Impact of Exchange Rate on Firm Productivity: Exploring the Role of Financial Constraints

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APPROVAL SHEET

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In the name of Allah, the Most Merciful, the Most Kind

"Say He is the All-Merciful. We believe in Him, and we put all our trust in Him."

(Surah Al Mulk 67 29)

O my Lord! open my breast for me, And make my task easy to me, And loose the knot from my tongue, (That) they may understand my word.

(Surah Taha 20·25-28)

Dedication

To Prophet Muhammad (S.A.W.W)

&

To My Family

Declaration

I hereby declare that this thesis, neither as a whole nor as a part thereof, has been copied out from any source It is further declared that I have carried out this research by myself and have completed this thesis on the basis of my personal efforts under the guidance and help of my supervisors If any part of this thesis is proven to be copied out or earlier submitted, I shall stand by the consequences No portion of work presented in this thesis has been submitted in support of any application for any other degree or qualification in International Islamic University or any other university or institute of learning

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Abstract

Employing firm level data set over the period of 2000 to 2013, this thesis investigates the level and volatility effects of exchange rate on the productivity growth of Pakistan's manufacturing firms We have also explored the role of financial sources (debt financing, and domestic equity markets) in the productivity growth of firms' Moreover we examined whether financial sources mitigates the impact of exchange rate uncertainty on firm productivity growth The empirical results using dynamic panel data estimation technique (system GMM) and comprehensive robustness test suggest that exchange rate volatility has a significant productivity growth reducing effect on manufacturing firms However, having access to domestic equity market does not alleviate these effects while access to debt market alleviates negative effects of exchange rate volatility We detect, however, that productivity is positively related to having access to external credit Additionally, we find that while export (inward) oriented firms are affected less (more) by exchange rate depreciations, they are also less (more) sensitive to exchange rate volatility

Chapter 1

Introduction

The preliminary part of the thesis has tried to enhance the importance of the topic Moreover, it provides discussion about the exchange rate volatility and firms' productivity It also covers the basic objectives of the study, poses the research questions In addition, it also gives detail on the key contributions and outlines the gap in the literature

1.1 Back ground of the Study

The issue of exchange rate volatility[1] started after the breakdown of fixed exchange rate system under the Breton Wood's agreement After the fall of Bretton Woods Agreement the adoption of floating exchange rate system created randomness and uncertainty in the values of exchange rates over the time due to which both real and nominal exchange rates fluctuated widely In addition, the rising financial liberalization as well as capital market integration also caused the fluctuations in the exchange rates of developed and developing countries It's because exchange rates are sensitive to small changes in economic scenarios at domestic and international level Exchange rates also show frequent responses as well In the post Bretton Wood period the rising volatility of exchange rate has been the center of attention for the policy makers and researchers and still the interest is intense Additionally, the instability in the values of exchange rate has

[1] The exchange rate volatility is defined as the extent to which the exchange rate fluctuates around its equilibrium value over time

not only aroused scholar's interest towards it but they are also interested in its impacts, which originate due to the volatile performance of exchange rates

Moreover, exchange rate uncertainty not only arise by certain activities but it also has an impact on economic growth, international trade, particularly on firms' export performance, investment, employment levels and on the profitability of firms' Similarly, the exchange rate volatility also has considerable effects on consumer prices which in turn affects demand and finally affects consumption Additionally, it also affects the capital flow at international level by lowering the foreign direct investment as well as portfolio investment in the host country (Chipili, 2010) These reasons have forced the policy makers to take interest in studying the dynamic behavior of exchange rate and its volatility, in order to make suitable financial and economic policies Indeed, many studies have explored the effects of exchange rates and its volatility along these lines (see, for example Ramey & Ramey, 1995, Aghion et al , 2006, Aizenman & Marion, 1999 among many others) Yet, the effects of exchange rate dynamics on firms' productivity remained less explored in the literature When we review the empirical literature we find only few studies in this area Particularly, Aghion et al (2009) and Demir (2010, 2013) etc have focused on the impact of exchange rate volatility on firm productivity and both find out its negative impact on productivity Moreover, Aghion and Demir both have also explored that more financially an economy is developed less adversely it is affected by the exchange rate uncertainty

In principle the exchange rate volatility affects firms' productivity through several channels These channels are (1) by varying the production cost, (2) by decreasing the availability of credit from financial institutions, (3) by influencing the balance sheets and

net income of firm, and (4) by discouraging trade via rise in transaction risk and explored that the growth effects of uncertainty depends on firm characteristics (Demir, 2013, Caglayan et al , 2014, Aghion et al , 2009, Braun & Larrain, 2005, Baum & Caglayan, 2010)

Additionally, increasing uncertainty of exchange rate causes a temporary fall in productivity growth as firms temporarily stop their investment and hiring (Bloom, 2009) Like the exchange rate volatility, exchange rate depreciation also affects the productivity of firm via three channels First channel is the unit cost effect of exchange rate depreciation which increases the cost of imported goods Second one is the depreciations impact on innovation and on research and development (R&D) Continuity in the depreciation of exchange rate increases the price to import technology Third, exchange rate depreciation reduces the forces of creative destruction (Harris, 2001)

The exchange rate volatility affects the productivity but the intensity of the impact depends on the financial development According to a simple monetary growth model presented, where wages are sticky, exchange rate fluctuations have a negative effect on growth performance of those firms facing credit constraints (Aghion et al , 2009) The mechanism underlying the positive growth interaction between financial development and the exchange rate volatility is as follow Suppose that the borrowing capacity of firm is dependent on firms' current earnings Then, appreciation of domestic currency causes the current earnings to decrease which in turn affects the borrowing capability in order to deal with the liquidity shocks and innovation in the long term Opposite is the case for depreciation Conversely, credit constraint existence means that the positive effects of

depreciation on innovation will not fully compensate the negative effect of an appreciation in general Thus, productivity raise as a result of innovation by those entrepreneurs with sufficient funds to meet short-run liquidity shocks

The impact of exchange rate movements on firm performance along with financial constraints is covered by many international researchers from different perspectives While only few studies have covered the topic of firm productivity, even by knowing the fact that productivity is an important concern, as the expansion in productivity is a vital source of the economic growth Deprived labour productivity has been referred as one of the basis leading towards the decrease in the growth of the economy (World Bank Report, 2003) Keeping in view the importance of firms' productivity growth and the most frequently discussed exchange rate movements, this study aims to take step towards this direction and explore this new area of research

1.1 Problem Statement

In the current era of rising globalization and exchange uncertainty, variations in exchange rates have a considerable impact on firms' operations, productivity and profitability Exchange rate uncertainty not only influence multinational and fat companies but it also impacts the small and medium range corporations Even it also affects those firms which operate in home country Identifying and dealing with exchange rate risk is a matter of obvious concern to business vendors Investors must be familiar with it as well because of the huge impact it can have on their investments Exchange rate volatility hurt firms' by making it hard for it to set prices, manage costs and forecast revenues Such an uncertain profit stance may lower the stock prices of companies at the same time urge

investors to claim high risk premiums, which increase the cost of funding business investment (Olasupo, 2005)

According to Loudon, 1993 firms face three types of risks under exchange rate volatility First one is the transaction exposure and it is faced by those firms which are involved in international trade Under this exposure exchange rate variations influence the companies entered in an obligation of receiving and making payments in international currency This sort of exposure to the exchange rate volatility can lead towards the losses for firms Second one is the translation exposure which exposes firms' financial statement to exchange rate fluctuations This sort of exposure is medium to long term in nature Third one is the economic exposure and it arises with the effects of unanticipated currency volatility on the firms' cash flows Exchange rate fluctuations impact the competitive position of a corporation even if it does not operate or sell overseas For example, a manufacturer who only sells locally but involved in importing from USA Then in this case if rupee gets depreciated against US dollar then it would make it expensive for the company

1.2 Gap in the literature

Most of the researches in Pakistan have investigated the impact of exchange rate volatility on trade particularly exports (Mustafa et al (2004), Kumar & Dhawan, 1991, Kemal, 2010, Saqib & Sana, 2012, Khan et al , 2014 have explored matters in this dimension) The recent studies at firm level have focused on the areas like the impact of trade liberalization on firm entry and exit (Nasir, 2014) and the influence of foreign ownership on total factor productivity (Batool et al , 2009) etc Moreover, there is a study

which deals with the relation between financial constraints and firm growth (Ahmed & Hamid, 2011) but not with the exchange rate movements

The above discussion makes clear that no study in Pakistan has reviewed the impact of exchange rate movements on firm productivity in context of Pakistan This study aims to deal with manufacturing sectors' firm productivity and exchange rate movement's simultaneously because of the fact that manufacturing sector is the second biggest sector of the economy and plays a vital role in the economic development Moreover, it accounts 19 1 percent of Pakistan's GDP in 2015 Therefore, it needs an in depth study Moreover, this study explores this relation along with export orientation and sources of finance For the analysis we use two measures of uncertainty where as the previous studies have used only one measure

1.3 Objectives of the study

The objectives of the study are

- To examine the level and volatility effects of exchange rates on productivity growth of manufacturing firms
- To measure the role of financial sources under the impact of exchange rate movements (level and volatility) on firms' productivity
- To study whether the exchange rate movements (level and volatility) have more impact on the productivity of export oriented firms than non oriented

1.4 Research questions

i Whether exchange rate volatility has an impact on the productivity growth of manufacturing firms?

ii Whether the access to equity markets or to debt markets, alleviates the adverse impact of exchange rate volatility on productivity?

iii Whether the productivity effect of exchange rate volatility is stronger for export oriented firms?

iv Whether exchange rate depreciation leads to improvements in productivity of export oriented firms?

v Does firm productivity improve with debt financing?

1.5 Significance of the Study

The study is significant in providing an insight into the process of writing on the impact of exchange rate movements and firm productivity in case of Pakistan This study will be helpful for firm managers in accessing the volatility impact on firm productivity and in this way they can improve productivity by taking precautionary measures Moreover, this study is important for portfolio managers as they are more concerned for exchange rate uncertainty while making investment portfolio As cash flows and firm value get affects under exchange rate fluctuations

The study will be helpful for the upcoming researchers of finance who are interested to explore the area of firm productivity Understanding of the exchange rate volatility effects on productivity helps the policy maker in designing the effective policy in order to enhance the productivity in Pakistan This study might be supportive for the exporting

firms as well because through this study they come to know about firms exporting behavior under exchange rate movements

1.6 Scheme of the study

The present study has been structured in the following manner

The first chapter includes the background of the present study, it also elucidates the importance of exploring the specific area of knowledge and paves the way for the forth coming chapters The relevant objectives have also been expounded here It also highlights the significance of conducing the particular study and how it has added up to the existing knowledge in the specific field Introduction gives a glimpse of the entire research project

The second chapter provides an overview on the current and past state of the literature on uncertainty and productivity of the firm In this section the related literature has been reviewed critically Different researches conducted so far on rewritings have been given in detail

The third chapter has elucidated in detail about the data and the sources from where we have extracted the statistics It also highlights the concerned variables in detail and reviews their construction All the techniques that have been used for the empirical analysis are mentioned in this chapter It also includes a brief discussion on the empirical methodologies employed

Chapter 4 pays attention on the empirical findings and the analysis of these results The assessment of the objectives has been conducted on the basis of the developed models In simple it empirically gives answer to the posed questions

Chapter 5 concludes the whole thesis Specifically, this section commence by presenting the background of the study Next, it presents a sum up of the empirical results to the questions posed in the introductory chapter of the study and discusses the policy implications In this chapter, we also cater the limitations of our thesis Finally, we end up by highlighting the areas for future research

Chapter 2

Literature Review

2.1 Introduction

This chapter presents an extensive summary of the previous and present literature that has emerged The literature is reviewed in domains which are directly linked to the scope as well as with the purpose of the study Moreover, a brief summary is given at the end of each category of literature

There are four categories of literature The first strand of literature provides negative effects of volatility on productivity The second strand consists of few studies which contribute to the literature by exploring the relationship between exchange rates and trade (i e exports) The third strand deals with the availability of credit and firms' productivity Fourth strand is composed of rare studies conducted in Pakistan at firm level but these studies ignored exchange rate volatility

2.2 Studies Related to the Impact of Exchange Rate Movements on Productivity and Growth

The impact of volatility and its sources remained a debating issue among researchers after the fall of Bretton wood system Many studies have been conducted on the level and volatility effects of exchange rate One of them is the study of Demir (2013) who explored the impact of exchange rate uncertainty on domestic versus foreign firm's growth as well as its impact on public versus private manufacturing firm's growth The empirical analysis is involving Turkish manufacturing firm's data from the period of

1993 to 2005 and is empirically analyzed using system generalized method of moments (GMM) technique The conclusion expose that uncertainty has significantly negative impact on Turkish manufacturing firm's growth Moreover, the results have shown that the access to both equity and debt markets (foreign or domestic) will help in reducing this negative impact of volatility

Similarly, Caglayan and Demir (2014) also investigated the exchange rate movement's impact on foreign and domestic manufacturing firms' productivity along with the access to finance (debt and equity market) The empirical analysis of the study is done using two step system GMM method over the period of 1993 to 2005 Moreover, they have used GARCH (1 1) technique for the calculation of exchange rate uncertainty At the end, study concludes that exchange rate volatility significantly reduces the productivity of firm Additionally, they also find out that the access to equity market have no impact on the productivity reducing effect of volatility While the access to external debt plays a positive role in increasing the productivity level of firms

Additionally, Aghion et al (2009) also studied whether the effect of exchange rate volatility on productivity growth depends on a country's level of financial development In this study the growth is measured by taking the log of out per worker while exchange rate uncertainty is measured using both GARCH (1 1) as well as standard deviation measure For the empirical evidence they have used panel data set of 83 countries over the period of 1960 to 2000 and applied GMM dynamic panel data estimator technique The regression results indicate the differences in productivity growth of industries across countries with different level of exchange rate uncertainty, financial development and liquidity requirements The conclusion of the study signifies the negative impact of

exchange rate volatility on the productivity growth of industries with high liquidity requirements as compared to those having less liquidity need The findings of the analysis emphasized the importance of financial development that more financially a country is developed, faster a country will make progress with high flexible exchange rate and less adversely it is affected by the uncertain exchange rate

Many studies also examined the channel through which volatility effect the growth, one of them is the availability of finance and is demonstrated in Aghion, Bacchetta et al , (2005, 2009) Both explained the adverse impact of volatility on growth especially when financial access is limited and this empirical analysis is carried out using panel data set for the time period 1960 to 2000 Results show inverse relationship between volatility and economic growth on one hand and between volatility and the financial development on the other hand

In theory, exporting firms generally have high productivity than non-exporting firms Moreover a powerful export sector can lead towards an encouraging economic growth of the country (Cheung & Sengupta, 2013) Countless empirical studies are available in the literature that has focused on the relationship between the exchange rate and trade but most of these studies are conducted at aggregate level There are few empirical studies that deal with the exchange rate and exporting firms With the help of them they have shown volatilities impact on firm productivity In this context, study of Tung (2008) is considerable He presented a theoretical model by improvising the Krugman's model (1979), added an exchange rate variable in the profit function of firms The theoretical model illustrates that as exchange rate appreciates some firms will exit and continuing firms face two forces that take its sales in opposite ways The increasing competition

cause each firm to sell less, the shutting down of other local firms enables surviving firms to get a big market share Simulation results explains that currency appreciations likely to decrease a firm's exports even as they raise its domestic sales However, in case if foreign consumers become less responsive to price changes than domestic ones or in a situation where the exit rate of export market is high, the relationship among exchange rate and exports of the continuing firms turn out to be non-monotonic Thus, the impact of exchange rate appreciations on a firm's operation and on labour productivity depends on the direction and degree of the changes in local sales and exports

He empirically tested the hypothesis extracted from the theoretical model by analyzing the influence of exchange rate appreciation on firms export decision as well as on the production scale and in turn the role of these decisions on productivity growth The empirical consequences are consistent with the predictions of the theoretical case where the exit rates are high for both production and export markets The empirical analysis of the theoretical model is done using Taiwan's firm level data The time period involved for the manufacturing firms' data set consist of 1986, 1991 and 1996 The empirical analysis conducted through fixed effect exposed that the exchange rate appreciation will lead towards an increase in exports and domestic sales The empirical results suggest that currency appreciation have caused an increase in the level of production among the surviving firms, is consistent with the case of high exit rates Further, it causes an increase in total sales which in turn have a significant effect on firm's productivity growth

In addition, Cheung and Sengupta (2013) tried to explore how exchange rate movements (real effective exchange rate and exchange rate uncertainty) affect the export shares of

Indian, non financial firms for the year 2000-2010 They have measured the uncertainty in exchange rate with the annual standard deviation of the monthly real effective exchange rates The empirical analysis of the impact is analyzed through the base line regression and their study revealed that the volatility and currency appreciation has negative impact on the export share of Indian firms Also those firms that have small share of exports are more affected by the movements of exchange rate

Similarly, the study of Hericourt and Poncet (2013) conducted in china examined the real exchange rate (RER) volatility impact on exporting firms performance for the period of 2000 to 2006 using fixed effect technique For empirical analysis they have used exporters' data The present study identified negative impact of exchange rate volatility via increase in sunk costs on the export performance of firms but to what extent they are affected depend on their access to credit While the sunk cost in this study is described as the investment done in the intangible capital In addition, Greenaway and Kneller (2007) also investigated the negative impact of exchange rate volatility on exports and exposed that exchange rate volatility results in sunk costs The study of Li et al (2015) has shown the same impact at firm level but this study relates with level effect of exchange rate Additionally, Berman et al (2012) analyzed the behaviors of exporting firms against exchange rate changes using French firms data for the time period 1995 to 2005 They find out that the massive exports are done by the high potential firms which partly absorb the depreciating effects by increasing their markup and with the less increase in their export volume

2.2.1 Brief Summary

It's clear from the above literature that research on firm productivity effects of exchange rate uncertainty is much more limited Only one study particularly deals with the exchange rate movements' impact on firm productivity using Turkish firm level data (Caglayn & Demir, 2014) The study of Demir (2013) has also reviewed the impact of exchange rate volatility but he has reviewed it by using firm growth as dependent variable which is measured with the logarithmic growth rate of employees While Aghion et al (2009) carried out exchange rate uncertainty impact on productivity at aggregate level They have measured the productivity by using output per workers' proxy while they have measured the uncertainty with standard deviation measure Few studies also analyze the exchange rate volatility impact on firms' performance through exports and find out mix results Like Fung (2008) found exchange rate appreciations positive impact on firm productivity through exports while Hericourt and Poncet (2013) has shown negative impact of volatility on exports performance of firms via increase in sunk costs While in our study we have examined the impact of both level and volatility of exchange rate on firm productivity Our study is only covering manufacturing firms' data Moreover, in our study firm productivity is measured through the labour productivity We also tried to explore the impact of exchange rate volatility on the productivity of export oriented firms as well

2.3 Studies Related to the Export Orientation and Productivity

Exports role in encouraging growth and productivity has been discussed empirically In this respect Sjoholm (1999) has conducted an empirical analysis in Indonesia on the relationship of import and export with the productivity In simple he tried to find out

whether the participation in international trade will affect the productivity of establishment In this study establishment define as plant not as firm The empirical analysis is carried out on annual industrial level data over the period of 1980 and 1991 All the regressions are regressed through OLS The consequences of the study show that the establishments involve in either imports or exports face relatively high productivity The results also reveal that the establishments who particularly involve in exports face more increase in the level of productivity In simple, the study concludes that higher the share of output as exports, higher will be the productivity growth With respect to the impact of imports on productivity growth, the results are quite mixed

Similarly, Castellani (2002) conducted its research using the sample of Italy's manufacturing firms' over the period of 1989 to 1994 The outcome of the study show that as exports to the foreign market increases, the productivity growth will also increase Additionally, the results reveal that firms also learn from the competitors in the international export market Moreover, export orientation may cause efficiency gains for the firms, the gain can be because of the utilization of the economies of scale and can be because of the learning related with the information spillovers from international competitors (World Bank, 1993)

Likewise, Baldwin and Gu (2003) have done an empirical study in Canada at firm level over the period of 1974 to 1996 They investigated the relation between exports and productivity of firm Finally they come up with the view that labour productivity and the change in productivity is higher for those firms who are indulge in exporting

Likewise, In Indonesia a study was conducted by Blalock and Gertler (2004) which tried to reveal the differences in the level and growth rates of exporting and non exporting

firms over the period of 1990 to 1996 The results of the study expose that the productivity is more for the exporters than non exporting firms and it also disclosed that the productivity is not higher before exporting

Similarly, Wagner (2007) has reviewed the empirical strategies and the end results generated in 54 studies using data from 34 countries (1995-2006) In general the study analyzed the relation between exporting and productivity Two hypotheses have been carried out in this research One is the self selection of high productive firms to enter in export markets The other point is the learning of new exporters from international competitors and buyer in order to improve the export performance End results show that the exporting firms are more productive than non-exporting In simple, the high productive firms select itself for entering into export markets where as exporting does not increase the productivity level Alvarez and Lopez (2005) argue that firms in developing countries purposely increase productivity in order to become exporters

Additionally, Harris and Li (2012) empirically investigated the relation of export market behavior and firm productivity in UK For the analysis they have used both production as well as service sector data over the period of 1996 to 2004 Findings of the study disclose that productivity level will increase as firms enter into export markets whereas productivity will decrease as they exit the export market Overall they concluded that such findings have more effect in service sector than the production zone

2.4 Studies Related to the Financial Sources and Growth

Most of the previous researches have focused on the relation between the financial development and the economic growth The discussion on the relation among finance and growth is back to Schumpter (1911) and this relation has both macro as well as micro

aspects Whereas at macro level Schumpter (1911) predicted that the financial developments lead towards the positive impact on growth

Some related literature which studies the impact of aggregate financial development on firm productivity includes Beck et al (2000) They analyzed the impact of financial development on the sources of economic growth using data of 63 countries for the period of 1960 to 1995 The sources which they have mentioned are TFP (total factor productivity), private saving rates and physical accumulation The empirical analysis is conducted using two techniques one is the cross sectional instrumental variable estimator and the second one is the dynamic GMM technique In their study the key measure of financial development is the private credit or in simple it is the credit to the private sector by the intermediaries divided by GDP They concluded that financial intermediary development has an impact on economic growth through growing productivity

Additionally, Demirguç-Kunt & Maksimovic (1998) examined the differentiating financial and legal systems impact on the firms' external financing, use in order to finance the growth For the empirical analysis they have taken data of 30 countries (developed and developing) from 1980 to 1991 and estimated all the regressions using OLS They have shown that the firms use great amount of external finance in countries with good legal system Moreover, a huge banking structure and a working stock market has link with firm growth which is financed through external sources The government subsidies to industry will not increase the firms' portion depending on external finance In simple the results conclude that both working stock market as well as great legal system plays an important role in the assistance of firm growth

Similarly, Beck et al (2005) using cross country firm level data found that not only legal constraints, corruption but also the financial constraints adversely affect the firm growth This link, though, differ with firm size They also come up to the point that small firms' growth is more harshly affected due to financial constraints than the other bigger firms The influence of both financial as well as legal constraints is more on smaller firms than the other ones Moreover, they verify that financial development debilitate the effects of various obstacles to firm growth and also verify that small firms have more advantage from the financial development Likewise, Aghion et al (2005) examined the effect of financial constraints on the investment and its role in the relation between volatility and growth In this study volatility and growth are the mean and standard deviation of the annual growth while the annual growth is measured by taking the logarithmic difference of per capita income This study developed a theoretical growth model and then used panel of 60 countries for the period of 1996 to 2006 for the empirical analysis of the model they proposed Moreover, in this study an exogenous shock is shown with the export weighted variations in the international prices of commodities According to them higher the volatility higher will be the liquidity shock They established that high financial constraints make the investment (R & D) and growth more responsive to shocks and also creating a negative correlation between volatility and growth As clear from the above discussion that this study is conducted at aggregate level but similar to the rest of the literature it is also enhancing the importance of financial access

In addition, the impact of credit access on productivity has been explored by Gatti and Love (2008) using Bulgarian firms' data OLS technique was used for the overall benchmark results while 2SLS was used for robustness check Total factor productivity is

measured with difference between actual output and estimated output which is measured using a production function having actual output as well as input quantities The access to credit is proxied with the existence of line of credit and overdraft facilities They found that the credit access is positively related with TFP In addition, the study exposed that the firms having insufficient access to credit face low productivity Moreover, Bakke (2009) also found that the reduction in credit leads to declining productivity

Levine and Missaka (2014) have the objective of exploring the relationship between the use of external financing and future firm productivity using data of four European countries over the year 2000 to 2010 The relation is robust by using different measures of firm productivity and financing The results indicate that the rise in debt will direct towards an increase in future TFP by keeping labour and capital constant Additionally, Benhima's (2012) study is based on theoretical as well as on empirical analysis A theoretical model has been presented by adopting the stylized model of Aghion et al (2009) Under this model if firms suffer from credit constraints then negative shocks affect the firms' cash flows which in turn worsen the innovation capabilities Whereas the positive shocks generally have no affect if firms are at its optimum position Moreover, these positive shocks will not overcome the consequences of the negative cash flows volatility In addition wages are sticky or preset in the model due to which the exchange rate policy becomes important for the cash flow volatility The model is exceeded with the addition of two features for measuring the role of dollarization in different regimes of exchange rate 1) in first feature while innovating, divide the production into tradable and non-tradable products 2) firms' liability can be partly or wholly denominated in the form of tradable goods

In fact, with low elasticity of substitution among tradable and non tradable products, the output calculated in foreign exchange is more unstable under flexible regimes As a result, floating exchange rates are harmful for growth in contrast to fixed rates, particularly in extreme dollarized countries In low-dollarized countries, this positing can be reversed because of the hedging properties of domestically-denominated debt

The above mentioned theoretical analysis is proved empirically as well by using 76 countries data (developed and developing countries) over the period of 1995 to 2004 The productivity growth in this study is measured by taking log of the real output per worker He empirically investigated that the exchange rate uncertainty will harm the growth if more amount of external debt is in foreign currency More particularly flexible exchange rate reduces growth in high dollarized countries and improves growth in low dollarization countries This concludes that the volatility impact depends on the access to funds

2.4.1 Brief Summary

Researchers have covered the area of finance with different angles' because of its significance Most of the previous studies have examined the relation between financial development and growth at aggregate level Those researches which explored the same relationship at firm level or at micro level have mainly examined the impact of financial development on firm growth The word financial development means the institutions which provide access to credit should be made advance or developed so that the firms or the organizations can easily access the external finance when they required Varied proxies have been used for its measurement The study of Love and Gatti, Levine and Missaka (2014) have explored the importance of access to credit and revealed that it has a strong positive impact on productivity All of the above mentioned literature whether at

aggregate level or at micro level financial access have shown positive impact on the growth and productivity

In our study we have not only examined its impact on firm productivity moreover we have also focused on its role in the exchange rate volatilities impact on productivity growth We have used two proxies to show the financial access one is equity ratio and the other one is liquidity ratio

2.5 Studies Related to the Volatility of Exchange Rate in Pakistan

Exchange rate is an important variable and it is considered as backbone of trade So any fluctuations in this variable play a vital role in the economy The literature related to volatility of exchange rate in Pakistan is given below

Kumar and Dhawan (1991) was the first study who examined the effect of exchange rate uncertainty on the exports of Pakistan to the main trading partners They used different measures of exchange rate risk i) standard deviation of the nominal exchange rate ii) moving average standard deviation iii) coefficient of variation in exchange rate All the measures are constructed using both nominal and real exchange rate Ordinary least squares (OLS) method is utilized for the empirical analysis and established that the increased volatility has an adverse effect on the export demand using quarterly data for the period 1974 to 1985 Moreover, the results also established that it is the fluctuations in the nominal exchange rates that are statistically significant not the variability in the real exchange rates

Likewise, Mustafa at al (2004) also examined the impact of exchange rate uncertainty on the growth of Pakistan's export as compared to other leading partners Exchange rate volatility has been measured through the standard deviation technique by utilizing the

daily data on effective exchange rates over the period of 1991 to 2004 The study concludes that exchange rate uncertainty has a significant negative effect on the export growth, not only in the long run but also in the short run Moreover Saqib and Sana (2012) also explored the impact of exchange rate volatility on the export (trade volume) using time series data of Pakistan over the period 1981-10 They have used linear regression technique for the analysis The findings of the study show that the REER has negative impact on the trade volume where as import have direct relation with the trade volume and positively affect the exports of the country

Similarly, the objective investigated by the study of Bashir et al (2012) is to examine the variations in exports to US, UK and UAE resulting due to the uncertainty in exchange rate This research is employing monthly data from the year 1988 to 2011 The conditional variance series derived from the GARCH (1 1) technique have been used for the measurement of exchange rate risk Vector error correction methods as well as Autoregressive distributed lag (ARDL) cointegration method have been used for the overall empirical analysis The empirical results propose that a destabilized export can occur in Pakistan because of any instability in the exchange rate with its major trading partners (UK and UAE) and in turn it will result in an injured economy In case of United States this relationship is not revealed to be significant

In contrast, Khan et al (2014) investigated the impact of exchange rate volatility on the demands of imports and exports of Pakistan with respect to the trading partners For exchange rate uncertainty measurement they utilized monthly data over the period of 1970 to 2009 and determined it through GARCH (1 1) technique Rest of the empirical work is done using fixed effect technique The results of the study show that the volatility

dampens the import and exports when Pakistan has used the US dollar as a legal currency with trading partners When it has used the bilateral exchange rate, volatility has no effect on the imports and exports of the country

Moreover, Kemal (2010) investigated that whether volatility affects the trade of Pakistan or not, using GARCH based volatilities and the analysis is done with Three Stage Least Square (3SLS) method The data is collected annually for the time period of 1982 to 2004 The findings of the study revealed that exchange rate uncertainty has negative impact on imports and vice versa on exports The result shows that overall it helps the balance of trade in its improvement Mahmood et al (2011) has tried to explore in Pakistan that whether volatility has an impact on macro economic variables using GARCH based volatility measure They have used annual data over the time period of 1975 to 2005 OLS technique has been used for the analysis The conclusion of the study illustrates that volatility has an impact on macro variables and disclosed that it has negative impact on FDI whereas it has positive impact on trade openness, GDP as well as on growth rate

In addition, Amor and Sarkar (2008) study is basically based on two goals One is to examine the relation among the exchange rate volatility and the fundamentals of exchange rate volatility Second one is based on two hypotheses i) whether real exchange rate variations are less volatile where the financial integration is high ii) whether financial openness helps in satisfying the exchange rate fluctuations They have investigated this impact in 10 economies of South and South East Asia over the period of 1979 to2004 and between one of them is Pakistan They used standard deviation method for measuring the volatility whereas rest of the analysis is conducted using dynamic panel GMM technique

The empirical analysis reveals that liberalization helps in decreasing the RER fluctuations while on the other hand financial integration augments the volatility In simple they have concluded that there is a positive relation between real exchange rate volatility and openness in those countries that have the flexible exchange rate system

The aim of Azid et al (2005) is to investigate the effect of exchange rate variability on the economic growth of Pakistan using quarterly data The study has measured the volatility of exchange rate through the GARCH model and the data on manufacturing production is used to measure the output The total time span involve in the study starts from 1973 and ends till 2003 The result of the study reveals that the exchange rate uncertainty has positive effect on manufacturing production but it is insignificant
The rare studies conducted at firm level in Pakistan other than volatility are as follow

In this regard Ahmed and Hamid (2011) have studied the relation of financial constraints and firm growth in Pakistan The data have been taken from the survey of the World Bank conducted in fiscal year 2007 The instrumental variable (IV) approach is applied in the study Annual average employment growth is used as a proxy for the firm growth while the proxies that have been used to measure the access to credit are (i) percentage of working capital funded through the institutional sources in the previous year, (ii) percentage of the new investments funded through the financial sources in the previous year The literature comes to a conclusion that financial constraint is a hurdle in the firm's growth and secondly financial development is necessary for easy accessibility to credit and the firm specific characteristics such as quality of human capital, size and export level have an indirect impact on firm growth via financial constraint

In addition, Batool et al (2009) have checked the influence of foreign possession on total factor productivity (TFP) in Pakistan The study has used annual data of 12 firms from Food and Tobacco sector (1994 to 2007) and for 32 firms from financial sector (1995 to 2007) They carried out the empirical analysis through Random effect and extracted the total factor productivity (TFP) from the estimated Cobb Douglas production function At the end study wrap up's that the foreign ownership has positive impact on TFP where as firm size has negative impact on TFP In addition to the above studies Nasir (2014) has studied the effect of trade liberalization on the firm's entry and exit particularly in Punjab and exposed that a reduction in local tariff or reduction at the international level have no significant impact on the entry and exit Instead the movements in the exchange rate have more impact than the tariff changes

Additionally, Abbas et al (2015) examined the impact of exchange rate and firm size on exports and on domestic sales They utilized panel data method over the period of 1998 to 2010 only considering 205 manufacturing firms The exchange rate uncertainty is calculated by taking the standard deviation of the monthly real effective exchange rate and for the overall analysis fixed effect technique is used Total assets of the firm have been used as a measure for firm size The results of the study establish a positive relation between exchange rate, firm size and exports The second regression exposed a positive link between firm size and domestic sales but found a negative relation between real effective exchange rate and local sales

2.5.1 Brief Summary

Many researches' have been conducted on the exchange rate in Pakistan from different perspectives because of the importance it holds in the economy and also for the reason that different factors get affects' from it Few of the studies among them have covered the perspective of exchange rate volatility Some of them we have discussed above Those researches have mainly focused the relation between uncertainty and exports while the other researches have touched the areas like economic growth, financial integration etc along with exchange rate volatility Moreover, the aggregate level data have been utilized by these studies The collective conclusion of the above studies says that the exchange rate variability has negative impact on the exports The research by Amor & Sarkar (2008) revealed that openness facilitates' in reducing the fluctuations of exchange rate

On the other hand the studies which employed firm level data have focused on the areas like the impact of financial constraints on firm growth and the firm growth is measured by the annual average employment growth, impact of foreign ownership on total factor productivity, impact of exchange rate and firm size on local and international (exports) sales etc

There are different methods of estimating the exchange rate volatility as there is no collective decision on a single measure of volatility Kumar and Dhawan (1991) measured the exchange rate risk through different ways They measured volatility by taking standard deviation of the nominal exchange rate, through moving average standard deviation and also with the coefficient of variation They applied these measures on quarterly data of both nominal and real exchange rates Mustafa at al (2004) also measured volatility with the help of standard deviation technique by utilizing daily data

on exchange rate Most of the previous literature have measured the exchange rate volatility through the conditional variance series developed through GARCH (1 1) technique (for example, Azid et al , 2005, Kemal, 2010, Bashir et al , 2012, Khan et al 2014 etc)

It is evident from the literature of the Pakistan that no study has focused on the area of firm productivity and exchange rate movements (volatility and level effect) simultaneously The studies who examined the firm growth or productivity, haven't measured it through labour productivity Moreover, the present study will carry on both GARCH (1 1) and standard deviation measures for the calculation of exchange rate uncertainty One is for the bench mark result and the other one is for robustness check

Chapter 3

Data and Methodology

3.1 Introduction

The main objective of this chapter is to discuss the data utilized in this study Moreover, a comprehensive discussion has also been given on the definitions, measurements and on the sources of variables, employed in the empirical examination of exchange rate movements and firm productivity issues in Chapter 4 Under methodology we presented the proposed econometric model and methodology used to investigate the objectives mentioned in Chapter 1

3.2 Methodology

This segment presents the proposed analytical methodology utilized to answer the formed research questions or more specifically to investigate the stated objectives of the study As the present study has three main objectives so in order to estimate them we built three equations

3.2.1 Exchange Rate Movements and Firm Productivity

In order to examine the focal point of the thesis which is the impact of exchange rate movements on the change in firm productivity we estimate equation (1) which is the base line model of the study Here we are involving both level (depreciation) and the volatility of exchange rate along with the lagged dependent variable

$$\Delta(FP)_{i,t} = \alpha + \gamma_1 FP_{i,t-1} + \gamma_2 \sigma_{t-1} + \gamma_3 EX_{t-1} + \gamma_4 EXP_{i,t-1} + \gamma_5 SZ_{i,t-1} + \gamma_6 IND_{j,t} + \mu_i + \varepsilon_{i,t} \quad 1$$

The above model is adopted from the study of Caglayan et al (2014) and in the above model i and t represent firm and year respectively $\Delta(FP)_{i,t}$ is the change in firm productivity and it is measured as the logarithmic difference of labour productivity $(FP)_{i,t-1}$ signifies the lag value of productivity and it is measured by taking the log of labour productivity Description of the, rest of the variables have been given earlier

In equation 1 γ_1 shows the catching up process of the less productive firms' while γ_2 shows the relation between the variable of interest, exchange rate volatility, and change in firm productivity We expect that both coefficients ($\gamma_1$and γ_2) will take negative value While, the effect of exchange rate depreciation on change in firm productivity can be either positive or negative The coefficient of depreciating exchange rate is shown with γ_3 which on one hand makes the imported intermediate goods expensive and decreases the firm productivity whereas on the other hand exchange rate depreciation can increase the firm productivity by increasing the export competitiveness γ_4 is the coefficient of exports, showing relationship between change in firm productivity and exports Moreover, it is expected to take positive sign because of different channels involving self selection as well as learning by exporting There is an ambiguity about the γ_5 sign It also can be either positive or negative If escalating size lead towards the diseconomies of scale then size and productivity relation can be negative Alternatively economies of scale and entry barriers might support the big firms over small firms $(\mu)_i$ in the above model denotes the firm specific effect while $\varepsilon_{i,t}$ on the other hand signifies the error term

Moreover, both industry and size variables are introduced as control variables

3.2.2 Access to Financial Sources

The word financial sources defined here as the two sources of finance One is the finance comes from equity market and the other one is the finance comes through external borrowing (debt market) Equity and debt ratios are used to measure the finance comes from the equity and debt market respectively

We will extend the basic model in equation (2) for quantifying the second objective and here the extension is shown with the inclusion of a variable describing firms' access to credit (AC)

$$\Delta(FP)_{i,t} = \alpha + \gamma_1 FP_{i,t-1} + \gamma_2 \sigma_{t-1} + \gamma_3 EX_{t-1} + \gamma_4 AC_{i,t-1} + \emptyset\left(\sigma_{t-1} \times AC_{i,t-1}\right) + \gamma_5 EXP_{i,t-1} + \gamma_6 SZ_{i,t-1} + \gamma_7 IND_{j\,t} + \mu_i + \varepsilon_{i\,t} \quad 2$$

In the above equation $(AC)_{i,t-1}$ is a set of variables, reflecting firms approach to domestic equity (equity/total assets) and debt markets (leverage) The interaction of credit access with exchange rate volatility permits us to check whether the effect of uncertainty on firms' productivity will vary with firms' access to finance In simple, whether the access to credit will help in eliminating or overcoming the effect of exchange rate volatility

3.2.3 Export Orientation

Third equation is build for exploring whether productivity growth of firms differs under the shocks of exchange rate based on export orientation In order to examine this objective we have divided the data into two groups between export oriented and non export oriented firms For that purpose we have defined export oriented firms as those who's more than 10% of the output is being exported

The following equation is the extension of the 2nd equation with two interaction terms The first interaction term is between exchange rate and export dummy and it controls the level effect impact on export oriented firms While, the other interaction term is between exchange rate uncertainty and export dummy

$$\Delta(FP)_{i,t} = \alpha + \gamma_1 FP_{i,t-1} + \gamma_2 \sigma_{t-1} + \gamma_3 EX_{t-1} + \gamma_4 AC_{i,t-1} + \emptyset(\sigma_{t-1} \times AC_{i,t-1}) + \gamma_5 EXP_{i,t-1} + \rho_1(EX_{t-1} \times EXP_{i,t-1}) + \rho_2(\sigma_{t-1} \times EXP_{i,t-1}) + \gamma_6 SZ_{i\,t-1} + \gamma_7 IND_{j,t} + \mu_i + \varepsilon_{i,t} \quad 3$$

3.3 Estimation Technique

3.3.1 Measuring Volatility

We don't get any unanimous consensus of the researchers about the accurate proxy for measuring volatility This is the reason that different researchers used multiple measures in their studies for volatility measurement Exchange rate uncertainty measurement remained an important matter, that's why different methods have been applied and analyzed The methods generally applied by the researchers include moving averages, moving standard deviation, stochastic volatility models, logarithm of the exchange rate These volatility methods have been criticized because of their inability to fully detain the volatility in the exchange rate Moreover, these techniques are heavily tailed in their distribution Volatility clustering is also observed in the exchange rate during the use of these methods

In order to capture these properties we employed, the Autoregressive Conditional Heteroskedastic (ARCH) model derived by Engle (1982) and the Generalized

Autoregressive Conditional Heteroskedastic (GARCH) model derived by Bollerslev (1986) in this study for measuring the exchange rate volatility

ARCH/GARCH technique discussed extensively in the literature and considered as the most effective way to measure uncertainty because of its diversity to account the aspect of persistence in shocks take place over time ARCH/GARCH models require long time series data for making the estimates of parameters to be accurate (Matei, 2009)

Following are some studies which have used GARCH (1 1) methodology to measure the exchange rate uncertainty For example, Aizenman & Marion (1999) use conditional variances obtained from the estimation of GARCH models in order to measure the exchange rate volatility Demir (2010, 2013) have also utilized the average annual conditional variances measured from the GARCH (1 1) technique for the measurement of uncertainty in exchange rates GARCH variance has also been utilized by Kemal (2005) in order to construct a proxy for the exchange rate volatility

In our study we measure the uncertainty using GARCH (1 1) model for the bench mark results as it effectively captures the autocorrelation problem and for robustness test we use standard deviation measure Moreover, these measures are constructed using monthly nominal exchange rate data After obtaining the measures we converted the data into annual frequency in order to match it with the rest of the annual firm level data The GARCH[2] (1 1) model consist of 2 equations One is mean equation and the other one is variance equation The following are the equations

$$E_t = a_0 + a_1 E_{t-1} + \varepsilon_t \qquad \text{Mean equation}$$

[2] GARCH stands for generalize autoregressive conditional heteroskedasticity

$$H_t = \beta_o + \beta_1 \varepsilon^2_{t-1} + w_1 H_{t-1} \qquad \text{Variance equation}$$

Where E_t is the exchange rate, ε_t is error term, H_t is the current conditional volatility, and H_{t-1} is the lagged conditional volatility However, in GARCH (1, 1) model it is mandatory that all of the coefficients should be positive Following the study of Aranyarat (2011) we have constructed the GARCH (1 1) model

3.3.2 Estimation Technique of Empirical Models

A model which involves a lagged dependent variable as an explanatory variable requires an instrumental variable method because the error term will not be orthogonal to lagged dependent term If OLS (ordinary least square) technique is employed in this situation it will result in biasness

In our study, similar to Demir (2010 & 2013), Caglayn et al (2014) and others, we apply generalized method of moments (system GMM), also known as robust two-step dynamic system panel data (DPD) estimator, for the empirical estimation of the models It is defined as a method which combines the economic data with the population moment conditions in order to produce the estimates for unknown parameters of the model

We have used system GMM approach because our study is based on dynamic panel data model GMM has become a well-liked tool among researchers In 1982 Hansen developed this methodology, which is basically introduced in 1894 by Karl Pearson Hansen Shared the Nobel prize of 2013 in economics because of this attempt

Further, Arellano, Bond (1991) as well as Arellano, Bover (1995) and Blundell, Bond (1998) designed dynamic panel data estimators, both of which have gained much importance These estimators were designed for the situations like, where 1) the

individuals are large in no and the time span is small 2) the dependent variable is dynamic and depend on its lag values 3) there is linear relationship 4) independent variables having endogenous nature and fixed individuals 5) effects heteroskedasticity and when autocorrelation is not across individuals (Roodman, 2009a)

Moreover, as compared to OLS this methodology removes the unobservable firm effects through the first difference of the underlying variable, those maintaining correlation between the independent variables and the residuals terms This method also resolves the endogenity problem by using the lagged levels of independent variables as instruments It also controls heterogeneity across individual firms This technique is fairly elastic and let the researcher to make use of different instruments with different lag structure

Two tests will be used in this study in order to confirm the validity of the instruments chosen One is J statistics which is used to test the over identifying restrictions of instruments Second one is autocorrelation test of Arellano & Bond (1991) to inspect the serial correlation in error terms The above mentioned tests make sure that the instruments used are suitable, satisfying the conditions of orthogonality and make clear the absence of second order serial correlation Similarly, we have used different instruments while analyzing the models

3.4 Variables of the study

For the empirical estimation the required firm specific variables are Size, Leverage, Equity, Sales, Exports, Industry Sales, Total Assets and Salaries/wages On the other hand in order to measure the exchange rate movements or more specifically in order to measure the exchange rate volatility and the level effect we require monthly exchange

rate data but later on we annualize these monthly figures in order to match with the annual firm level data set

In this study we have taken change in firm productivity as dependent variable While, lagged firm productivity, size, exports, leverage, equity, industry output growth, uncertainty, and exchange rate are taken as independent variables of the study In between these industry output growth and size are the control variables Moreover, following Abram et al (2006) we determine output through the firm sales

3.4.1 Definition of Variables

The definitions and description of the economic and firm variables is given as follow

Variables and Abbreviations	Description of Variables
Change in firm productivity $\Delta(FP_t)$	Logarithmic difference of the total output during the year divided by the wages/salaries We determine total output through the value of total sales
Firm productivity $(FP)_{i,t}$[3]	It is the natural log of total output during the year divided by the wages/salaries We are using wages, salaries and employee benefits as a measure of labour unit
Exchange rate volatility (σ_t)	ARCH/GARCH specifications are employed to acquire the conditional variance as a proxy for exchange rate uncertainty
Firm size $(SZ)_{i,t}$	Natural logarithm of Total assets of the firm
Firm exports $(EXP)_{i,t}$	Total exports as a percentage of total sales
Leverage ratio $(Lev)_{i,t}$	The sum of short term as well as long term debt at the end of the year divided by total assets
Equity ratio$(Eqty)_{i,t}$	It is the value of subscribed and paid up capital of the firm divided by total assets Subscribed and paid up capital is not part of total liabilities it is a separate entity
Industry output growth $(IND)_{j,t}$	It is accounted by taking the logarithmic growth of sales from the production of industry j at time period t
Exchange rate $(EX)_{i,t}$	It is the annual average logarithmic growth rate of monthly nominal effective exchange rate

[3]Labour productivity is used as a proxy for firm productivity A research by Spring Singapore (2011) mentioned three ways to measure labour one of them is labour cost which includes wages salaries and employee's benefits

3.4.2 Description of Variables

This section will give illustration on the above variables

Change in Firm Productivity

It is the dependent variable of the study and it is measured by taking the logarithmic difference of labour productivity

Firm Productivity

It is measured by taking the natural log of labour productivity As in this thesis labour productivity is used as a proxy for firm productivity Labour productivity is defined as the ratio between total output and labour input (Navaratne, 2008)

Usually labour is measured with the number of working employees or hours worked per person in a firm but due to the unavailability of the data on the number of employees in each manufacturing firm we have used amount of wages/salaries as a proxy for labour input[4] According to Ownag (2000) labour unit is easily measureable and generally labour statistics is measured with the number of employees or through the wage bill Similarly, Syverson (2011) also mentioned three measures of labour input one of them is quality adjusted labour measure (wage bill) Wage bill as labour measure is based on the notion that wages capture marginal products of heterogeneous labor units

In general labour productivity is easily measureable but at the same time labour productivity is a partial productivity measure and reflects the joint influence of a host of factors

[4] Fox & Smeets (2011) also measures the labour input with the wage bill

- **Discussion on the relation between exchange rate movements, wages and sales**

Exchange rate movements may have an impact on wages through different channels First, as in macro models, depreciation of the exchange rate can make imported goods more expensive, increase the consumer price index and reduce the real wages Second, exchange rate depreciation is associated with enhanced competitiveness, which can lead to an expansion in local production and, therefore, to a higher labor demand and to a rise in real wages in the economy (Campa and Goldberg, 2001, Goldberg and Tracey, 2003) Third, by raising the costs of imported capital and intermediate goods, and technology, which are often complements to domestic labor, exchange rate depreciation may reduce the demand and the real wage for workers (Robertson, 2003) Finally, exchange rate fluctuations may also influence inflation expectations and so enter in the wage setting mechanism Exchange rate can affect the domestic wages through the labor supply channel as well

Exchange Rate Volatility

As we have utilized the conditional variance series extracted from the GARCH (1 1) method because it is the standard measure of risk In all regressions we have used the monthly data of exchange rate instead of utilizing short term measures like daily or weekly rates We haven't used short time period alternatives by assuming that daily variations are less appropriate for manufacturing firms than for the financial firms Kemal (2010) and Mahmood et al (2011) etc have also used conditional variance series derived from Garch (1 1) for the measurement of uncertainty

Nominal Effective Exchange Rate

It is used to control for the level effect opposite to uncertainty This measure has an ambiguous effect on the change in firm productivity Demir (2010, 2013), Caglayn (2014) have also measured the level effect through the same way which I have mentioned earlier

Size

The natural logarithmic of the firms' total asset proxy is used to account the size effects If increasing firm size lead towards the diseconomies of scale then the relationship between size and growth can be negative Moreover, large firms face more sunk costs therefore they might be more sensitive to rising exchange rate uncertainty The same proxy for the measurement of size is utilized by Cheung and Sengupta (2013), Demir (2010, 2013), Caglayn (2014)

Exports

The proxy of export share represents the degree of tradable output, competitiveness and access of firms' to international markets We used one period lag because of the endogeneity problem between export performance and exchange rate uncertainty Cheung and Sengupta (2013), Demir (2010 2013), Caglayn (2014) have also used the same proxy

Leverage

It is measured through the debt ratio of firm i at time t -1 It reflects the dependence of firms' on and access to the external finance The one period lagged value is used employed to evade from the endogeneity problem Leverage represents firms' approach to external finance, therefore it can have a positive impact on firms' growth Caglayn

(2014), Desai et al (2008) both these studies have also used the same proxy for the measurement for external debt

Equity

It is measured through the equity ratio It shows the access of firms to the equity coming from the stock market In simple it's the amount of capital actually paid by the shareholders to the firms against its shares

Industry output growth

It is measured by the logarithmic growth rate of industry sales and is controlling for the effects of industry output on firm level productivity growth Moreover, following Abram et al (2006) we determine output through the sales The same proxy measure have also been employed by Demir (2010, 2013), Caglayn (2014) in their researches as well

3.4.3 Variable Construction

In this section of the chapter we have explained the construction of few key variables required The variables firm productivity, size, exports, leverage, equity and industry output growth are the important variables in the assessment method The below mentioned variables need a closer look as most of them are not instantly observable So they need to be constructed with the help of other entities

Variables	**Definitions**
Firm productivity $(FP)_{it-1}$	Log (Labour productivity= total output/total labour input (wages/ salaries))
Industry output growth $(IND)_{jt}$	Logarithmic growth rate of industry sales
Size $(SZ)_{i,t-1}$	Log (Total assets= Noncurrent assets + current assets)

Exports $(EXP)_{i\,t-1}$	Log(1+Exports/total sales)
Leverage $(AC)_{i\,t-1}$	(current liabilities + non-current liabilities) / Total Assets
Equity $(AC)_{i,t-1}$	Paid up capital/ Total assets

3.5 Data and Data Sources

In order to empirically investigate the impact of exchange rate movements on firm productivity along with export orientation as well as with access to financial sources we require a large panel of data set The present study is using annual data of non financial firms over the period of 2000 to 2013 The data set is involving only manufacturing firms which are registered at the Karachi Stock Exchange

The annual statistics of the firm specific variables has been extracted from the State Bank of Pakistan's Financial Statement Analysis of Companies" (non-financial) listed at Karachi Stock Exchange (KSE) Moreover, we have utilized monthly exchange rate data in order to measure the volatility and the level effect So for that purpose monthly data on exchange rate over the period of 1986 to 2013 is taken from International Financial Statistics (IFS), more specifically it's a data base of the International Monetary Fund (IMF)

Chapter 4

Empirical Results

4.1 Introduction

The focus of this chapter is to present the empirical results and the analysis of these results Before presenting the empirical results of the objectives we begin the empirical analysis by presenting the summary statistics to get a general idea of the data set Moreover, in this chapter, we have also discussed conditions of GARCH (1 1) model, to measure the exchange rate volatility Next, we present the estimated results on the relationship between exchange rate movements and firm productivity Then we provide analysis on the results of the impact of exchange rate volatility on firm productivity under financial sources Next, on empirical basis, we enlighten the impact of exchange rate movements on the productivity of export oriented firms Lastly, for robustness check we restimate all the regressions using 2nd measure of uncertainty which is standard deviation of exchange rate

4.2 Descriptive Analysis

The descriptive analysis of the data is presented in Table 4 1 The sample used for the overall analysis consists of manufacturing firms Summary statistics include mean, standard deviation, minimum and maximum values of each variable included in the analysis In summary statistics, mean is the average value of a variable, whereas, standard deviation represents the divergence of a variable from its mean value Moreover,

minimum and maximum depicts the lowest and highest value of a variable in the data set

We have taken annual data for the analysis and it is given in Pakistani rupees

Table 4.1: Summary Statistics

Variables	Observations	Mean	Std Dev	Min	Max
ΔFP_t	3017	-0 0130	0 3078	-6 3032	8 4698
Firm productivity (FP_t)	3017	0 8511	1 3012	-2 9119	6 6886
Volatility (σ_t)	3017	1 0083	0 7598	0 3896	3 1736
Size (SZ_t)	3017	7 1218	1 4183	3 2972	12 2400
Export (EXP_t)	3017	0 1541	0 2188	0 0	0 6933
Leverage (Lev_t)	3017	0 7123	0 4632	0 0	9 8067
Equity ($Eqty_t$)	3017	0 1811	0 2290	0 0012	2 7864
Industry output growth (IND_t)	3017	0 1132	0 3847	-3 7587	4 9555
Exchange rate (EX_t)	3017	-0 0048	0 0045	-0 0165	0 0032
SD-volatility	3017	1 7072	1 9304	0 2388	7 6255

Notes FP (firm productivity) is measured by taking the natural log of labour productivity, whereas changes in FP is measured by taking the difference of FP σ is the GARCH based exchange rate volatility, Size is calculated by taking the log of total assets, export is determined with exports share in total output or in total sales Leverage is computed using total debt to total assets ratio Moreover, equity is measured using equity to total assets ratio and it represents a firm's approach to domestic equity market Industry output growth is measured by utilizing the industry sales value EX is the annual growth rate of nominal effective exchange rate SD-volatility is the annual standard deviation of nominal exchange rate with monthly data All the growth rates are measured in log differences

The summary statistics is showing that the mean value of change in firm productivity which is the dependent variable of the study is -0 0130 and it ranges between -6 3032 and 8 4698 Along with this mean the standard deviation of the change in firm productivity is 0 3078 Mean of labour productivity growth is small and negative yet with a high standard deviation The negative mean value suggests that there are large numbers of relatively less productive firms' in the observations Likewise, the average of firm productivity is 0 8511 with the standard deviation of 1 3012 The mean value of the GARCH based volatility is 1 0083 with the standard deviation value of 76 9% Similarly,

the size variable has the standard deviation of 1 42 with an average rate of 7 1218 and it ranges between 3 297 and 12 49 respectively Additionally the variable export which is measured as exports share in total output lies between 0 and 0 6933 with an average value of 0 1541 and with a standard deviation value of 0 2188 Concerning with the firms access to equity and debt markets, access to external debt as well as to equity market is captured with the debt and equity ratios The mean value of these ratios is 0 1811 and 0 1132 respectively (standard deviation values are 0 4632 and 0 2290 respectively) Sales growth signifies industry's output growth and its values lie between -3 7587 and 4 9555 with a mean value of 0 1132 Finally, the last variable SD-Volatility (measure of exchange rate uncertainty) has an average value of 1 7072 and it ranges between 0 2388 and 7 6255 with the standard deviation value of 1 9304

4.3 Generating Exchange Rate Volatility Series

In order to measure the exchange rate uncertainty impact on productivity, we first need to calculate the volatility series from the monthly exchange rate data Researchers make use of different methodologies for establishing measure of uncertainty In this study we use both GARCH (1 1) as well as standard deviation technique in order to quantify the volatility Once we obtain the conditional variances of monthly exchange rate series, we take average of the series and annualize them

Before moving on to the GARCH (1 1), we have checked the stationarity of the data Whether the time series data is stable or not, is determined through the unit root test The most often used approach in unit root test is the ADF (Augmented Dickey-Fuller) test Under this approach, the absolute value of ADF test statistics should be greater than the 1%, 5%, and 10% critical values in order to achieve the stationarity So, the augmented

Dickey-Fuller test is applied in our study for examining the stationarity of the monthly nominal exchange rate data The variable exchange rate appears stationary at first difference Thus, it is integrated of order one

4.3.1 Results of Augmented Dickey-Fuller Test (ADF)

The results of the unit root test are

Critical Values for the ADF Test					
Significance level	1%	5%	10%	Augmented Dickey Fuller test statistics	
				t-statistics	P value
Critical values at level	-3 45	-2 87	-2 57	2 16	0 999
Critical values at first difference	-3 45	-2 87	-2 57	-15 78	0 000

Test interpretation:

H_0 There is a unit root for the series

H_1 There is no unit root for the series and the series is stationary

The critical values at first difference in the above table shows that the null hypothesis of a unit root is rejected in favour of the stationary because the computed p value at first difference is not greater than the significance level alpha=0 05 Moreover, the test statistic is more negative than the critical value So it is proved from the results of the above table that the variable exchange rate appears stationary at first difference

There are two preconditions before estimating ARCH-GARCH model One is clustering volatility[5] in the residual and the 2nd one is the ARCH effect If our mean equation holds both these effects then we can run ARCH-GARCH model The ARCH effect is tested in pre estimation as well as in post estimation analysis In post estimation, it is checked whether the remaining conditional heteroscedasticity (ARCH effect) is removed or not For this purpose, ARCH LM (Lagrange multiplier) test is applied

Table 4 2 provide GARCH (1 1) estimates attained by estimating the model for exchange rate Specifically, the table demonstrates co-efficient, standard error, and probability

Table 4.2: Estimates for Exchange Rate Volatility

	Coefficient	Std. Error	Z-Statistics	Probability
	Mean equation			
Constant	0 2309	0 0582	3 9672	0 0001
AR(1)	0 1705	0 0750	2 2728	0 0230
	Variance Equation			
Constant	0 1948	0 0247	7 8819	0 0000
ARCH(1)	0 3877	0 0804	4 8168	0 0000
GARCH(1)	0 4798	0 0509	9 4268	0 0000
	ARCH LM test			
	F-statistic		**Probability**	
	0 0569		0 8109	

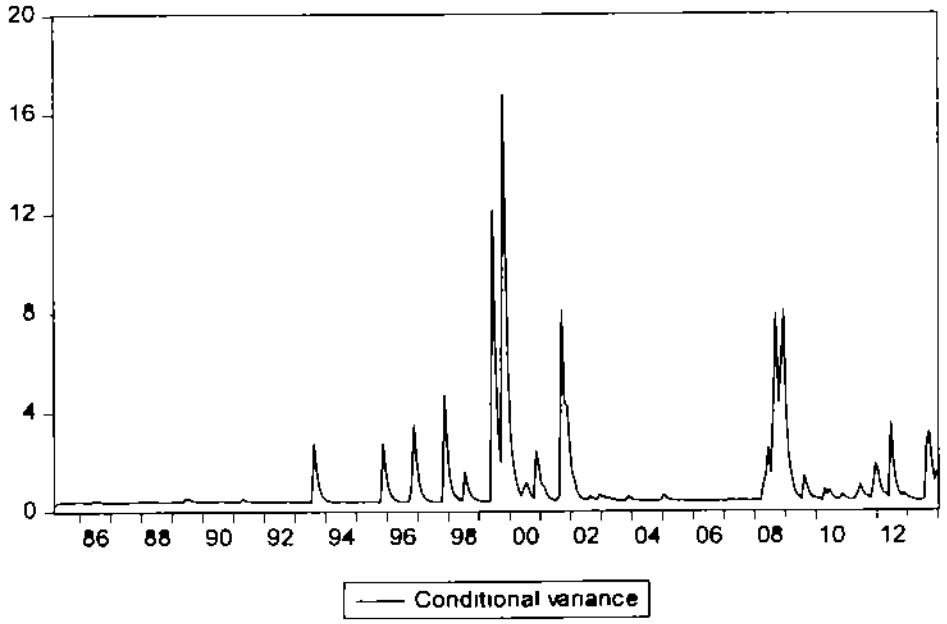
In the above table the sum of ARCH and GARCH coefficient values is less than 1 Moreover, ARCH and GARCH terms are statistically significant at the 1% level of

[5] Clustering volatility means period of high volatility follows the same period (high) and similarly periods of low volatility follows the low for a prolong period

significance The results show that the past values of volatility affect the present values and the shocks are persistent Additionally, the estimated results of diagnostic test (ARCH LM test) reveal that our uncertainty model sounds specified and makes clear that there is no ARCH effect left in the residual terms The acquired series are then annualized in order to match with the annual frequency of the firm level data set Then finally we made the conditional variance series of the exchange rate volatility and used them at the time of estimating bench mark results[6]

Figure 4.1: Time series Graph of Conditional Variance Series

The graph of the forecasted conditional variance series is as follow



In figure 4 1 the vertical axis is showing the time period of the data involved in the study whereas the values of the conditional variance series are plotted on the horizontal axis

[6] Demir (2013), Kemal (2010), and Mahmood et al (2011) have also used the GARCH (1 1) method for measuring volatility Moreover, Aizenman and Marion (1999) also used the same technique for the measurement of exchange rate risk

The above figure is showing volatility in the sample There is low volatility in the beginning while in the year 1999 and 10th of its month the volatility is lot more

4.4 Generalized Method of Moments (GMM)

For the bench mark results as well as for robustness check we have used the two step system GMM dynamic panel data (DPD) estimator technique We have used this technique because of the fact that our models are involving dynamic panel data Moreover, we have chosen this technique because this method helps in alleviating the endogenity problem as well as it also helps in tackling with the heterogeneity problem across the firms

In all the regressions, we have used the change in firm productivity as the dependent variable While, firm productivity, exchange rate uncertainty, exchange rate, exports, size, industry output growth, equity and leverage are used as independent variables The two variables size and industry growth are playing the role of control variables in all the models

4.5 GMM Estimates for the Impact of Exchange Rate Uncertainty on Firm Productivity

We begin the empirical analysis by investigating the impact of exchange rate uncertainty on changes in firm productivity, as proposed in equation (1) of chapter 3 Afterwards, we estimate augmented models which are presented in equation (2) The results from these two set of regressions are presented in Table 4 3 The first column of Table 4 3 provides results of base line regression (based on equation 1) Then the second column of table 4 3 present results based on equation 2, which augments the first model with an addition

of equity variable and with an interaction term between equity and exchange rate volatility The third and fourth columns (based on equation 2) of Table 4 3 examines the role of external credit in firm productivity While the fourth column show results of an interaction term between external credit and exchange rate volatility

4.5.1 Empirical Results of Table 4.3

The empirical results of Table 4 3 reveal that the coefficient value of one period lagged firm productivity is highly significant and negative in all regressions which imply that the firms which are less productive catch up more abruptly with their productive parts This relationship has also been shown by Demir (2013) Moreover, the coefficient sign of exchange rate uncertainty is showing a significant negative impact on the change in firm productivity for all the models This means that as the exchange rate uncertainty increases the growth of the firm productivity will decrease

In statistical terms 1% change in volatility has caused 0 6% decrease in productivity growth of firms and this relationship is significant at 1% level of significance This negative relation is based on the idea that uncertainty adversely affects the productivity by hindering the ability of firms in investing[7] in new more productive technologies under high volatility Investment in new technologies can help firms to innovate and to compete in the market Chong and Gradstein (2009) have also documented the same results Moreover, Caglayan and Demir (2014) have also focused on the exchange rate

[7]There are number of studies which show that exchange rate volatility negatively affects the investment ability of firm few of them are Bloom (2009), Aghion et al (2009), Azrenman and Marion (1999)

volatility's impact on firm productivity and find out its negative impact on productivity of Turkish manufacturing firms'

Table 4.3: Exchange Rate Volatility (using GARCH) and Firm Productivity

Variables	Model 1	Model 2_A	Model 2_B	Model 2_C
FP_{t-1}	−0 0354***	−0 0145***	−0 0385***	−0 0174***
	(0 0021)	(0 0026)	(0 0029)	(0 0019)
σ_{t-1}	−0 0058***	−0 0021*	−0 0027**	−0 0274***
	(0 0006)	(0 0011)	(0 0013)	(0 0014)
EX_{t-1}	−1 2209***	−0 6947***	−0 9921***	−0 2468*
	(0 1587)	(0 2442)	(0 2235)	(0 1394)
$Eqty_{t-1}$		−0 0128*	−0 0591***	−0 0305***
		(0 0069)	(0 0116)	(0 0041)
$\sigma_{t-1} \times Eqty_{t-1}$		−0 0108***	−0 0197***	−0 0218***
		(0 0039)	(0 0042)	(0 0034)
Lev_{t-1}			0 1546***	0 0578***
			(0 0192)	(0 0032)
$\sigma_{t-1} \times Lev_{t-1}$				0 0433***
				(0 0019)
EXP_{t-1}	0 0308***	0 0132*	0 0394**	0 0321***
	(0 0037)	(0 0079)	(0 0160)	(0 0053)
SZ_{t-1}	−0 0033***	−0 0045**	−0 0101***	−0 0046***
	(0 0009)	(0 0020)	(0 0030)	(0 0009)
IND_{t-1}	0 0503***	0 0392***	0 0494***	0 0662***
	(0 0060)	(0 0096)	(0 0075)	(0 0055)
Observations	3017	3017	3017	3017
No of instruments	125	73	105	135
AR(2)	0 491	0 447	0 475	0 415
Hansen J-statistics	0 342	0 173	0 198	0 185

Notes for all regressions growth rates are measured through log differences (***) represents significance at 1% level where as (**) and (*) shows significance at 5 % and 10% levels respectively Hansen is a test of over identifying restrictions for instruments AR (1) and AR (2) are tests to check the existence of auto correlation in the residual terms Consult Table 1 for the definitions of the rest of the variables The values in parenthesis are standard errors P-values have been mentioned for all the test statistics

Similarly, the coefficient sign of exchange rate is negative and it is significant at 1% level of significance This implies that both statistically and economically the exchange rate has a negative impact on the productivity In other words the negative coefficient

indicates that an increase in exchange rate has a negative impact on the change in firm productivity i e higher the exchange rate, the lower will be the productivity of a firm It is based on the idea that as exchange rate depreciation will increase the imported intermediate inputs as well as capital goods will become expensive These expensive imports adversely affect the firm productivity Harris (2001) has shown a negative relationship between exchange rate depreciation and productivity in Canada Likewise, the empirical results of Fung (2008) and Demir (2013) have also shown negative impact of exchange rate on firm productivity

Moreover, the coefficient sign of export variable in column (1) is significantly positive This result implies that the rise in export share will increase the productivity growth of firm Baldwin & Gu (2003) for Canada, Blalock & Gertler (2004) for Indonesia and Castellani (2002) for Italy revealed the same empirical result that as the exports share in output increases higher will be the productivity growth of firms' According to Castellani (2002) export orientation may cause efficiency gains for the firms, the gains can be because of the utilization of the economies of scale and can be because of the learning by exporting which may increase the level of productivity Wagner (2002) has also reported a positive relationship between exports and labour productivity for large cross country firm level data set over the period of 1978 to 1989

The control variables size and industry output growth in column (1) of Table 4 3 appear with the anticipated signs The coefficient of the variable size has appeared with the negative sign, suggesting that an increase in size may lead towards the diseconomies of

scale[8] which, in turn, causes the firms to grow slower Batool et al (2009) have also taken size as control variable in their study and reported that firm size is negatively related to total factor productivity of Pakistani firms' The sign of industry variable is significantly positive which shows a positive relationship between firm productivity growth and industry In statistical terms, the empirical results show that a 1% increase in industry output growth leads to about 5% increase in the firm productivity We can observe from the table that this effect is statistically significant

4.6 Access to Domestic Equity and Debt Markets

The second column of Table 4 3 is based on the results of augmented model presented in equation (2), which examines the role of financial sources in firms' productivity and the interaction term in second column between equity and exchange rate variable allow us to determine whether the impact of exchange rate volatility on firm productivity varies on having firms' access to equity market

The results in column 2 of Table 4 3 shows that the coefficient sign of equity is statistically negative and significant at 10% level of significance which indicates that an increase in credit from equity side will not help in increasing the productivity Demir (2013) and Caglayn (2014) using Turkish manufacturing firms' data exposed that an access to domestic equity market does not play an important role in firm productivity

Moreover, as the coefficient sign of the interaction term (between equity and uncertainty) is negative due to which the results show that having access to domestic equity market does not have any impact on the negative productivity effect of exchange rate volatility

[8] These are the forces that cause higher firms to produce goods and services at a high per unit cost

either In other words the firms having access to equity markets are exposed to exchange rate uncertainty

In Table 4 3 the last two columns allow us to analyze the role of debt financing in the productivity growth of firms' We have concluded from the coefficient sign of leverage that it plays a significant and positive role in the productivity Moreover, the fourth column of Table 4 3 shows the interaction between leverage and volatility The coefficient sign of the interaction term is positive and statistically significant at 1% level of significance, which shows that the exchange rate volatility does not affect firms' that have access to debt financing Similarly, Levine and Missaka (2014) also examined the same impact by using data of four European countries and explored that the rise in external credit cause an increase in TFP Moreover, Love and Gatti (2008) and Bakke (2009) also provided the same results and propose that the insufficient access to external credit leads to declining productivity at firm level

4.7 Exchange Rate Movements and Export Orientated Firms

Table 4 4 present the results of equation (3) developed by extending the equation (1) in order to explore the impact of uncertainty and level effects of exchange rate on export oriented firms For that purpose we have divided the sample into export oriented and non export oriented firms using a dummy variable[9] The coefficient sign of export dummy is significantly positive which shows that export oriented firms enjoy more productivity than others In simple the positive sign indicates, as the export share increases the productivity of that firm will increase This result is consistent with the earlier studies

[9] Where export oriented firms are defined as those which on average exports more than 10% of their total output

which also come up with the same result that export oriented firms achieve high productivity (Demir, 2013 and Alvarez et al , 2005)

Table 4.4: GARCH Volatility, Export Orientation and Firm Productivity

Variables	Model 3_A	Model 3_B
FP_{t-1}	−0 0144 ***	−0 0121***
	(0 0023)	(0 0025)
σ_{t-1}	−0 0053***	−0 0354***
	(0 0017)	(0 0033)
EX_{t-1}	−2 082 ***	−2 5413***
	(0 3968)	(0 4379)
$Eqty_{t-1}$	−0 0333***	−0 0233 **
	(0 0086)	(0 0096)
$\sigma_{t-1} \times Eqty_{t-1}$	−0 0071***	−0 0177 ***
	(0 0021)	(0 0067)
Lev_{t-1}	0 0905***	0 0162***
	(0 0091)	(0 0025)
$\sigma_{t-1} \times Lev_{t-1}$		0 0436***
		(0 0030)
EXP_{t-1}	0 0269***	0 0259***
	(0 0053)	(0 0042)
$EX_{t-1} \times EXP_{t-1}$	0 0199***	6 1932***
	(0 0049)	(1 0232)
$\sigma_{t-1} \times EXP_{t-1}$	5 896 ***	0 0201***
	(1 148)	(0 0042)
SZ_{t-1}	−0 0033*	−0 0044**
	(0 0017)	(0 0018)
IND_{t-1}	0 0519 ***	0 0529 ***
	(0 0067)	(0 0070)
Observations	3017	3017
No of instruments	108	111
AR(2)	0 430	0 402
Hansen J-statistics	0 180	0 243

Notes: The above regressions are done using two step GMM method * Symbol denotes the significance level of a variable For the definitions of the variables refer to table 1 In the above table we have two interaction terms with export dummy

Moreover, in column 2 of Table 4 4 the interaction term between exports and exchange rate shows that the exchange rate leads to an improvement in productivity, as captured by

the positive and significant coefficient of the interaction term It can be clarified by the fact that export based firms required to improve its productivity in order to compete in the export markets at the time of exchange rate depreciations In simple, as the exchange rate depreciates the exporters will get more in domestic currency so exporting firms take measures to improve their productivity

When we turn to investigate the impact of uncertainty on the productivity of export based firms, we find that the interaction term (between exchange rate uncertainty and exports) in column 2 of Table 4 4 takes positive sign at 1% level of significance This implies that the exporting firms are less vulnerable to exchange rate uncertainty and these firms have better management of exchange rate risk (Demir, 2013)

4.8 Robustness test with Standard Deviation Volatility

In order to check the sensitivity of our results we have employed another proxy for volatility which is the Standard deviation based volatility measure So we repeat our benchmark regressions using this (Standard deviation) measure of uncertainty and confirm our previous findings in terms of coefficient sign and statistical significance of all variables of interest Table 4 5 and 4 6 display results of the regressions using standard deviation measured exchange rate volatility

Table 4 5 is constructed similar to Table 4 3 except that the volatility of exchange rate is obtained from the standard deviation measure Moreover the results of Table 4 5 confirm our earlier findings of Table 4 3 and show a significant negative impact of exchange rate uncertainty on firms' productivity growth Accordingly the first column of Table 4 5 shows that 1% increase in uncertainty is expected to reduce productivity growth by 0 3%

Table 4.5: Uncertainty (Standard Deviation) and Firm Productivity

Variables	Model 1	Model 2_A	Model 2_B	Model 2_C
FP_{t-1}	−0 0189***	−0 0266***	−0 0170***	−0 0144***
	(0 0024)	(0 0042)	(0 0024)	(0 0022)
$SDvolty_{t-1}$	−0 0033***	−0 0023**	−0 0034***	−0 0074***
	(0 0005)	(0 0011)	(0 0006)	(0 0008)
EX_{t-1}	−1 3179***	−1 7196***	−1 269 ***	−1 6773***
	(0 2483)	(0 6330)	(0 2603)	(0 2531)
$Eqty_{t-1}$		−0 0487***	−0 0355***	−0 0161***
		(0 0187)	(0 0082)	(0 0029)
$SDvolty_{t-1} \times Eqty_{t-1}$		−0 0099***	−0 0036***	−0 0029**
		(0 0026)	(0 0014)	(0 0014)
Lev_{t-1}			0 0899 ***	0 0272 ***
			(0 0085)	(0 0024)
$SDvolty_{t-1} \times Lev_{t-1}$				0 0046 ***
				(0 0006)
EXP_{t-1}	0 0099***	0 0304*	0 0231***	0 0156 ***
	(0 0027)	(0 0168)	(0 0087)	(0 0043)
SZ_{t-1}	−0 0016*	−0 0188***	−0 0023	−0 0019***
	(0 0009)	(0 0048)	(0 0017)	(0 0006)
IND_{t-1}	0 0356***	0 0073***	0 0557***	0 0502 ***
	(0 0074)	(0 0134)	(0 0062)	(0 0061)
Observations	3017	3017	3017	3017
No of instruments	96	69	110	107
AR(2)	0 451	0 470	0 432	0 424
Hansen J-statistics	0 699	0 224	0 160	0 150

Notes: In this Table uncertainty is measured by taking the annual average standard deviation of the monthly nominal exchange rates Whereas the rest of the definitions of the variables are same as given in the other tables

In addition, the coefficient estimates in columns 2 to 4 of Table 4 5, regarding the access to financial sources (equity and debt markets) are also quite similar to those before At the end, Table 4 6 provides results of level and volatility effects of exchange rates on export oriented firms The results of these two regressions in Table 4 6 are also similar to previous estimates Overall the results with standard deviation based exchange rate volatility measure do not considerably differ from the previous results Moreover, the

results confirm that the exchange rate uncertainty has a significant negative impact on the firms' productivity growth

Table 4.6: Uncertainty (Standard Deviation) and Firm Productivity

Variables	Model 3_A	Model 3_B
FP_{t-1}	−0 0144***	−0 0138***
	(0 0024)	(0 0019)
$SDvolty_{t-1}$	−0 0064***	−0 0097***
	(0 0010)	(0 0012)
EX_{t-1}	−3 8703***	−3 7847***
	(0 5204)	(0 5054)
$Eqty_{t-1}$	−0 0464***	−0 0229***
	(0 0082)	(0 0049)
$SDvolty_{t-1} \times Eqty_{t-1}$	−0 0023**	−0 0054***
	(0 0010)	(0 0013)
Lev_{t-1}	0 0435***	0 0079***
	(0 0080)	(0 0022)
$SDvolty_{t-1} \times Lev_{t-1}$		0 0062***
		(0 0007)
EXP_{t-1}	0 0332***	0 0342***
	(0 0052)	(0 0048)
$EX_{t-1} \times EXP_{t-1}$	5 5756***	5 7736***
	(0 9332)	(0 9141)
$SDvolty_{t-1} \times EXP_{t-1}$	0 0078***	0 0071***
	(0 0016	(0 0015
SZ_{t-1}	−0 0101***	−0 0082***
	(0 0019)	(0 0014)
IND_{t-1}	0 0568***	0 0509***
	(0 0063)	(0 0054)
Observations	3017	3017
No of instruments	109	120
AR(2)	0 434	0 420
Hansen J-statistics	0 187	0 405

Notes In this Table we have introduce a dummy variable and assigned value 1 if exports share in total output is more than 10 % and 0 if its share is less than 10%

Chapter 5

Conclusion

5.1 Introduction

This chapter presents the summary of the whole study along with the key findings and conclusions It also includes the recommendations, what further needs to be analyzed regarding the issue in Pakistan and the suggestions for upcoming researches have been given in detail in order to bring those areas into light which need further research

5.2 Background of the Study

The issue of exchange rate volatility comes on fire beyond 1970's and the reason was the breakdown of fixed exchange rate system under the Breton Wood s agreement After the fall of Bretton Woods Agreement, both real and nominal exchange rates fluctuated widely because of the introduction of floating exchange rate system Moreover, in the current era of rising globalization and exchange rate uncertainty, variations in exchange rates affect firms by influencing the firm growth, firms' export performance, investment, employment levels, profitability and of course the productivity etc

In general, economic analysis propose a causal link moving from productivity levels to exchange rates, while Harris (2001) recently proposed that a reverse causality link may also exist, where exchange rate depreciations and volatility could be detrimental for the productivity of firms' This rising volatility of exchange rate in the post Bretton Wood period aroused the attention of the policy makers as well as researchers and still the interest is intense

Generally, there have been concerns about the possible effects of exchange rate uncertainty could have on firm productivity The empirical researches have been conducted in this area but it has been minimal and is limited to researchers like Aghion et al (2009), Caglayan et al (2014)

5.3 Key Findings

In this thesis we investigate the impact of exchange rate uncertainty and currency depreciation on firm level productivity growth We execute our examination using firm level panel data set This data includes only Pakistan's manufacturing firms (registered at Karachi Stock Exchange) data over the period of 2000 to 2013 The most prominent finding of the study is that the exchange rate volatility has economically as well as statistically significant negative impact on firms' productivity In addition, access to domestic stock market does not seem to decrease the negative effect of volatility on the firm productivity under the shocks of exchange rate Nevertheless, we also show that firms' having access to external capital markets are expected to be less affected by exchange rate shocks

Additionally, we come to the point that the availability of the external credit will help in increasing productivity at firm level Moreover, its availability seems to diminish the negative effects of exchange rate uncertainty on productivity growth

Overall the empirical analysis reveals that exchange rate depreciation have a significantly negative productivity growth effect While, In case of export oriented firms the empirical analysis shows that these firms are found to be more resilient and shown improvement in their productivity growth against exchange rate depreciations Moreover, uncertainty-

export interaction shows that the exporting firms are less exposed to exchange rate uncertainty

In general, in the present research we have shown that the exchange rate uncertainty as well as exchange rate depreciation adversely effects the productivity growth of firms in Pakistan

The robust analysis has also explored the same results with standard deviation volatility measure as we have achieved from the bench mark results In the presence of these findings we conclude that, exchange rate movements (uncertainty and level effect) are likely to have a negative effect on the total output and on the long run expansion Overall, the consequences of the study highlight the importance of the availability of the external funds and in reducing the negative effects of exchange rate uncertainty

5.4 Policy Implications

Our study has shown a negative impact of exchange rate volatility on firm productivity which proposes that this will be a vital issue for the policy makers in Pakistan Moreover, this significant negative relation confirms' the need for current policies to take into consideration the plausible link between exchange rate volatility and firm productivity in Pakistan By keeping in view the findings of the study we suggest that exchange rate stability as well as avoidance of misalignments might need to be included in the objective function of state bank

In addition, we have seen that exchange rate depreciation as well as its uncertainty has an impact on labour productivity (proxy for firm productivity) Therefore, it seems that exchange rate volatility can bring movements in Pakistan's labour productivity It

suggests that exchange rate policies can be formulated to improve labour productivity in Pakistan at firm level

5.5 Future Directions

The existing research opens up some novel areas for the future research such as the present study can be replicated in future by analyzing the impact of exchange rate movements on small, medium and large firms' productivity Moreover, the distributional affects of the exchange rate movements on the local firms can be examined further Similarly, upcoming researches can explore the impact of exchange rate variability on firm productivity exploring the role of better portfolio and risk management The future researchers can also replicate this study for the service sector firms'

One more area which needs to investigate is the threshold effects of exchange rate volatility on Pakistan's' firm productivity The existing study is limited to Pakistan the researchers can extend the present analysis into more developing countries like in China, India and can make comparison between their impacts

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