Exchange Rate Volatility and Its Impact on Trade and Inflation: A Case Study of Pakistan & India

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Abstract:
This paper empirically and statistically analyzes the exchange rate volatility impact on trade and inflation focusing Pakistan and India and its major trading partners USA and China over past two decades. A panel data analysis from 1990-2010, has been conducted using three different estimation techniques which include ordinary least squares regression, fixed effect estimation, and random effect estimation approach. This paper explores whether exchange rate volatility depresses export volume in comparison to imports. It further constructed a hypothesis that nominal exchange rate variability can have a significant and negative impact on the exchange rate fluctuations. Lastly, this paper concludes that exchange rate volatility has a negative impact on export volume, import volume, and inflation rate.

Keywords: Exchange Rate Volatility, Inflation, Terms of Trade, Gross Domestic Product

1. Introduction

The exchange rate is one of the key macroeconomic variables in determining the exchange rate volatility in the economy over the years. The variability in the exchange rate plays a significant role in determining trade balance. Moreover, variations in the exchange rate have an adverse impact on trade process which translates into instability in capital movements. Furthermore, it discourages investor’s as exchange rate instability hampers growth. Exchange rate unpredictability effects not only long run but also medium term and short run. In long term decisions with regard to the volume of exports and imports, procurement policies and allocation of government sales and investment are greatly affected by variations in exchange rate. Apart from this, in the medium term, it affects the level of economic activity and balance of payments whereas in short run local traders and consumers can get affected. In addition, exchange rate volatility provides an opportunity for investors to invest in foreign currency especially in US dollars to earn a higher return which helps to strengthen the dollar against the domestic currency Pakistani Rupee further. Prices of imports, exports and growth rates are in direct relation with exchange rate volatility. Therefore, risk averter traders and investors prefer to invest in the system where the deviation of the differential between actual and expected value of the exchange is minimized. On the other hand, risk lover traders always favor the system with volatile exchange rates so as to maximize their profits due to high-risk premium attached to their respective investments. Thus, the nature of investors determines whether the exchange rate fluctuations have either positive or negative impact on exports, imports and net exports. Risk averter investors formulate a negative relationship between exchange rate variability and its impact on trade balances whereas risk lover trader would have a positive relationship between the variables.

In Pakistan and India, the official exchange rate is defined as exchange rate determined by higher government regulatory. It is a measure of local currency units relative to the U.S dollars. In Pakistan, the official exchange rate was 11.85 in 1982 and was last reported to be 93.40 in the year 2012. (Indexmundi) Moreover, inflation is defined as the general increase in price levels. Pakistan was quoted to have 5.9% inflation in the year 1982 and 12% in the year 2012. (Trading Economics) Furthermore, Pakistan has recorded trade deficit during the time frame of 1982-2012 except for the year 2003 whereas it was recorded exceptionally low in the year 2011. (The Economist) Pakistan suffered from the huge amount of trade deficits due to a significant amount of energy import and exchange rate fluctuations in an economy as our currency is devaluing relative to US dollar. Besides this, major imports include fuel which comprises 40% of total imports, machinery and equipment which has 18% proportion of imports and remaining consists of chemicals. Pakistan major exports are cotton and knitwear which is 28% of total exports, bed wear and rice which are respectively 8 %. Pakistan major trading partners are the United Arab Emirates with whom our country has 10 % of exports and 17% percent of

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imports. Moreover, China is a second largest trading partner with whom Pakistan has 9% of exports and 15% imports. Other major trading partners include United States, United Kingdom and Germany. (indexmundi). In comparison, Indian economy had fixed exchange system in 1991 but due to problems originating since 1985 it faced severe economic crisis up to the point where all foreign currency reserves were used up. Moreover, Indian rupee further devalued by the end of 1999 but from the time frame 2000-2007 it stabilized due to huge inflows from the foreign direct investment.

The main aim of this paper is to investigate whether exchange rate instability effects trade if this is so then in what direction. Moreover, if exchange rate volatility is due to an appreciation of exchange rate then it would have a negative impact on exports while positive on the level of imports. Besides this, in case of depreciation there would be a positive impact on exports where as negative on imports. There is rich economic literature available to estimate the relation between trade, inflation and exchange rate volatility. Exchange rate fluctuations have an adverse impact on trade it was in view with Cushman (1983), Akhtar and Hilton (1984), Kenen and Rodrik (1986), Peree and Steinherr (1989), Kumar and Dhawan (1991) and Pozo (1992) where as Rogoff (1998) was in view that exchange rate volatility causes problems both for importers and exporters. Moreover, Arize (1996) states negative relationship in both long and short run among exchange rate instability between imports and exports. Furthermore, exchange rate variability can influence domestic prices through both direct and indirect channels (Hyder and Shah, 2004). In general currency depreciation leads to high import prices and cheaper exports and currency appreciation causes higher export prices and lower import prices. (Jabara, 2009)

Apart from this, exchange rate volatility also translates into domestic inflation which is also a major concern for economic instability in our economy. During the time frame of past three decades there been a continuous discussion in economic literature with reference to the relationship among the variation of inflation and mean inflation rate. Moreover, Okun (1971) critically evaluated that countries with high mean inflation also experience variable inflation and he further interlinked it with imperfections in public policy making to achieve stable inflation rates. This study in specific examines the relationship between variability in real effective exchange rate (REER), nominal effective exchange rate (NEER) and inflation. Due to high ratios of imports to GDP it is expected to have exogenous changes in exchange rates to promote changes in consumer prices thus to show the impact of rising import prices. This paper has adopted three different volatility measures for exchange rates and inflation. Moreover, Arize and Malindretos (1997) had adopted the standard deviation of quarterly changes in REER, NEER and consumer price index. But, our paper also incorporates results for two other measures that use the parametric models for time varying variance of NEER, REER and inflation. This paper further employed an instrumental variable estimator to resolve the potential problems attached with non-spherical errors and the endogenous exchange rate variability. This technique is adopted to adjust standard errors and to further guarantee that the covariance is positive and semi-definite.

Moreover, this paper explains weak real exchange rate helps to boost the CPI inflation rate which further translates into rising domestic currency prices for final imported goods and also high wage inflation. On the other hand, economic literature also provides evidence that weak exchange rates help to stimulate exports. As there is a rise in gross export volume it leads to export sector surplus but at the expense of other sectors in an economy which is not indexed to inflation.

This paper is an empirical analysis of exchange rate volatility and its impact on trade and inflation in Pakistan and India and its major trading partners China and USA. The study’s aim is to analyze, first whether the exchange rate variability has any effect on exports, imports and net exports among the major trading partner; and, second, whether fluctuations in the exchange rate have any effect on the inflation and domestic price levels. Adopting Siregar and S. Rajan (2003) specification, we estimated the effects of trade which includes exports and imports on exchange rate volatility and other factors which include domestic and foreign real GDP and price levels. Moreover, to look at the inflation and its impact on exchange variability we have used Arize, Malindretos and Nippani (2004) model. We have used panel data from 1990 to 2010 to extract the relevant data from the world development indicators, international monetary fund and the national statistical bureau of
Pakistan. The results show that exchange rate volatility has a significant but negative impact on export volume, import volume and inflation rate.

This paper is structured in the following sequence. Section 2 describes the related literature and section 3 presents study’s theoretical framework. Moreover, section 4 describes the dataset used for empirical estimation. Section 5 presents the model to be estimated and section 6 reveals the findings obtained from the two different models and respective estimation techniques. The study’s concluding remarks are discussed in Section 7.

2. A Review of the Literature

The academic literature and various findings on this topic neither theoretically nor experimentally concludes whether or not the volatility of exchange rate discourages international trade. The paradox of exchange rate volatility impact on trade and inflation remain unresolved. But, there are a significant amount of studies both time series and cross sectional analyzing theoretically and experimentally the relationship among exchange rate volatility and its impact on trade and inflation. Many authors had applied different models to determine the impact of exchange rate variability on trade. Chowdhury (1993) provide evidence from the G-7 countries to examine the impact of exchange volatility and its impact on trade flows with the use of multivariate error correction model. The author examined that there is a significant amount of negative correlation between the two variables in all respective G-7 countries especially in the volume of exports. Moreover, the author had made an assumption that market participants were risk averse, so to eliminate or lower the risk of exchange rate volatility there was a reduction in consumer activities and shifts in demand and supply. It further effects the distribution of output among the various sectors in these countries.

On the other hand, it is important to consider that different exchange rate regimes fixed, floating or pegged have different outcomes and impact in generating inflation in an economy. By over viewing the exchange rate volatility impact on inflation in major South East Asian countries results revealed that in era of floating exchange rates there was high amount of variability in the exchange rates as most of the developing nations peg their exchange rate to key currency or either basket of currencies thus less consideration had been paid towards fluctuations. There had been using the age of rational expectation and theories consistent expectation models to investigate the results. Therefore variations in effective exchange rate had a drastic negative impact in the form of domestic inflation in all countries under consideration. (Alba and Papell, 1996)

Besides this, there could be a positive relationship between exchange rate volatility and trade flows. McKenzie and Brooks (1997) explained the effect on exchange rate volatility on Germany-US bilateral trade flows. They had tested exports from Germany and imports from the US. The results and findings of this paper hold a different viewpoint from previous researches as it concluded the positive and statistically significant relationship between the exchange rate variability and trade flows. They had used both nominal and real exchange comparison to determine the impact on trade. Apart from this, Broll and Eckwert (1999) explained that a positive effect of exchange rate variability on export production formulates theoretical findings. They further put forth their argument that as the exchange rate volatility increases the value of the real option to export in international market also increases which lead to higher potential gains from trade.

Apart from this, exchange rate volatility impacts on trade are not only confined to be either positive or negative it is in fact further sub categorized in short and long run time frame. It is explained by Arize, Osang and Slottje (2000). They investigated pragmatically the impact of exchange rate fluctuations on the export flows of thirteen developing countries. They explained the short and long run impact of exchange rate volatility on the trade flows. The result showed that both in short and long run the rising exchange rate volatility of real effective exchange rate had a dynamically negative impact on the export demand of each country. Thus, it further worsens the terms of trade and led to the reallocation of resources by market participants.

Moreover, exchange rate pass- through and exchange rate instability were key factors of the effectiveness of exchange rate depreciation for accomplishing the targeted trade balance. Furthermore, many developing economies like India and Pakistan lack bargaining power not only as a seller but also as a buyer in the international market. (Dholakia and Saradhi, 2000).

Besides this, exchange rate volatility can adversely affect the export performance in case worst economic crisis hit an economy. Moreover, it leads to a devaluation of exchange rates which could be defined as expansionary
or either contracting depending upon the boost given to export sector of the economy and its possible effects on output depressing and expenditure switching policies. If there was a failure in the exportable sector due to poor response towards price incentives then devaluation of exchange rates should be considered contracting. (Siregar and Rajan, 2003).

Moreover, exchange rate volatility also has combine effects on inflation and trade. Taylor rule and its equation are used to overview the impact of both variables simultaneously in case of Canda-US exchange rates. The significant variations in nominal exchange rates had an adverse impact on the convergence of the prices at the consumer level. The high variability in exchange rates is consistent with Central Bank that aims to target inflation in the low exchange rate pass-through environment. Thus, results were in compliance with the previous authors that exchange volatility depresses the trade flows and lead to domestic inflation in an economy. (Globerman and Storer, 2004)

In order to establish exchange rate variability impact Arize, Malindretos and Nippani (2004) established their hypothesis that whether nominal exchange rate volatility causes a positive and significant impact on inflation and its fluctuations. The data analysis was formulated for 81 countries with floating exchange rate regimes and Pakistan is also one of them. The findings and estimates were in accordance with the hypothesis being generated.

In addition, to determine price response to exchange rate variations vector correction model is used to critically determine exchange rate reforms and a shift in government policies on inflation. (Omotor, 2008). The findings proved that money supply and exchange rate led to stronger vibrant effects on inflation than the output level. This paper provides a major conclusion that despite there is a stable, consistent or complementary policy on money supply it is essential to have exchange rate stability for less variability in prices and further for domestic output expansion particularly the agricultural output. The above findings are consistent with our home country. Apart from this, exchange rate volatility also has an impact on international trade. In case of East Asian countries exchange rate instability has a negative correlation with intra-East Asian trade than on other trade regions. Moreover, there were many identified key elements of discouragement for trade in the region. As East Asian countries major proportion focuses on trade in intermediate goods in the international production channels which are significantly responsive to exchange rate instability. In addition, the negative impact of exchange rate volatility is higher than the tariffs and lower than the distance related costs in the East Asian countries. (Hayakawa and Kimura, 2009)

To study the impact of exchange rate fluctuations in Pakistan domestic consumer price index different authors have formulated appropriate policies in response towards currency movements. They have evaluated the results using the elasticity which is lower in short run but quiet higher in the long run to explain the overall consumer price level effect. Moreover, dynamic findings showed that supply shocks were the major determinant of volatility and price variability. (Naz, Mohsin and Zaman, 2012)

By investigating the link between exchange rate instability and inflation using nonlinear time series analysis past inflation rates acts as a transition variables to evaluate the results. The estimated results concluded that decline in exchange rate navigated during the time frame of the 1980s and 1990s which led to lower inflation. (Shintani, Hagiwara and Yabu, 2012)

3. **Theoretical Framework**

3.1 **Empirical Model**

Our theoretical framework is based on Siregar and Rajan (2003) and Arize, Malindretos and Nippani (2004). The model presented by Siregar and Rajan (2003) model assumes that they are two primary determinants of exports and imports demand function. Firstly, foreign income component is used to measure the purchasing power of major trading partners and their economic activities. It further helps to determine income effect. Secondly, trade flows or either the relative price component is used to evaluate the price effect. Moreover, exchange rate unpredictability is an added feature that should be taken explicitly into account to determine the instability factor. In addition, after determining and incorporating all the variables author had driven following export and import demand functions
In the above equations \( x_{it} \) is calculated as the export volume natural logarithm of particular country in consideration in our case it is Pakistan and India, \( m_{it} \) is the import volume natural logarithm of particular country and we have chosen Pakistan and India, \( \gamma_{it}^{foreign} \) is the log of real foreign GDP of specific trading partners which includes China and USA, \( \gamma_{it}^{local} \) is calculated through domestic real GDP natural logarithm of Pakistan and India, \( P_{it} \) is term of trade with respect to particular countries and \( V_{it} \) is defined as volatility of the real exchange rate for the Pakistan and India.

According to our hypothetical estimates, export volume to the overseas nation is expected to rise as the real income of trade partner increases. In comparison the volume of imports to the domestic country is expected to be higher as the real income of domestic country ascends. Thus we anticipate \( \alpha_2 > 0 \) and \( \beta_2 > 0 \). Moreover, a growth in the provisions of trade will lead domestic goods to be less competitive than foreign goods which further translates into fall in exports and rise in imports whereas a fall in balance of trade will origin terms of trade to be far competitive than foreign goods which further boost the exports demand and leads to fall in imports. Therefore, it is expected \( \alpha_3 < 0 \) and \( \beta_3 > 0 \). Furthermore, as the impact of exchange rate variability on net exports is uncertain therefore \( \alpha_4 \) and \( \beta_4 \) could have either positive or negative signs. Besides this, the effect of exchange rate volatility on multilateral trade especially on exports shows a negative relationship (Chowdhury, 1993) whereas Mckenzie and Brooks (1997) bilateral trade, Mckenzie (1998) multilateral, bilateral and sectoral trade and Daly (1998) bilateral trade shows a positive relationship between exchange rate volatility and trade.

**Trade Volume:**

The dependent variables for the model under consideration are total exports and total imports and to evaluate that we have taken the sequence in terms of either quantity or volume. Export is explained as a factor in international trade where by goods are produced in one country and further transported to another country for prospect sale and trade. Export help to add value to countries gross output. Export is generally conducted between countries that have fewer trade restrictions such as quotas, tariffs and subsidies. Moreover, import is also defined as an instrument for international trade where goods or services are bought in one country from another. Furthermore, the higher the value of imports in comparison to exports would lead to a negative balance of payments. In addition, Pakistan’s collective exports and imports volume data are accessible and it does not present a case of bilateral trade. Therefore, in order to extract Pakistan’s trade volume with China we have divided the available value sequence of bilateral trade by using a suitable price index and both variables in US dollars:

\[
x_{it} = \alpha_1 + \alpha_2 \gamma_{it}^{foreign} + \alpha_3 P_{it} + \alpha_4 V_{it} + \varepsilon_{1it},
\]

\[
m_{it} = \beta_1 + \beta_2 \gamma_{it}^{local} + \beta_3 P_{it} + \beta_4 V_{it} + \varepsilon_{2it}
\]

\[
x_{CP} = \frac{XVAL_{CP}}{XP_t},
\]

\[
m_{CP} = \frac{MVAL_{CP}}{XP_t},
\]

\[
x_{USP} = \frac{XVAL_{USP}}{XP_t},
\]

\[
m_{USP} = \frac{MVAL_{USP}}{XP_t},
\]

\[
x_{CI} = \frac{XVAL_{CI}}{XP_t},
\]

\[
m_{CI} = \frac{MVAL_{CI}}{XP_t},
\]

\[
x_{USI} = \frac{XVAL_{USI}}{XP_t},
\]

\[
m_{USI} = \frac{MVAL_{USI}}{XP_t},
\]
Where $X_t^{CP}$ represents Pakistan’s exports to China in terms of quantity; $M_t^{CP}$ is Pakistan’s imports from China in terms of quantity; $XVAL_t^{CP}$ is exports to China in terms of value; $XP_t$ is Pakistan’s exports in terms of prices; $MVAL_t^{CP}$ is Pakistan’s imports from China in value terms and $XP_t^{CP}$ is Chinese export price which is substitute for Pakistan’s import value from China. Moreover, $X_t^{USP}$ represents Pakistan’s exports to United States in terms of quantity; $M_t^{USP}$ is Pakistan’s imports from United States in terms of quantity; $XVAL_t^{USP}$ is exports to USA in terms of value; $XP_t$ is Pakistan’s exports in terms of prices; $MVAL_t^{USP}$ is Pakistan’s imports from USA in value terms and $XP_t^{USP}$ is USA export price which is substitute for Pakistan’s import value from China.

Besides this, $X_t^{USI}$ represents Pakistan’s exports to United States in terms of quantity; $M_t^{USI}$ is Pakistan’s imports from United States in terms of quantity; $XVAL_t^{USI}$ is exports to USA in terms of value; $XP_t$ is Pakistan’s exports in terms of prices; $MVAL_t^{USI}$ is Pakistan’s imports from USA in value terms and $XP_t^{USI}$ is USA export price which is substitute for Pakistan’s import value from China.

Moreover, $X_t^{CI}$ shows India’s exports to China in terms of quantity; $M_t^{CI}$ is India’s imports from China in terms of quantity; $XVAL_t^{CI}$ is exports to India in terms of value; $XP_t$ is India’s exports in terms of prices; $MVAL_t^{CI}$ is Pakistan’s imports from India in value terms and $XP_t^{CI}$ is China export price which is substitute for Pakistan’s import value from China.

Income:
Income is defined as money that an individual or business receives in exchange for providing a good or service or through investing capital. Moreover, for estimation of our model GDP of Pakistan, India, China and USA is extracted on an annual basis which will be used as close estimates for their respective real incomes.

Terms of Trade:
Terms of trade mean the value of exports relative to its imports. The joint terms of trade with China ($p^{China}$) is calculated by dividing of Pakistan’s exports price to China export price which is set as alternate for Pakistan’s import cost from China. Moreover, for the remaining countries terms of trade is calculated in similar fashion as stated above. Besides this, the actual exchange rate of rupee in other the the the the s substitute for Pakistan’s import value from China.

Volatility:
Volatility is defined as dispersion from the standard deviation and mean. Due, to uncertain results calculated in the pragmatic literature review by Mckenzie and Brooks. (1997) and Mckenzie (1998) there is the absence of coherent characterization or means of computing unpredictability. Usually, there is a single measure of exchange rate volatility but for our model two measures were constructed. Our model uses real other than nominal exchange rates in computation. Firstly, index of real exchange rate volatility is constructed using moving average standard deviation (MASD) of the growth rate of the exchange rate (ER). This model was originally adopted by Kenen and Rodrik in (1986).
In the above equation \( m \) is referred to as the order of the moving average and \( ln \) signifies the log form of the series.

Augustine C. Arize, John Malindretos and Sinivas Nippani (2004) employ a simple model which interlinked the standard deviation of the dependent variable which is the inflation rate to mean the inflation rate which is one of the independent variables. To further argument this model with nominal and real exchange rate volatility some other independent variables are also measured which includes variability of country inflation rate (\( \alpha INFl \)), inflation of country by taking its average (\( \mu INFl \)) and country’s exchange rate variability (\( \gamma EX \)). In all of the above independent variables \((i)\) is referred as data for particular co to to to tountry. Follow the wing regression equation has been constructed by the author:

\[
\alpha INFl_i = \alpha + \beta_1 INFl + \beta_2 EX
\]

**Inflation:**
Inflation is the rate at which general level of prices for goods and services is rising which further leads to falling in real purchasing power. In the above equation variability of inflation is defined as the percentage changes in the consumer price index. Moreover, this approach is used by many authors and thus referred to as the standard measure.

**Average inflation rate:**
It is calculated as the mean percentage change of consumer price index.

**Exchange rate variability:**
A measure of the standard deviation through percentage changes in the nominal or real effective exchange rate. To evaluate the robustness of our results, author employed two alternative variability measures which include the rolling method and recursive procedure. Moreover, both of them assume that the rate of inflation and the change in the NEER and REER can be approximately described by a distributed lag of past rates of the respective variables. For instance, to estimate a moving fourth order autoregressive process for Pakistan’s inflation rate. Variability for any time period, \( t \) is substituted by autoregressive (AR) standard error process estimated over earlier quarters. Therefore, for each period, an equation of the following form is constructed:

\[
\pi_{it} = \sigma_0 + \sum_{i=1}^{4} \phi_i \pi_{it-1} + \varepsilon_t
\]

Where \( \pi_{it} \) is the rate of inflation in Pakistan at time period \( t \); \( \pi_{it-1} \) is the distributed lag of past inflation rates and \( \varepsilon_t \) is the error term at time \( t \).

### 3.2 Data
There is three set of a test conducted for the compilation of results in working models with the aim to depict the impact of exchange rate instability on Pakistan and India trade presentation. Firstly, the test was conducted on Pakistan and India entire imports and exports. The second set reports the regression results of Pakistan and India trade along with biggest trading partners China and USA. The third test was conducted to evaluate the exchange rate volatility impact on inflation of four countries Pakistan, India, China and USA. All of the raw data is on an annual basis and extracted from International Financial Statistics (IMF). Moreover, data in terms of trade, gross domestic product and inflation is extracted from Central Bureau of Statistics Pakistan and Central Bureau of statistics China, Central Bureau of India and United States. The data is extracted for the time frame 1990-2010. The data for inflation rate is extracted from World Development Indicators. International Financial Statistics is a compilation of financial data which is collected and extracted from various sources, covering over 200 countries worldwide. Moreover, data is updated and published monthly by the International Monetary Fund. The statistics provide data mainly on economic indicators, world consumer price indexes, world exports, world foreign exchange and world gross domestic product. The Pakistan Bureau of Statistics is Pakistan’s major executive and federal department charged with the national statistical services to provide solid and comprehensive statistical research. It provides statistics on the government, trade, economy and other fields. Moreover, the World Development Indicators is a compilation of internationally recognized data. It is a
collection of the most accurate global development data which includes national, regional and global estimates of different countries.

3.2.1 Data Description

To estimate Pakistan and India export and import relationships with its two major trading partners namely China and the USA a panel analysis was conducted for the time period from 1990 to 2010. In addition, the exchange rate volatility impact on inflation is also observed through panel analysis by under taking the data for inflation, mean inflation and exchange rate volatility for each respective country. Moreover, three different techniques were adopted that includes: Ordinary Least Squares regression, Fixed Effects and Random effects estimation. To further determine between the fixed and random effects estimations, a Hausman Testing technique was used to evaluate the most significant outcomes. If the hausman testing results are greater than five percent then fixed effects are considered to be more significant in comparison to random.

Appendix A shows table 1, table 2 and table 3. Table 1 shows the estimation results of Pakistan and India exports with its major trading partners China and USA. Table 2 represents the Pakistan and India imports with its major trading partners China and USA. Table 3 represents exchange rate volatility impact on inflation of four countries namely Pakistan, India, China and USA.

Figure 1 in appendix B show Pakistan and India both experienced increasing trend for both exports and imports of the countries. But, India has a relatively higher volume of export and imports from Pakistan. From the year 2000 till 2004 there was the nominal difference between export and import volume as both Pakistan and India were experiencing economic growth in the economy. But, after 2004 there was a sharp rise in the inflation rate of Pakistan which translated into broadening the gap between import and export volume.

Figure 2 in appendix B represents Pakistan and India terms of trade with its major trading partners USA and China. As shown in the figure 2 Pakistan and India both have the highest terms of trade with the USA in comparison to China. Pakistan and India terms of with the USA peaked during the year 2000 as Pakistan has a new military regime which stipulated the growth performance due to development and growth policies especially in the manufacturing sector.(World Bank) Moreover, India also moves towards industrialization and reforms after the 1990’s. Besides this, there was a drastic decrease in terms of trade with the USA as there was global oil price shock hit the economies and it continued till the global financial crunch in 2008 after that it stabilized and accelerated.

Figure 3 in appendix B shows the exchange rate volatility in Pakistan and India local currency rupee. But, as shown in the figure 3 Pakistan experienced comparatively lower exchange rate fluctuation than India except from the time frame 2000-2003. During this time period Pakistan had to change economic policies which lead to an appreciation of the currency. In the year 1992 India experienced an economic recession due to which there was massive variability in Indian exchange rate.

Figure 4 in appendix B depicts the gross domestic product for the respective countries Pakistan, India, USA and China. It shows all the four countries have smooth increasing trend other than the USA. The USA experienced a massive drop in the gross domestic product in the year 1992 due to economic crises which lasted for about eight months and it further translated into the deterioration of macroeconomic objectives but later it smoothed out.

Figure 5 in appendix B explains the variations in an inflation rate of Pakistan, India, China and USA for the past twenty years. In past five years Pakistan has the highest inflation rate and the USA has the lowest. China experienced the highest inflation rate in early 1990’s due to economic recession but later due to the adoption of reforms and export led growth there was a massive decrease in inflation figures.

As shown in appendix A table 1 India has comparatively higher export and import volume in comparison to Pakistan and it also applies for the standard deviation. Moreover, Pakistan and India both have the highest terms of trade with the USA. Furthermore, the Indian rupee is considered to be more volatile in nature. Having a look at the gross domestic product it shows on average of past two decades India has the highest GDP then the USA, China and Pakistan. Similarly, Pakistan had the highest inflation rate in all four counties for past twenty years on average.
<table>
<thead>
<tr>
<th>Variables</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>Maximum</th>
<th>Minimum</th>
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</thead>
<tbody>
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<td>Pakistan Export Volume Log</td>
<td>11.731</td>
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<td>12.303</td>
<td>11.124</td>
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<td>India Export Volume log</td>
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<td>13.323</td>
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<td>0.089</td>
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<td>Volatility in Indian Rupee</td>
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<td>0.262</td>
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<td>0.170</td>
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<td>4.150</td>
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<td>GDP USA</td>
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<td>Inflation Rate Pakistan</td>
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</tr>
<tr>
<td>Inflation Rate China</td>
<td>4.729</td>
<td>6.517</td>
<td>24.237</td>
<td>-1.408</td>
</tr>
<tr>
<td>Inflation Rate USA</td>
<td>2.732</td>
<td>1.140</td>
<td>5.398</td>
<td>-0.356</td>
</tr>
</tbody>
</table>

### Hypothesis

**Hypothesis # 1:**

Ho: Inflation variability cannot have important linkage and positive relation with nominal exchange rate variability.

H1: Inflation variability can have important linkage and positive relation with nominal exchange rate variability.

**Hypothesis # 2:**

Ho: increase exchange rate volatility has no significant impact on Pakistan’s trade performance

H1: increase exchange rate volatility has a significant impact on Pakistan’s trade performance

As shown above two hypotheses were generated. The first hypothesis explains whether increase exchange rate volatility has a positive impact on inflation and the second explains whether exchange rate volatility has a significance impact on trade performance.

### 4. Results

In table 1, column 1, 2 and 3 take China as a trading partner whereas column 4, 5 and 6 take the USA as a trading partner. In table 1 column 1 and 4 shows the ordinary least square regression results for Pakistan and India export trading with China and USA. In table 1 column 2 and 5 shows the fixed effects estimation for Pakistan and India export trading with China and USA. Moreover, in table 1 column 3 and 6 shows the random effects estimation for Pakistan and India export with China and USA.
Terms of trade have a positive and significant relationship with the export volume except for country USA which has a significant but negative relationship with export volume under ordinary least square regression and random estimation as shown in Table 1 column 1, 2, 3, 4, 5 and 6. It is shown in table 1 column 2 that a one unit increase in China’s terms of trade will leads to 0.03403 percent increase in export volume of Pakistan and India in comparison in table 1 column 5 a one unit increase in USA terms of trade will translate into a 0.0589 percent increase in export volume of Pakistan and India using fixed effects estimation after conducting hausman test. It shows a positive increase in terms of trade will boost the export volume. Besides this, there could be either positive or negative significant relationship with the exchange rate volatility and trade due to the adoption of different techniques but generally with fixed effects it formulates a positive relationship. (K. Hayakawa and F. Kimura, 2009) In addition, fall in the balance of trade for both India and Pakistan leads domestic countries good to be far more competitive than foreign goods which help to stimulate the exports demand for respective countries and fall in imports. Moreover, as shown in the figure 1 Pakistan and India both exports have a significant increase over the past three decades with its trading partners. Furthermore, Pakistan exports fell to 2.5 percent whereas imports decreased by 20 percent in 1998 but after a span of few years in 2000 it was back on the road of development. (Pakistan Institute of Development Economic)

Moreover, the real income of export trading partners is determined through the natural logarithm of the gross domestic product of respective countries China and USA. Natural logarithm of the gross domestic product has a positive and significant relationship with the export volume under the three different estimation techniques as shown in Table 1 column 1, 2, 3, 4, 5 and 6 for both trading partners. In table 1 column 2, it is shown that a one unit increase in the natural logarithm of the gross domestic product of China will lead to 1.296 percent increase in export volume. Similarly, in table 1 in column 5, a one unit increase in USA natural logarithm of the gross domestic product will translate into 0.504 percent increase in export volume. A fixed effect approach is used for the above analysis due to the hausman test which has greater significance for this technique. Moreover, it is of view that exchange rate volatility in bilateral trade and specifically for exports shows a negative relationship which further adds evidence to our results. (Chowdhury, 1993)

In table 2, column 7, 8 and 9 take China as a trading partner whereas column 10, 11 and 12 take the USA as a trading partner. In table 2 column 7 and 10 shows the ordinary least square regression results for Pakistan and India import trading with China and USA. In table 2 column 8 and 11 shows the fixed effects estimation for Pakistan and India import trading with China and USA. Moreover, in table 2 column 9 and 12 shows the random effects estimation for Pakistan and India export with China and USA.

Terms of trade have a negative and insignificant relationship with the import volume except for trading partner China which has a significant but negative relationship with import volume under ordinary least square regression and random effect estimation as shown in Table 2 column 7, 8, 9, 10, 11 and 12. Moreover, the real income of import trading partners is determined through the natural logarithm of the gross domestic product of respective domestic countries Pakistan and India. Natural logarithm of the gross domestic product has a positive and significant relationship with the import volume under the three different estimation techniques as shown in Table 2 column 7, 8, 9, 10, 11 and 12 for both trading partners. In table 2 columns 8, it is shown that a one unit increase in the natural logarithm of gross domestic product having China as a trading partner will leads to 2.916 percent increase in import volume. Similarly, in table 2 column 11, a one unit increase in the natural logarithm of gross domestic product for having the USA as a trading partner will translate into 2.96 percent increase in export volume. A fixed effect approach is used for the above analysis due to the hausman test which has greater significance for this technique. Moreover, intuitively it is expected that

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import volume from overseas increases as there is a boost in the real income of domestic countries Pakistan and India. Apart from this, exchange rate volatility can be in either direction as shown in table 2 column 7, 8, 9, 10, 11 and 12 under three different estimation techniques. In case of China and USA as import trading partner it has an insignificant relationship with import volume under fixed effect estimation but using random effect estimation it shows negative but significant results. In table 2 column 9 and 12 shows that a one unit increase in exchange rate volatility will hinder growth in import volume by 2.436 percent for having China as a trade partner and for the USA as a trade partner import volume will fall by the 3.153 percent. Moreover, it is of view that exchange rate volatility in bilateral trade generally has a negative relationship which further adds evidence to our results. (Chowdhury, 1993)

In table 3, column 13, 14 and 15 show three different techniques being used to estimate the exchange rate volatility impact on Inflation. In table 3 column 13 shows ordinary least square regression for four respective countries which includes Pakistan, India, China and USA. Similarly, in table 3 column 14 and 15 estimated results for respective countries through fixed and random estimation methods. Moreover, a hausman test is also conducted to decide between fixed and random effects and the results shows that is most appropriate to use is the fixed approach.

Mean inflation for all the four respective countries shows a positive and a significant relationship with inflation rate under three different estimation techniques. In table 3 column 14 shows that a one unit increase in mean inflation will lead to 1.003 units increase in inflation. It is in correspondence to the expected result. Moreover, as mean inflation is the monthly average of the inflation rate thus if annual inflation is increasing it will also move in the similar direction.

Exchange rate volatility has a negative but significant relationship with inflation rate for all four countries under fixed and random estimation except under ordinary least square regression as shown in table 3 column 13, 14 and 15. In table 3 column 14 shows that a one unit increase in volatility will cause 0.4096 percent decrease in the inflation rate. It implies that higher exchange rate fluctuations will lead to falling in inflation rates as exchange rate variability economically lower the prices in general.

5. Conclusion

This paper aims to explain the exchange rate volatility impact on trade and inflation of Pakistan and India under different exchange rate regimes over the past two decades from 1990 till 2010 by considering China and USA as its two major trading partners. A panel data set was formulated to conduct a cross country comparison. It further employs three different techniques which include ordinary least square regression, fixed effect estimation and random effect estimation. It is worth noting that this paper would add not only to the studies of Siregar and Rajan (2003) who have conducted time series analysis on one particular country where as this paper further explains exchange rate volatility impact on two different countries by further undertaking its two trading partners and different estimation techniques. It will add to the robustness of the findings as it also applies hausman testing for higher significance of results. Moreover, this paper would also add to Arize, Malindretos and Nippani (2004) study which primarily focuses on the exchange rate volatility impact on inflation of developed nations. Furthermore, the data set has been extracted for the recent years from 1990 to 2010 which makes this study more accurate and appropriate for the current time period. It will also add to prevailing literature and would confirm the economic theories associated with our study. Besides this, exchange rate volatility formulates a negative relationship with export and import volume for the respective countries Pakistan and India and its trading partners. Similarly, exchange rate volatility has also significant but negative impact on inflation. It shows that developing countries and emerging economies such as Pakistan, India and China should explicitly take into consideration the impact of exchange rate volatility so as to adopt the inflation control strategies on time to avoid the severe economic crises.

After examining the result findings there are the host of policy implications. Firstly, in view of present analysis in order to stabilize the exchange rate there should be one basket of a common currency which boost the international trading of goods and further translate into higher foreign direct investment. Secondly, there should be separate policies for different trading partners in accordance with trade relations so as maximize export and
import volume. Moreover, there should be the encouragement of free trade agreements with trading partners. Lastly, there should be better inflation controlled strategies so that exchange rate volatility has minimum effect on inflation rates.

APPENDIX A

Table 1

<table>
<thead>
<tr>
<th>Trading Partners</th>
<th>China</th>
<th>USA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dependent Variable: Export Volume Log</td>
<td>OLS (1)</td>
<td>Fixed Effects (2)</td>
</tr>
<tr>
<td>Terms of Trade</td>
<td>0.0282052**</td>
<td>0.0340342**</td>
</tr>
<tr>
<td>GDP Log</td>
<td>1.2944119***</td>
<td>1.2968683***</td>
</tr>
<tr>
<td>Volatility</td>
<td>-0.0102</td>
<td>0.0589**</td>
</tr>
<tr>
<td>Constant</td>
<td>6.905384***</td>
<td>6.884107***</td>
</tr>
<tr>
<td>R- Squared</td>
<td>0.9938</td>
<td>0.9937</td>
</tr>
<tr>
<td>Hausman Test</td>
<td>Prob &gt; chi2 = 0.8866</td>
<td>Prob &gt; chi2 = 0.0680</td>
</tr>
</tbody>
</table>

| No. of observations | 42 | 42 | 42 |
| Fixed Effects Level | YES | YES | YES |

Note: *** indicates 1% significance level, ** indicates 5% significance level and * indicates 10% significance level

Table 2

<table>
<thead>
<tr>
<th>Trading Partners</th>
<th>China</th>
<th>USA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dependent Variable: Import Volume Log</td>
<td>OLS (7)</td>
<td>Fixed Effects (8)</td>
</tr>
<tr>
<td>Terms of Trade</td>
<td>-0.3943***</td>
<td>-0.03308</td>
</tr>
<tr>
<td>GDP Log</td>
<td>1.2381***</td>
<td>2.9159***</td>
</tr>
<tr>
<td>Volatility</td>
<td>-2.4364***</td>
<td>-0.1934</td>
</tr>
<tr>
<td>Constant</td>
<td>7.5301***</td>
<td>0.5643</td>
</tr>
<tr>
<td>R- Squared</td>
<td>0.8345</td>
<td>0.7043</td>
</tr>
</tbody>
</table>

| No. of observations | 42 | 42 | 42 |
| Fixed Effects Level | YES | YES | YES |

Note: *** indicates 1% significance level, ** indicates 5% significance level and * indicates 10% significance level
Table 3

<table>
<thead>
<tr>
<th>Dependent Variable: Inflation Rate</th>
<th>OLS (13)</th>
<th>Fixed Effects (14)</th>
<th>Random Effects (15)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean Inflation</td>
<td>1.0012*** (0.00202)</td>
<td>1.0029*** (0.0024)</td>
<td>1.0012*** (0.00202)</td>
</tr>
<tr>
<td>Volatility</td>
<td>-0.2942 (0.1775)</td>
<td>-0.4096** (0.1963)</td>
<td>-0.2969** (0.1779)</td>
</tr>
<tr>
<td>Constant</td>
<td>-0.0024 (0.0175)</td>
<td>-0.0041 (0.0190)</td>
<td>-0.0024 (0.0176)</td>
</tr>
<tr>
<td>No. of observations</td>
<td>84</td>
<td>84</td>
<td>84</td>
</tr>
<tr>
<td>R-Squared</td>
<td>0.9997</td>
<td>0.9997</td>
<td>0.9997</td>
</tr>
<tr>
<td>Fixed Effects</td>
<td>Yes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hausman Test</td>
<td>prob &gt; chi2 = 0.0794</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: *** indicates 1% significance level, ** indicates 5% significance level and * indicates 10% significance level

APPENDIX B

Figure 1
References


