of innovation in the production process. It is clearly depicted in both the ATE and ATET which are statistically significant with positive signs. The coefficient of ATE and ATET for all types of global linkages are statistically significant at one percent level of significance except ATET for the foreign ownership that is statistically significant at 10 percent level.

The table B3 in the appendix B reports the results for the effects of global linkages on the management innovation. The column 1 present the results for the effects of firms exporting status on the management innovation. The results show that both ATE and ATET are statistically significant with positive signs. This result corroborates the claim that exporting status of a firm increases the probability of the introduction of new management practice. However, the result in column (2) show that the both ATE and ATET are statistically insignificant for the importing status of a firm. This result validates the claim that imported inputs is not relevant for the introduction of a new management practice. Nevertheless, the result in columns (3-4) show that ATE and

ATET for two another measure of global linkages of firms —foreign technology licensing and foreign ownership— are statistically significant with the positive sings. These results suggest that foreign technology licensing and foreign ownership of the firm increase the probability of introduction new management practice. Finally, the table B4 in the appendix B presents the results for the effects of global linkages on the marketing innovation. The results in column (1) show that ATE and ATET for the exporting status of the firms is statistically significant with positive signs. These results reflect that exporting status of the firms encourage firms to introduce the new marketing method. However, the results reported in column (2) show that ATE and ATET for the importing status of the firms remain statistically insignificant. Yet, the results reported in columns (3-4) show that ATE and ATET for both foreign technology licensing and foreign ownership statistically significant with positive signs. These results substantiate the claim that both types of global linkages — foreign technology licensing and foreign ownership— encourage firms to introduce the management and marketing innovation in their business operation. The overall results are fairly robust across alternative estimation techniques.

4.8 Conclusions

Globalization has put pressure on firms for competitiveness in the domestic as well as international market. Certainly, innovation and continuous upgrading of product is an important driver for international competitiveness for the firms operating in developing countries. Yet, there exist idea gap in developing countries— deficiency of knowledge to create economic value— that impede their successful catch-up with developed countries (Romer, 1993). The idea gap can successfully bridge by linking the firms to their global counterparts. The global linkages of firms act as conduit for the transmission and diffusion of ideas from developed north to developing countries in

south. In this context, this study examines the link between global engagement of firms and various types of innovation using explicit survey information of manufacturing firms operating in four South Asian countries. We use the probit model and endogenous treatment based on control function approach as estimation techniques.

Findings of the study reveal that export share has statistically significant positive effects on the probability of introducing the process, management and marketing innovations while it is statistically insignificant for the product innovation. On the other hand, import share has statistically significant positive effect on the product and process innovations while it is statistically insignificant for the management and marketing innovations. Similarly, foreign technology licensing has statistically significant positive effect on the product and process innovations while it is statistically insignificant for the management and marketing innovations. On the other hand, foreign ownership of the firm has statistically insignificant for the product and process innovations while it is statistically significant positive impact on the management and marketing innovations. We also test the complementarity between the global linkages and the institutional quality in local economies to explain the firms' innovations decisions. Overall results reveal that there exists complementarity between institutional quality and global linkages of firms in term of exporting, importing, and foreign technology licensing. This implies that institution quality in South Asian countries positively moderates the effect of global linkages—importing, exporting and foreign technology licensing— on firm-level innovations. However, local institutional structure discourages the foreign investment in the product and process innovations. At large our results are robust across alternative estimation techniques. These results have an important implication for the South Asian economies. These countries should encourage firms to engage with their global counterpart to introduce innovation in their

different dimension of business operation. In cognizance of the role of institutional quality, it is important that selected South Asian countries should focus on the institutional environment and improve the regulatory quality, control the pervasive corruption and properly enforce rule of law. So that local institutional structure facilitates firms for the introduction of innovation in their business operations.

4.9 Limitations and Future Research Directions

Despite the significant managerial, and policy implications presented, our research findings are not without limitations. These limitations, however, provide an avenue for future research on the phenomena. This study examines the moderating role of regional institutional quality in the interlinked relationship between the global linkages and innovation. The study is based on the data of managers' perception regarding regularity quality, rule of law and corruption as obstacle to their business operation. The institutional quality based on the perception of incumbent firms' manager is inherently subjective. Thus, future studies may consider the more objective measures of regional institutional quality such as experts' opinion for more nuance and reliable results.

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Appendix A

Table A 1 Variables and their description

Variables	Description
Export intensity	"Ratio of export sales to total annual sales."
Import intensity	Ratio of imports in total annual purchase of material inputs and/or supplies
Firm Size (F_Size)	Dummy if a firm has more than 200 employees
Productivity (prod)	"Logarithm of value added per permanent employee"
Access to Finance(finance)	"Percentage of working capital financed by banks and non-bank borrowing"
Foreign Ownership (f_Own)	Dummy variable equal to unity for establishments that are owned by the foreign private sector
Workers skills(w_skills)	"Ratio of skilled production workers to unskilled production workers."
Highly educated workers (w_edu)	"percentage of full time permanent workers who have at least a bachelor's degree"
Product innovation(innov_1)	" Dummy variable equal to one if firm introduced significantly improve products"
Process innovation (innove_2)	"Dummy variable equal to one if firm introduced significantly improved process or methods of production"
Management innovation(innov_3)	"Dummy variable equal to one if firm introduced significantly improved management practices"
Marketing innovation (innov_4)	Dummy variable equal to one if firm introduced significant improved marketing methods "
Firm use of ICT(F_ICT)	"Dummy variable equal to one if firm have its own website or use email
foreign technology licensing	"Dummy variable equal to one if firm use licensing for foreign technology"
Importing	"Dummy variable equal to one if firm import either directly or indirectly it inputs"
Exporting	"Dummy variable equal to one if firm export either directly or indirectly"

Appendix B

Table B1: Results of endogenous treatment with control function approach for binary outcomes

	Outcome variable: Product Innovation			
	Treatments			
	(1) Exporting	(2) Importing	(3) Technology Licensing	(4) Foreign Ownership
ATE	0.2090	0.2917**	0.1332***	0.0532
	(0.2786)	(0.1061)	(0.0553)	(0.0638)
ATET	0.1426	0.2244**	0.1678***	0.07056
	(0.1506)	(0.1734)	(0.0577)	(0.0837)
N	8423	8423	8423	8423

Table B2: Results of endogenous treatment with control function approach for binary outcomes

	Outcome variable: Process Innovation			
	Treatments			
	(1) Exporting	(2) Importing	(3) Technology Licensing	(4) Foreign Ownership
ATE	0.1453***	0.1417***	0.3156***	0.2787***
	(0.0172)	(0.02444)	(0.02144)	(0.0419)
ATET	0.1196***	0.1227***	0.3018***	0.1183*
	(0.0174)	(0.0255)	(0.02195)	(0.06417)
N	8423	8423	8423	8423

Table B3: Results of endogenous treatment with control function approach for binary outcomes

	Outcome variable: Management Innovation			
	Treatments			
	(1) Exporting	(2) Importing	(3) Technology Licensing	(4) Foreign Ownership
ATE	0.1433***	0.1303	0.1378***	0.1812***
	(0.0177)	(0.1233)	(0.0216)	(0.0719)
ATET	0.1346***	0.1151	0.1224***	0.1636***
	(0.0176)	(0.1242)	(0.0235)	(0.0617)
N	8423	8423	8423	8423

Table B4: Results of endogenous treatment with control function approach for binary outcomes

	Outcome variable: Marketing Innovation			
	Treatments			
	(1) Exporting	(2) Importing	(3) Technology Licensing	(4) Foreign Ownership
ATE	0.1357***	0.1497	0.1235***	0.2982***
	(0.0165)	(0.1244)	(0.0220)	(0.0563)
ATET	0.1181***	0.1155	0.1269***	0.1885**
	(0.01756)	(0.1243)	(0.02248)	(0.0612)
N	8423	8423	8423	8423

Appendix C

Equations for the empirical specifications in the table 1

$$Product\_in_{jic} = \alpha + \gamma_1 size_{jic} + \gamma_2 prod_{jic} + \gamma_3 ICT_{jic} + \gamma_3 W\_Skills_{jic} + \gamma_4 W\_Edu_{jic} + \gamma_5 Finance_{jic} + \gamma_6 Exp\_share_{jic} + \gamma_7 Import\_sh_{jic} + \delta_1 D_i + \delta_2 D_c + \varepsilon_{jic} \quad (1)$$

$$Process\_in_{jic} = \alpha + \gamma_1 size_{jic} + \gamma_2 prod_{jic} + \gamma_3 ICT_{jic} + \gamma_4 W\_Skills_{jic} + \gamma_5 W\_Edu_{jic} + \gamma_6 Finance_{jic} + \gamma_7 Exp\_share_{jic} + \gamma_8 Import\_sh_{jic} + \delta_1 D_i + \delta_2 D_c + \varepsilon_{jic} \quad (2)$$

$$Market\_in_{jic} = \alpha + \gamma_1 size_{jic} + \gamma_2 prod_{jic} + \gamma_3 ICT_{jic} + \gamma_3 W\_Skills_{jic} + \gamma_4 W\_Edu_{jic} + \gamma_7 Finance_{jic} + \gamma_8 Exp\_share_{jic} + \gamma_9 Import\_sh_{jic} + \delta_1 D_i + \delta_2 D_c + \varepsilon_{jic} \quad (3)$$

$$Manag\_in_{jic} = \alpha + \gamma_1 size_{jic} + \gamma_2 prod_{jic} + \gamma_3 ICT_{jic} + \gamma_4 W\_Skills_{jic} + \gamma_5 W\_Edu_{jic} + \gamma_6 Finance_{jic} + \gamma_7 Exp\_share_{jic} + \gamma_8 Import\_sh_{jic} + \delta_1 D_i + \delta_2 D_c + \varepsilon_{jic} \quad (4)$$

$$Product\_in_{jic} = \alpha + \gamma_1 size_{jic} + \gamma_2 prod_{jic} + \gamma_3 ICT_{jic} + \gamma_3 W\_Skills_{jic} + \gamma_4 W\_Edu_{jic} + \gamma_5 Finance_{jic} + \gamma_6 Exp\_share_{jic} + \gamma_7 Import\_sh_{jic} + \gamma_8 IQI_{jic} + \gamma_9 IQI * Exp\_share_{jic} + \gamma_{10} IQI * Import\_sh_{jic} + \delta_1 D_i + \delta_2 D_c + \varepsilon_{jic} \quad (5)$$

$$Proces\_in_{jic} = \alpha + \gamma_1 size_{jic} + \gamma_2 prod_{jic} + \gamma_3 ICT_{jic} + \gamma_4 W\_Skills_{jic} + \gamma_5 W\_Edu_{jic} + \gamma_6 Finance_{jic} + \gamma_7 Exp\_share_{jic} + \gamma_8 Import\_sh_{jic} + \gamma_9 IQI_{jic} + \gamma_{10} IQI * Exp\_share_{jic} + \gamma_{11} IQI * Import\_sh_{jic} + \delta_1 D_i + \delta_2 D_c + \varepsilon_{jic} \quad (6)$$

$$Market\_in_{jic} = \alpha + \gamma_1 size_{jic} + \gamma_2 prod_{jic} + \gamma_3 ICT_{jic} + \gamma_4 W\_Skills_{jic} + \gamma_5 W\_Edu_{jic} + \gamma_6 Finance_{jic} + \gamma_7 Exp\_share_{jic} + \gamma_8 Import\_sh_{jic} + \gamma_9 IQI_{jic} + \gamma_{10} IQI * Exp\_share_{jic} + \gamma_{11} IQI * Import\_sh_{jic} + \delta_1 D_i + \delta_2 D_c + \varepsilon_{jic} \quad (7)$$

$$Market\_in_{jic} = \alpha + \gamma_1 size_{jic} + \gamma_2 prod_{jic} + \gamma_3 ICT_{jic} + \gamma_4 W\_Skills_{jic} + \gamma_5 W\_Edu_{jic} + \gamma_6 Finance_{jic} + \gamma_7 Exp\_share_{jic} + \gamma_9 Import\_sh_{jic} + \gamma_{10} IQI_{jic} + \gamma_{11} IQI * Exp\_share_{jic} + \gamma_{12} IQI * Import\_sh_{jic} + \delta_1 D_i + \delta_2 D_c + \varepsilon_{jic} \quad (8)$$

Equations for empirical specifications in table 2

We replace the foreign technology licensing and foreign ownership as potential linkages of firms with exporting and importing activities.

$$Product\_in_{jic} = \alpha + \gamma_1 size_{jic} + \gamma_2 prod_{jic} + \gamma_3 ICT_{jic} + \gamma_3 W\_Skills_{jic} + \gamma_4 W\_Edu_{jic} + \gamma_5 Finance_{jic} + \gamma_6 Lic\_tech_{jic} + \gamma_7 F\_own_{jic} + \delta_1 D_i + \delta_2 D_c + \varepsilon_{jic} \quad (1)$$

$$Process\_in_{jic} = \alpha + \gamma_1 size_{jic} + \gamma_2 prod_{jic} + \gamma_3 ICT_{jic} + \gamma_4 W\_Skills_{jic} + \gamma_5 W\_Edu_{jic} + \gamma_6 Finance_{jic} + \gamma_7 Lic\_tech_{jic} + \gamma_8 F\_own_{jic} + \delta_1 D_i + \delta_2 D_c + \varepsilon_{jic} \quad (2)$$

$$Market\_in_{jic} = \alpha + \gamma_1 size_{jic} + \gamma_2 prod_{jic} + \gamma_3 ICT_{jic} + \gamma_3 W\_Skills_{jic} + \gamma_4 W\_Edu_{jic} + \gamma_7 Finance_{jic} + \gamma_8 Lic\_tech_{jic} + \gamma_9 F\_own_{jic} + \delta_1 D_i + \delta_2 D_c + \varepsilon_{jic} \quad (3)$$

$$Manag\_in_{jic} = \alpha + \gamma_1 size_{jic} + \gamma_2 prod_{jic} + \gamma_3 ICT_{jic} + \gamma_4 W\_Skills_{jic} + \gamma_5 W\_Edu_{jic} + \gamma_6 Finance_{jic} + \gamma_7 Lic\_tech_{jic} + \gamma_8 F\_own_{jic} + \delta_1 D_i + \delta_2 D_c + \varepsilon_{jic} \quad (4)$$

$$Product\_in_{jic} = \alpha + \gamma_1 size_{jic} + \gamma_2 prod_{jic} + \gamma_3 ICT_{jic} + \gamma_3 W\_Skills_{jic} + \gamma_4 W\_Edu_{jic} + \gamma_5 Finance_{jic} + \gamma_6 Lic\_tech_{jic} + \gamma_7 F\_own_{jic} + \gamma_8 IQI_{jic} + \gamma_9 IQI * Lic\_tech_{jic} + \gamma_{10} IQI * F\_own_{jic} + \delta_1 D_i + \delta_2 D_c + \varepsilon_{jic} \quad (5)$$

$$Proces\_in_{jic}$$

$$= \alpha + \gamma_1 size_{jic} + \gamma_2 prod_{jic} + \gamma_3 ICT_{jic} + \gamma_4 W\_Skills_{jic} + \gamma_5 W\_Edu_{jic}$$

$$+ \gamma_6 Finance_{jic} + \gamma_7 Lic\_tech_{jic} + \gamma_8 F\_own_{jic} + \gamma_9 IQI_{jic} + \gamma_{10} IQI * Lic\_tech_{jic}$$

$$+ \gamma_{11} IQI * F\_own_{jic} + \delta_1 D_i + \delta_2 D_c + \varepsilon_{jic} \quad (6)$$

$$\begin{aligned} Market\_in_{jic} = {} & \alpha + \gamma_1 size_{jic} + \gamma_2 prod_{jic} + \gamma_3 ICT_{jic} + \gamma_4 W\_Skills_{jic} + \gamma_5 W\_Edu_{jic} \\ & + \gamma_6 Finance_{jic} + \gamma_7 Lic\_tech_{jic} \\ & + \gamma_8 F\_own_{jic} + \gamma_9 IQI_{jic} + \gamma_{10} IQI * Lic\_tech_{jic} + \gamma_{11} IQI * F\_own_{jic} \\ & + \delta_1 D_i + \delta_2 D_c + \varepsilon_{jic} \quad (7) \end{aligned}$$

$$\begin{aligned} Market\_in_{jic} = {} & \alpha + \gamma_1 size_{jic} + \gamma_2 prod_{jic} + \gamma_3 ICT_{jic} + \gamma_4 W\_Skills_{jic} + \gamma_5 W\_Edu_{jic} \\ & + \gamma_6 Finance_{jic} + \gamma_7 Lic\_tech_{jic} \\ & + \gamma_9 F\_own_{jic} + \gamma_{10} IQI_{jic} + \gamma_{11} IQI * Lic\_tech_{jic} + \gamma_{12} IQI * F\_own_{jic} \\ & + \delta_1 D_i + \delta_2 D_c + \varepsilon_{jic} \quad (8) \end{aligned}$$

CHAPTER 5

CONCLUSIONS AND POLICY IMPLICATIONS

In the light of the vast and still growing body of literature on the firm heterogeneity in international trade theory, this thesis explores the performance of manufacturing firms operating in four largest South Asian countries. The dissertation consists of three essays, although interrelated, but each essay is independent self-contained study.

Given the framework of the New-New trade theory—role of firm heterogeneity in international trade theory, first essay examines the trade margins of the firms, especially exploring their response to corruption. The New-New trade theory provide additional channel of aggregate productivity growth through inter-industrial reallocation in favor of most productive firms due to the more liberalize trade regime. However, this channel is missing in South Asian countries where small and inefficient firms dominate both local and international market. Because of sluggish productivity growth, the exports competitiveness is low and aggregate economic activity is derived by the domestic demand. Existing literature document that extensive margin of trade play major role in export growth process. Hence, we argue that poor performance on exports front attributes to the pervasive corruption in South Asian developing countries which increases the market entry fixed cost and put limit on the extensive margins of international trade. On the other hand, corruption facilitates the incumbent firms to increase their volume of exports and promotes the intensive margin of trade. We test these alternative hypotheses using the data of manufacturing firms operating in selected South Asian countries. The results of the study reveal that corruption reduce the probability of the new firms' entry intro export market and hence put limit on the growth of extensive margin of trade. However, corruption has statistically significant

positive effect on the intensive margin of trade. These results confirm that pervasive corruption and malfunctioning state apparatus limit the scope of inter-industrial reallocation in favor of most productive firms in the selected South Asian countries.

In the second essay, we investigate that how much imported inputs prove beneficial for the productivity performance of manufacturing firms engaged in international trade. In addition, the study also tests complementarity between firms' capabilities and imported inputs in augmenting productivity performance of the firms. This study is motivated by the fact that magnitude of productive impact of imported inputs varies strongly in different studies on different countries. This heterogeneous outcome in different studies, motivate us to incorporate the role of firm capabilities—ratio of skilled to unskilled workers, education of the workers, training to the workers, internal R & D activities, and management capability of firms — as additional variables in the standard production function. The empirical estimation is carried out with the Stochastic Frontier Model, Ordinary Least Square (OLS) and Instrumental Variable (IV) approach. Overall results of the study show that imported inputs have the positive and statistically significant impact on the productivity of the firms operating in selected South Asian countries. The findings of the study also support the claim that firms' capabilities augment the gain from the imported inputs. Moreover, we also find that productivity gain from imported technology is higher than imported inputs.

The third essay explores that how firms' exposure to global market is prove beneficial in terms of introduction of innovation in their production process. More recently, the role of conducive institutional environment for innovation and international competitiveness has received much attention. It is argued that properly devised institutions provide strong incentives for the productive behavior—inventions and innovations —in an economy while poorly devised institutions encourage rents

seeking in the economy. Hence, this study also explores that how local institutional structure in which firm is operating respond to the innovation capacity of globally engaged firms. We use the probit model and endogenous treatment based on control function approach as estimation techniques. Overall results of the study substantiate the claim that global linkages of the firms induce different types of innovations in the production process. Moreover, the relationship between global linkages of the firms and innovation also depends on the institutional structure of the country where firms are operating. The results of the study show that in most of the cases the institutional quality complemented global linkages of the firms for the introduction of different types of innovations.

Few policy implications can be safely drawn from our empirical analysis.

First, the results of the study reveal that corruption reduce the probability of the new firms' entry intro export market and hence put limit on the growth of extensive margin of trade. Despite the trade liberalization regime in selected south Asian countries, corruption prevalence limits the scope of inter-industrial reallocation in favor of most productive firms. Its facilities the incumbent firms and discourages the entry of new firms in exports market and impedes the additional channel of productivity growth and catch-up as suggested by the trade models based on firm's heterogeneity. Hence, corruption control measures such as digitalization of the economy can promote inter-industrial reallocation in favor of the most productive firms in selected South Asian countries which amplifies the overall productivity growth

Second, our results show that use of imported inputs in production process increase the productivity of firms in selected South Asian countries. Hence, these countries should reduce tariffs on imported inputs to increase access to higher quality foreign inputs. Moreover, findings of the study also support the claim that firms' capabilities augment the gain from the imported inputs. Given the role of firms'

capabilities, these countries should allocate more resources to education and encourage firms to invest in firms' capabilities such as training to workers, management capability of firm, and internal R &D effort.

Third, our results support the claim that global engagement of the firms helps the firms for introduction of different types of innovation. Hence, these countries should encourage firms to engage with their global counterpart to introduce innovation in their different dimension of business operation. In cognizance of the role of institutional quality, it is important that selected South Asian countries should focus on the institutional environment and improve the regulatory quality, control the pervasive corruption and properly enforce rule of law. So that local institutional structure facilitates firms for the introduction of innovation in their business operations.