



## THE IMPACT OF THE EXCHANGE RATE FLUCTUATIONS ON PAKISTAN'S EXPORT SECTORS: AN EMPIRICAL ANALYSIS BASED ON THE SECTORIAL DATA

Abid Ali Shah<sup>1</sup>  
Iftikhar Mehboob<sup>2</sup>  
Syed Hassan Raza<sup>3</sup>

### ABSTRACT

*This study examines the relationship between the exchange rates and the export sectors of Pakistan. The objective is to study the empirical relationship between the exchange rates and the export sectors. The analysis was conducted on the sectorally segregated monthly data of the exports from July 2003 to April 2010 with nominal exchange rates. The empirical estimation has been resorted to detect both the effects of the nominal exchange rates and the respective volatility of the exchange rates on the export sectors. For the estimation of the long run relationship cointegration and an autoregressive time series regression models are used while generalized autoregressive conditional heteroskedastic methodology has been used to estimate the effects of the exchange rates volatility on export sectors. The results of cointegration and ordinary least square revealed a significant longrun relationship between exchange rates and export sectors, which confirmed that the depreciating currency in case of Pakistan improves the competitiveness of the export sectors, while there is an evidence of volatility effects on the export sectors*

**Key Words:** Exchange Rates Volatility, Auto Regressive Time Series Regression, GARCH.

### INTRODUCTION

The relationship between the exchange rates and its volatility with the international trade of a developed, Emerging Market Economies (EMEs) or developing economies in terms of its exports and imports had been proven theoretically and duly tested empirically. The dynamics of this relationship has its influence on the exchange rate system or regimes adopted by every country to be used to extract full benefit out of its trade potential and also to safeguard its economy from potential currency or financial crisis.

<sup>1</sup>PhD Scholar, Faculty of Management Science, International Islamic University, Islamabad, Pakistan.

<sup>2</sup>Faculty of Management Sciences, National University of Modern Languages, Islamabad, Pakistan.

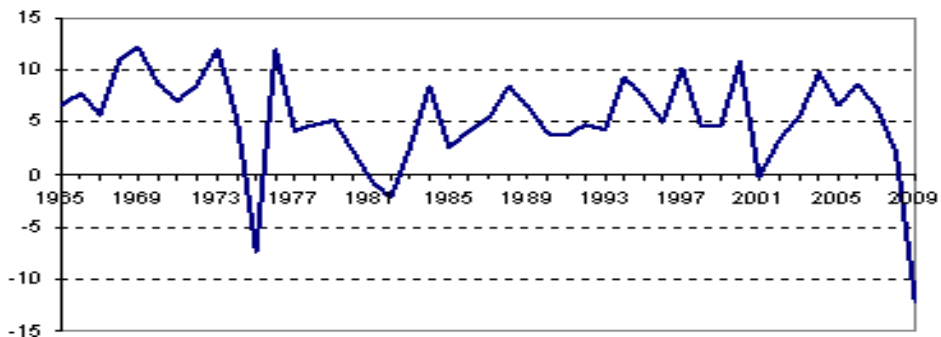
<sup>3</sup> Associate Professor, Faculty of Business Administration, Allama Iqbal Open University, Islamabad, Pakistan.

The major problem especially for the developing countries rested in achieving the right kind of policy setup which would help the country in extracting full benefits out of its trade potential. Throughout the history the world trade has witnessed changes that presented the countries with challenges in finding the right kind of setup to prevent itself from the possible crisis and effectively dealing with those changes.

With the view to achieving the objective by fully utilizing the trade potential every country must be equipped with the understanding of its trade and economic dynamics. These dynamics must be in alignment with the relative policy and regime it adopts with respect to its exchange rates. Once this alignment is lost, the economic, financial or currency crisis is inevitable. Hence the challenge for the countries lied in finding that alignment or the right match between the economic and trade dynamics and the exchange rate regime it adopted.

The world economy experienced different financial crisis, but the crisis of 2008 created a huge decline in the international trade in different regions. Since then the world economy has been on the way to recovery. According to the World Trade Organization (WTO) report of 2010, the world trade grew at 9.5%, following the dismal of 2009 (the year when the international trade experienced the sharpest ever decline in trade during the period of more than 70 years) as shown in Figure 1. The recovery after 2008/09 has a clear encouraging sign for the global trade and it suggested that the global economy was fast recovering. This decline in the world's trade had been the largest since the World War-II. With the trade volumes contracting up to 12.2%, nearly all the world major economies had shown a decline in the trade volumes with US (13.9%), EU (14.8%) and Japan (24.9%). The Oil Exporting Countries had shown comparatively a smaller decline in relation to the large industrialized economies with Middle East (4.9%), Africa (5.6%) and South and Central America (5.7%), while Asia (11.1%) and China (10.5%).

**Figure-1.** International Trade from 1965 to 2009



**Source:** Volume of world exports 1965-2009, Image Source: WTO

On the import side the situation was reverse in which the major decline was seen in the Oil Exporting Countries with 20.2% and for South and Central America the imports fell by 16.5%. Among the remaining countries, the imports of the United States declined to 16.5% and the European Union 14.5% which was greater than the world average, while Japanese imports dropped by 12.8%, nearly equal to the world rate.

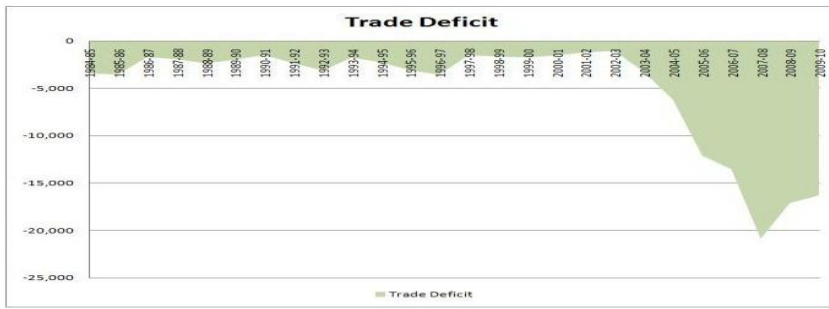
The Pakistan economy had been characterized with huge amounts of deficits as to whether it was the trade or the budget deficits, which had many economic and political reasons of mismanagements. In 2007, the trade deficit of Pakistan was \$9.7 million which rose to \$15 billion in 2008, which remained at \$15.32 billion during the fiscal year 2009-10, as indicated in Figure 2.

Although Pakistan was a member of international organizations like ASEAN, ECO, SAFTA, WIPO and WTO, but the economy suffered from many weaknesses when it came to the trade on the bilateral levels. The decrease in the GDP and the overall instability in the country resulted in an increase in the deficits. The exports fell from \$21.09 billion in 2008 to \$17.87 billion in 2009. The total imports also reduced from \$38.19 billion in 2008 to \$28.31 billion in 2009. Pakistan is a small open economy, which relies exclusively on imports as the exports of Pakistan are import oriented (Khan & Qayyum, 2007).

**The Crisis of 2008**

The 2008 financial crisis despite any reasons or the source of the crisis declined the overall international trade, though there might be a recovery, but the recession was still not over and there are signs of increased protectionism.

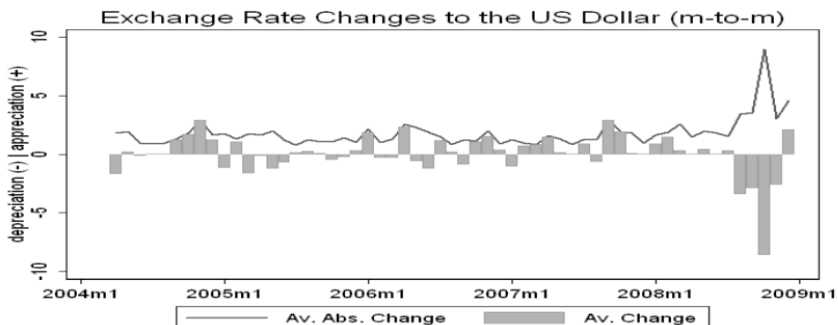
**Figure-2.** Pakistan’s Trade deficit



**Source:** State Bank of Pakistan (SBP)

The crisis in 2008 increased the movement in the exchange rates, as indicated in Figure 3. The average absolute monthly change in the exchange rate to the US dollar for the major exporting countries increased sharply, indicating a higher volatility in exchange rate markets. Moreover, the average change for these countries amounted to 8% depreciation at its peak in 2008 (Weber & Wyplosz, 2009). Though it had to be ascertained as to how much this volatility affected the world trade and it had not inflicted seriously the level of the world trade. After all, a world crisis more likely had to require widespread exchange rate adjustments as different countries were affected in different ways and they had varying capacities to absorb the shocks.

**Figure-3.** Level of Volatility in US dollars



**Source:** IFS and (Weber and Wyplosz, 2009)

## THE EFFECTS OF EXCHANGE RATES ON TRADE

The impact of the fluctuations or variations in the exchange rates had been studied extensively and analyzed in the literature, but there was no clear cut evidence about as to how it might affect the overall trade. The general perception about the variations in the exchange rates was that in a fixed exchange rate regime the currency of a country either was to be devalued or revalued against any other currency. While in a flexible exchange rate system the changes in the currency are made through depreciation or appreciation. Both kinds of variations had different effects on the trade as it affects the price level of the commodities to be exported and also the goods to be imported. The overall balance of the export receipts and that of import payments determines the trade balance of the country along with the balance of payment, it determined the position of the current account.

When examining the effects of the exchange rate on the international trade, it had to be considered in three different aspect, namely; its effects on the exports and imports of the economy; second, the effects on the other macroeconomic variables important enough in the formulation of the trade and the overall monetary and fiscal policy and third, its effects on a single firm as to how it effects the output of a single firm.

Musa (1985) discussed three different channels in which the changes in the prices could be affected by the exchange rate policies. The first was the System of multiple exchange rates in which different nominal exchange rates were applied to different export and import sectors, which might be similar to different taxes and subsidies used in the import and export sectors. The second effect could be through the changes in the allocation of the resources by the movements in the nominal multiple exchange rates or the unified exchange rates. Through this the countries could affect the prices of the domestic as well as of the foreign goods or it could influence the wages employed in the factors of production, while the third and final channels was through the changes in the government policies, the distribution of the expenditure among the goods or the level of spending in relation to the income.

The perception about the exchange rates variability is that the more fluctuations occurs in the exchange rates the more it becomes volatile and that volatility creates an uncertainty, thus, reducing the volume of the trade. The other view is that in a free market economy, the market itself adjusts to this variation and brings itself to the equilibrium with the exchange rates, thus, increasing the volume of trade. Most of the studies in the literature agreed on a single issue that the depreciation in the currency of a country increased the export competitiveness of the country by making the exports of that country cheaper in the international markets. If the exports of a country with a depreciated local currency exceeded the import at a faster rate it would be beneficial in the long run and would result in the widening of the balance of payment, and reducing the trade deficit (Aviel, 2000).

It is not always true that the currency devaluation would result in decrease in the trade deficit as in the case of US which continuously devalued its currency against other major currencies, but it did not resulted in the decrease of the trade deficit. The very reason was that other international currencies are linked or pegged to the US dollar, when dollar depreciates the other currencies linked internationally to it also depreciates which nullifies the effects of dollar devaluation. On the other hand countries like Japan, Holland and Switzerland that had no weak currencies but sill had trade surplus.

Some other reasons did exist owing to which the devaluation did not end up with trade surplus, as in this case the exporting commodities became competitive with lower prices in the foreign markets, however lower prices were not the only determinant, as they might not end up with higher demands in case of lower price elasticity. Again the firms might use it to increase the profit margins to compensate for the years in the recession. There were other aspects also which might come in to play like the quality; utility to the customers; designs; country of origin and prestige etc. Hence, the devaluation of the currency for bringing the trade equation to equilibrium might be a quick fix that may not always work. In the light of this to work the economies must bring themselves to better governance and administration; encourage savings and investments; increase productivity and the exchange rate policy, and the system should be supported by sound macroeconomic policies. Whatever the effects of the exchange rates volatility on trade might be, the literature was still not much clear about it. This relationship between the exchange rates and trade was somewhat ambiguous. As some studies shows a positive impact of volatility on trade while others pointed out a negative impact while some researcher could not find any evidence of any kind of relationship at all, while it had been confirmed also that the exchange rates having a relationship differed with various sectors of the economy depending on the dynamics of that industry. There also existed a major contradiction between the theoretical concepts and empirical analysis as one aspect of the trade relationship with exchange rates might lead to one direction but when empirically tested it might lead to the other.

### **Problem Statement**

The developing as well as the Emerging Economies had faced difficulties in achieving the right kind of the policy setup regarding the Exchange Rates that would help the country in extracting full benefits out of its trade potential. With that in the mind first its extremely necessary to analyze the nature of the relationship of the export sectors with the exchange rates. Its essential to examine as to whether the exchange rates has a long run impact of the exports and also how the volatility of the exchange rates might affect the export sectors. Throughout the history the world trade and economy had witnessed changes that presented the countries with the challenge of finding the right kind of setup to prevent itself from the possible crisis and deal with the changing dynamics resulted from the increasing level of volatility of the exchange rates.

This study attempted to answer the validity of the impact of the exchange rates and its volatility on Pakistan's export sectors and how different export sectors might be affected by exchange rate.

### **Objectives of the Study**

The main objective of the study is to test the impact of the Exchange Rates with its related Volatility on the major Export Sectors of Pakistan.

## **LITERATURE REVIEW**

The literature on the issue regarding the effects of the exchange rates on trade is not much clear and there are two aspects of it, one wherein the researchers had provided us with evidence by theoretical evaluation, while other includes studies that have tested empirically the various dimensions of this relationship.

A number of researchers have provided the evidence whether theoretical or empirical that exchange rates volatility might reduce the trade volume internationally with. The volatility increasing the risk associated with the terms of trade and any changes might adversely affect the trade with the

increase in the risks and uncertainty. There are also some studies that have provided contrasting evidence by holding that the exchange rate volatility might increase the volume of trade. Some empirical studies have failed to establish any relationship whatsoever when considering the effects on both exports and imports of the country.

The high level of volatility and exchange rates variations create uncertainty; increases the transaction costs, results in the increase in the interest rates and the level of inflation which disrupts the international trade and investments (Yagci, 2001). While Agbola (2004) provided an elaborated view by discussing three different dimensions in this regard. The three approaches discussed in the study are; the Elasticity Approach, that if the elasticities are lower, the devaluation would result in the deterioration of the overall trade balance in the short run. This requires the adjustments in the imports and exports over time and as the elasticities improve the trade activities expand. Upadhaya&Dhakal (1997) suggested that the maintenance of the trade balance requires the lowering of the export prices, and an increase in the import prices so that the elasticities could improve accordingly, thus, resulting in the improvement of the trade balance.

The second approach is monetary one pioneered by Frenkel and Rodriguez (1975) that indicated that the reduction in the currency value or devaluation reduces the real value of the cash balances that brought changes in the relative prices of the traded and the non-traded goods. Mostly this creates a shift from traded goods to the non-traded ones which improves the trade balance as well as the balance of payment.

The third approach is the Absorption one which focused on the reduction of the domestic absorption of the resources relative to the production which intern improved the trade balance. Devaluation increased production and switched the expenditure from the foreign goods towards the domestic ones and also brought a change in terms of trade that resulted in the improvement of the trade balance.

In the available literature the researchers used different empirical approaches, the first one being the before and after approach, first used by Edwards (1989). The analysis conducted to check the performance of the output before and after the devaluation episode as to whether it had brought about any changes in the output levels. The second approach is the Group one; here the performance of those economies, which has experienced devaluation in their currencies, was compared with those which didn't experience any devaluation in their currencies (Donovan, 1982). The last approach is the macro simulation one, the studies using this approach assumed different shocks in the exchange rates and then modeling is done to check the performance of the output after the exchange rate shocks (Gylfason&Risager, 1984).

The negative significant affect of the exchange rate volatility on exports had also been confirmed by Vergil (1999). This affect was both in the long as well as in the short run, but due to the presence of the forward exchange markets the effects become somewhat insignificant as the exporters could hedge against the volatility in the short run. This is only valid for the developed markets where the forward exchange markets are well established. Vergil (1999) also confirmed that on the policy front the countries must consider the trade volatility and its impact on the trade with every trading partner as well.

De-Grauwe (1988) confirmed that the increase in the exchange rate volatility resulted in increasing the risk and uncertainty which might induce double effects on the exports. The first is the substitution effect by which the exporters shift from more risky ventures to the less risky ones. The

second is the income effect as the volatility increases the level of risks decreasing the prospects of the profits. During this situation if the firms are able to adjust to the changing prices that could bring positive effects on trade, also if the income effect dominated the substitution effects than it might lead to a positive relationship between the trade and exchange rate volatility.

Clark et al. (2004) found no clear relationship between the volatility in the exchange rate and the increase in the export growth of the countries. According to the study the effects are negative but not robust and the exchange rate volatility was not a major concern in the international trade. Cushman (1986) provided different point of view about the exporting goods, that even if the exporter is exporting with a competitive edge, it might be lost by the importing country's exchange rates devaluation by which the local currency appreciates causing losses to the exporter. Also usually the depreciation ends up in inflation through which the commodity prices rises in the foreign country. Hence, the loss of the appreciating currency might be compensated by the high prices due to inflation.

Rinehart (1995) revealed that the devaluation of the currency is made use of by the developing countries to achieve different economic objectives. The developing countries usually run into large external trade imbalances, the devaluation of the currency is used to reduce them, promote export growth and enhance their competitive edge and take corrective measures to ensure that the currency is not overvalued. The study also indicated the role of relative prices in the trade flows supporting the use of devaluation for correcting trade imbalances and boosting up the exports. Hence both the income and the relative prices are found to be important while steadying the trade flows. There is enough evidence that the exchange rates can have both contractionary as well expansionary effects, Forbes (2002) indicated that through the economic growth and improvement it can have expansionary effects, while the contractionary effects might come due to recession and decrease in the output production as the devaluation increases the import costs and through high interest rates it reduces the availability of credit.

The firms with high foreign sales exposure were better off with the depreciating currency but that required high demand elasticity and it is also necessary that the share of the imports in the firms input must not be large enough to have negative effects. According to Forbes (2002) depreciation affected the firms on the production level, its profitability, the firm's investment decisions and the stock returns. If the firms are experiencing high growth in the market capitalization then that might increase the firm's present value of the future profits, however the firms might see a decrease in net profits due to the decreasing value of the currency not due to performance. Kamil (2006) showed that the firms with high foreign currency debts ran into bankruptcy if there is an unexpected change in the real exchange rates. These movements might have effects on the balance sheets of the firms. On the macroeconomic level the depreciation was more beneficial for the open economies with large export base while the closed economies suffered and experienced contraction in the economy.

According to Wijnbergen, (1986) through devaluation exporting firms benefited from the lower prices but in those emerging economies which were less industrialized and their firms had a major share in the imported intermediate goods, the input costs had increased which nullified the profit margins of the firms gained through lower prices. The firms that had broad base both on the domestic as well as foreign front are established and benefit from the high volatility of the exchange rates. The multinationals had the luxury of allocating the resources and the production within the domestic and the foreign markets which might be more beneficial to them. Hence, during the period of high exchange rate volatility they can increase both domestic and foreign trade base.

Berthou (2008) indicated that an increase in the trade among the countries also encouraged the currency union and, hence, reduced the overall volatility of the exchange rates. Both in the developed and the developing countries it was not the exchange rates volatility that might have affected the trade but it is the trade among them that resulted in the reduction of the volatility. Hence, if there is an extended trade among the countries that would reduce the volatility which might induce the currency unification on the regional level. Berthou (2008) also found the negative effects of currency appreciation on the overall export volume of the country. On the firm level most of the multinational firms had numerous transactions with deferent countries around the world; these firms can offset the adverse effects of the exchange rates movements by entering into the forward currency markets or by hedging (Clark et al., 2004). While hedging in the forward exchange markets the firms could hedge against the risk that rises in the exports and imports due to volatility in the exchange rates by holding a portfolio of assets and liabilities in different foreign currencies (Makin, 1978).

The relationship between the trade and the exchange rate volatility depends not only on the destination country but also on the different sectors involved in the import and export. Colacelli (2009) analyzed the relationship between trade and exchange rates both on the country as well as sectorial levels by taking the price elasticities of the exports of both high and low income countries. This study showed that the income elasticities of the high income countries were lower when trading with other high income countries, while they were greater when trading with the rest of the world with high volatility. Also the export response to the movement in the real exchange rates was large when trade took place in the different sectors while it was low in the homogeneous sectors.

As indicated by Chen (2009) every industry had its own characteristics and the effects of the exchange rate movements on every industry were also different, it emphasized the importance of the sectorial analysis. The agriculture sector had low initial investments and usually involved long term contracts. Hence the effects on this sector were different from those on manufacturing sector. These results about the different agriculture sector effects was also proved in the case of china, Indonesia and the United States, though in some cases the effects were not as much as compared to the level of fluctuation itself.

Akhtar and Malik (2000) took the case of Pakistan and analyzed the income and price effects of the export performance of Pakistan with its major trading partners. Their analysis showed high income effect for Pakistan's export in case of Germany, while the real devaluation of the currency would not result in the improvement of the trade balance with United States and Germany, but in case of UK and Japan it improved which emphasized the use of selecting the basket of currencies as an option for exchange rate regime.

Also, the negative effects of the exchange rate volatility and the trade volume of Pakistan was found with those countries with which the trade is less volatile, both in long as well as short-run these effects were confirmed by trade with United States, United Kingdom, Singapore, Australia and Bangladesh (Musthafa&Nishat, 2005).

Azid, Jamil and Kousar (2005) had rejected the hypothesis of any significant relationship between the exchange rate volatility and the manufacturing production in Pakistan. Though the results were positive but the analysis failed to support a strong significant relationship between the exchange rate volatility and its effects on the manufacturing production. The study also promoted the viewpoint against the adoption of the floating exchange rate regime for Pakistan.



The option of the improvement of the trade balance through the currency devaluation was tested empirically by Hasan and Khan (1994) and Zehra and Auranzeb (2000). Both the studies found that the devaluation did improve the trade balance of Pakistan. Devaluation of the exchange rates had a positive impact on the primary and the manufacturing export sectors of the country and proved to have a dampening effect on the major import sectors of the country.

The effects of the exchange rate movements depend on the level of diversification of the export sector. This was elaborated by Oskooee and Kandil (2007) the study examined the effects of the exchange rate devaluations in two time periods, first, the period of 1990's during that period the exports of Iran were dominated mainly by the oil exports while the second period was the one wherein the country diversified its export base. There was clear evidence that the devaluation had no effect during the first period as the oil already was priced in dollar, hence any movement against dollar would have no effect, while after the diversification the devaluation had a positive expansionary effects on the exports and the output growth.

## RESEARCH DATA AND METHODOLOGY

### Data

As most of the studies in the literature used the aggregate imports and exports of the countries, which nullifies the Sectorial effects of the exchange rates, as the exchange rates may have different effects on different sectors depending on the dynamics of each sector. As McKenzie (1999) had emphasized the use of Sectorial data in the empirical analysis. The study stressed on using the data segregated by sectors as well as time period and the destination markets.

Considering the objectives of the research the data had been taken in two sets, one, for the empirical analysis on the Sectorial basis for which the monthly data is taken on Sectorial grounds. The data series covers the period from Jan, 2003 to April, 2010, of export sector including the Textile, Manufacturing and food exports. The data for this purpose is obtained from the Archives of the State Bank of Pakistan, while the direct quotations of the local currency against the US Dollars are obtained from the website of Oanda.com. All the data series are treated further by taking their natural log.

### Model

The model selected for the analysis starts with the estimation of time series regression model, given as equation 1 below.

$$\ln(Q_t) = \omega + \alpha_i \ln Q_{t-i} + \beta_i \ln ER_t + \mu_{i,t} \quad (1)$$

Where  $\ln(Q_t)$  stands for the log of the export series of each of the export sector, while  $\ln Q_{t-i}$  is the one period lagged value of the sector's data. The Auto regressive term is added to catch any effects from the events of the past and  $\ln ER_t$  is the log of the nominal exchange rates for that period. Before moving towards the OSL and the GARCH estimation the series are tested for the stationarity and the order integration through ADF. With the view to analyze the effects of the volatility or the effects of the risk associated with the exchange rates movements the OLS model is combined with the GARCH model, which is given by equation 2. Having used the above model with GARCH the second equation to test the volatility effects is:

$$\ln(Q_t) = \omega + \lambda_i \ln(Q_{t-i}) + \alpha_i \ln ER_{it} + \beta_i \ln ER_{i,t-i}^e + \gamma_i h_{i,t-i}^2 + \varepsilon_{x,t} \quad (2)$$

Here the exports of each sector are regressed with both the GARCH terms of lagged square residuals and the past value of the expected variances of the exchange rates. The model is adopted in light of the research conducted by Wang and Barret (2002) and Chen (2009).

## METHODOLOGY

During the estimation of the models there are certain aspects that must be examined for the reliability of the results. These key points are the selection of the appropriate method for the calculation of the exchange rates volatility, which herein is measured by adopting the Generalized Autoregressive Conditional Heteroskedasticity (GARCH) approach. The second issue is to test the data for the possibility of non-stationarity and serial Autocorrelation. The third one is to use the segregated monthly Sectorial data for the analysis. The stationarity of the data series is examined by the Augmented Dickey Fuller (ADF) test and the analysis are further conducted once we get the evidence of the same order of integration of all the series.

### Cointegration Test

As most of the economic time series exhibits non-stationary, using regression analysis provides us with the spurious and unreliable estimates, hence, first we had to make the series a stationary one and then co-integration is used to check if the series are cointegrated in the long run. Once the long run relationship is established through Cointegration, OLS is used for further analysis and obtaining the coefficients. When the time series that are non stationary in the short-run but their linear combination in the long run is stationary than the series are considered to be cointegrated.

The analysis starts with the estimation of simple OLS model provided by the equation 1, where  $y_t$  is the time series of interest, and let  $x_t$  be a  $k \times 1$  dimensional vector of potential explanatory variables. To model  $y_t$  as a function of  $x_t$  we consider the linear regression

$$y_t = x_t' + \epsilon_t, \quad (3)$$

The Augmented Dickey Fuller test for testing Stationarity given by (Dickey and Fuller, 1981) is given by regression equation:

$$\Delta y_t = \alpha + \beta y_{t-1} + \sum_{j=1}^p \gamma_j \Delta y_{t-j} + \epsilon_t$$

Here the series duly tested for Stationarity is  $y_t$  while  $p$  represent the number of lags to capture the autocorrelation, if the  $\beta = 0$ , it would be the acceptance of the null hypothesis of a unit root process. If  $\beta < 0$ , it would be the acceptance of the alternative hypothesis of the series being the stationary series.

### Time Series Regression Model

The analysis regarding the estimation of simple OLS model is provided by the equation 1, where  $y_t$  is a time series of interest, and let  $x_t$  be a  $k \times 1$  dimensional vector of potential explanatory variables. To model  $y_t$  as a function of  $x_t$  we consider the linear regression

$$y_t = x_t' + \epsilon_t, \quad (4)$$

For observations  $t = 1, 2, \dots, T$ , where  $\beta$  is a  $k \times 1$  vector of parameters to be estimated and  $\epsilon_t$  is an error term. Depending on the variables included in the vector of regressors,  $x_t$  the interpretation of the linear regression in (3) changes.

As in most of the time series the past events could be treated as given, or predetermined, in the analysis of current events. Since many economic time series seem to depend on their own past it is

natural to include the lagged values,  $y_{t-1}, y_{t-2}, \dots$ , in the explanation of the current value. As an example we can let,  $x_t = y_{t-1}$ , and the regression model is given by

$$y_t = \theta y_{t-1} + \epsilon_t \tag{5}$$

Where in  $y_t$  depend only on the one period lagged value denoted as the first order autoregressive, or AR (1), model. By combining the equation 3 and 5, a simple autoregressive model is obtained with both the regressors as:

$$y_t = \beta_0 x_t + \beta_1 y_{t-1} + \epsilon_t, \tag{6}$$

The equation five is used to form the first equation in the model provided by equation 1.

$$\ln(Q_t) = \omega + \alpha_i \ln Q_{t-i} + \beta_i \ln ER_t + \mu_{i,t}$$

**Diagnostic Tests for the Reliability of the Coefficients**

The idea of a regression analysis for the time series data is to use the observations from the past to characterize historical relationships. If we want to use the historical relationships to explain current and future developments need the future behaving like the past; and that is exactly the assumption of Stationarity.

Stating that the explanatory variables must be uncorrelated with the error term.

Again, suppose  $y_t$  and  $x_t$  obeys the Assumption above, and assume that the regressors are predetermined (6) hold ground, provided the error terms are Homoscedastic, i.e.

$$E[\epsilon_t^2 x_t] = \sigma^2 \tag{7}$$

With no serial correlation i.e. for all  $t \neq s$ ,

$$E[\epsilon_t \epsilon_s x_t x_s] = 0 \tag{8}$$

Then the OLS estimator is asymptotically distributed normally, so that

$$\sqrt{T}(\hat{\beta} - \beta) \rightarrow N(0, \sigma^2 E[x_t x_t']^{-1}), \tag{9}$$

For  $T \rightarrow \infty$ .

The precise formulation of the condition in (8) is somewhat difficult to interpret, and often we ignore the conditioning on  $x_t$  and  $x_s$  and consider as to whether  $\epsilon_t$  and  $\epsilon_s$  are uncorrelated for  $t \neq s$ .

**Generalized Autoregressive Conditional Heteroskedastic Model**

The ARCH model proposed by (Engle, 1982), which suggest that the variances of the residuals at certain time period depend on the square of the error term from lag period, i.e.

$$y_t = \alpha + \beta' x_t + \mu_t \tag{10}$$

As the Hetroskedasticity is due to the changes in the variances over time depends on the square residuals from one lag period that can be given by:

$$\sigma_t^2 = \gamma_0 + \gamma_1 \mu_{t-1}^2 \tag{11}$$

Hence the ARCH (q) process with both the mean and the variance of the series can be given by:

$$y_t = \alpha + \beta' x_t + \mu_t \tag{12}$$

$$\mu_t / \Omega \sim iidN(0, h_t) \tag{13}$$

$$h_t = \gamma_0 + \sum_{j=1}^q \gamma_j \mu_{t-j}^2 \tag{14}$$

According to Engle the ARCH is more a moving average than an autoregressive specification (Bollersllev, 1986), added an autoregressive term in the ARCH model by incorporating the lagged conditional variances term given a GARCH (p,q) model which can be given as:

$$y_t = \alpha + \beta' x_t + \mu_t \tag{15}$$

$$\mu_t / \Omega \sim iidN(o, h_t) \tag{16}$$

$$h_t = \gamma_0 + \sum_{i=1}^p \delta_i h_{t-i} + \sum_{j=1}^q \gamma_j \mu_{t-j}^2 \tag{17}$$

Owing to this the value of the variance henceforth depends on both lagged squared residuals and the information about the past variances,  $h_t$ , the simplest GARCH (p, q) model is given as GARCH (1, 1) with the variance equation given by:

$$h_t = \gamma_0 + \delta_1 h_{t-1} + \gamma_1 \mu_{t-1}^2 \tag{18}$$

### EMPIRICAL FINDINGS AND DISCUSSION

Before discussing the sector-wise analysis of the imports and the exports of Pakistan it is interesting to view the graphical representation of all the sectors given in the appendix-II, which clearly indicates an ever increasing trend in both the sectors. In the midst of 2008 all the sectors shows a downward trend which indicates the effects of the global financial crisis that not only declined the overall trade of the world but also affected Pakistan trade sectors exclusively.

#### Augmented Dickey Fuller Test

The major export sectors of Pakistan include the Food group, manufacturing group and the textile group, where from the textile group is the one which generates the bulk of the export earnings. The results indicated in Table 1, confirms that all the series in the export sector are integrated of order one as at level the series exhibited unit root tested thought the Augmented Dickey Fuller test with only constant and not including the trend, while the test applied at the first difference indicates that the series becomes stationary and, thus are integrated of order one.

**Table-1.** ADF test of Stationarity, Export Sector

	At level ADF Test Statistic	First difference ADF Test Statistic	1% Critical Value*
Exchange rates	-1.89	-6.03***	-3.51 -2.90 -2.59
Food group	-1.70	-4.50***	-3.51 -2.90 -2.59
Manufacturing	-0.52	-4.63***	-3.51 -2.90 -2.59
Textile	-1.05	-7.42***	-3.51 -2.90 -2.59

**Note:**\*MacKinnon critical values for rejection of hypothesis of a unit root.

## COINTEGRATION TEST

The Cointegration test presented in Table 2 clearly indicates the presence of three cointegrating vectors among the series. This indicates the presence of the long-run relationship and also that the three main export sectors commoves with the exchange rates. The long run relationship among the series could be presented by three cointegrating equations.

**Table-2.** Cointegration Test, Export Sector: Exchange Rates, Food Group, Textile Group and Other Manufacturers

Eigen value	Likelihood Ratio	5 Percent Critical Value	1 Percent Critical Value	Hypothesized No. of CE(s)
0.39	76.96	54.64	61.24	None **
0.21	37.62	34.55	40.49	At most 1 *
0.16	18.48	18.17	23.46	At most 2 *
0.05	4.44	3.74	6.40	At most 3 *

**Note:**\*(\*\*) denotes rejection of the hypothesis at 5 % ( 1%) significance level. L.R. test indicates 4 cointegrating equation(s) at 5% significance level

## Ordinary Least Square Regression

The results given in Table 3, of the OLS estimation process indicates that the entire three major exports sector exhibits significantly strong relationship with the exchange rates. The manufacturing sector has the highest positive coefficient of 1.55, while the textile one has the coefficient value of 1.42, while the lowest coefficient is that of the food group.

While examining the effects of the lag value, the AR term indicates that in the food group the lag value shows no effect whatsoever, while in the other two sectors there is a significant effect of the lag value this effect being negative in the textile sector due to the decreasing demand in the sectors which is leaving a negative impact on the exports of the textile sector, while the effects is positive in the manufacturing sector. The R-squared of each of the OLS equation is much higher showing the fitness of the models while the Durban Watson statistic indicates no evidence of auto correlation but as an Autoregressive lag value of the dependent variable is used the Durban Watson becomes insignificant in the detection of the serial autocorrelation. That effect is checked with the Breusch-Godfrey Serial Correlation LM Test given in Table 4.

**Table-3.** OLS Regression Export Sectors, Method: Least Squares

Variables	Food Group	Textile Group	Other Manufacturers
	0.76	1.42	1.55
Exchange rates	30.88 <b>(0.00)</b>	4.25 <b>(0.00)</b>	3.08 <b>(0.003)</b>
	0.02	-0.60	0.65
One period lag value of sector *	0.52 (0.61)	-5.97 (0.00)	7.21 (0.00)
Durban Watson	2.07	1.92	2.21
R <sup>2</sup>	0.98	0.71	0.84
F-statistic	1066.5	28.73	126.04

(0.00) (0.00) (0.00)

**Note:** \* One period lag value represents the Autoregressive term included in the model.

The existence there of the Autocorrelation is removed by the Cochrane-Orcutt.

The results for the first two rows indicates the Coefficients, the t-Stat and the Probability value in the brackets

### Diagnostic Test

Having estimated of the OLS model the reliability, thus, of the obtained coefficients is checked through different diagnostic test run on the residuals of the OLS equation of the three sub sectors. The test for the serial auto correlation indicated by the B-G and the high order Ljung-Box Q statistic shows no evidence of autocorrelation. All the three sectors are showing both the statistics to be insignificant one.

The Iterative procedure to resolve the autocorrelation by introduced by Cochrane and Orcutt. The inclusion of the AR term in the equation and checking the coefficient of the lag term shows the possibility of the autocorrelation. The ARCH test on the residuals also shows no evidence of the Heteroskedasticity as the statistics with the relative probabilities is insignificant. The Chow break point test is used to test the structural stability of the data, this test for all the three sectors indicate structural stability in the data. Regarding the issue of the normality of the data the JB statistic shows no evidence of non normality of the data although there is a slight evidence of skewness and kurtosis but the insignificance of the J-B statistic is enough to determine the normality of the data.

### Generalized Autoregressive Conditional Heteroskedasticity

Table 5 shows the results of the GARCH effects of the exchange rates on the three sectors. As cleared from the Table 5 the mean equation of the GARCH model shows that the exchange rates volatility has significant effects on all the three export sectors with the coefficient of the food sector having value 0.690, while the coefficients of the other two sectors shows nearly same effect with values of 2.023 and 1.744 for textile and manufacturing group respectively, which indicates that the volatility in the exchange rates effects all the three main exports sectors of Pakistan. While the positive coefficient favor the affects of increase in the food exports. The result regarding the effects of the lag value of the exports in the mean equation also shows significantly positive effects. Which means that one lag dependent value in all the three sectors affects significantly the present value, that indicates that the past events in the sectors affects the present performance as was the case with the OLS estimation.

**Table-4.** Diagnostic tests for Autocorrelation, Heteroskedasticity, Stability and Normality

		Sub sectors					
Variables		Food Group		Textile Group		Other Manufacturers	
Breusch-Godfrey	Serial	2.24		0.72		2.49	
Correlation LM Test		(0.07)		(0.60)		(0.07)	
F-Statistic		8.96		3.21		7.42	
Obs *R-Squared		(0.06)		(0.52)		(0.06)	
Q-statistic	probabilities	10.12	(0.12)	2.66	(0.62)	8.33	(0.30)
adjusted for	ARMA term(s)	14.97	(0.38)	13.29	(0.35)	12.70	(0.63)
		22.53	(0.43)	20.04	(0.46)	18.01	(0.76)
ARCH Test		0.26		0.14		1.08	
F-Statistic		(0.61)		(0.71)		(0.36)	
Obs*R-Squared		0.26		0.14		3.28	
		(0.61)		(0.71)		(0.35)	
Chow Breakpoint Test		1.94		1.19		0.37	

F-Statistic	(0.10)	(0.32)	(0.83)
Log Likelihood Ratio	10.40 (0.07)	9.52 (0.22)	1.62 (0.81)
Skewness	-0.05	-0.50	-0.27
Kurtosis	2.36	3.49	3.33
J-B	1.42 0.49	4.12 0.13	1.31 0.52

**Note:** B-G serial correlation LM test: test for checking Autocorrelation.  
 Q-Statistic: to test the high order Autocorrelation.  
 ARCH: to test the model for the presence of Heteroskedasticity.  
 Chow: to test the structural stability of the model.  
 J-B: to test the presence of possible non normality of the data.

By examining the variance equation the GARCH effect. It is clearly evident in Table 5 that all the three sectors have significant effect, the coefficients of the GARCH are all positive with the values of 0.70, 0.85 and 1.06 for the food, textile and the manufacturing sectors respectively. The movement in the exchange rates surely has a significant impact on determination of the value and trend in the three export sectors. All the three sectors have reliable and high values of the R-Square showing the significance of the model used to determine the GARCH effects.

It is clear that the three export sectors of Pakistan have a significant relationship with the exchange rates. At the same time this exhibits the volatility effects of the exchange rate fluctuations. The positive coefficient suggests that the devaluation of the Pakistani currency has a positive impact on the exports sectors that is consistent with the results in the literature which indicated positive effects of the depreciation on the export sectors.

The analysis clearly indicates that strong empirical relationship exists between the exchange rates and the export sectors, thus it supports the hypothesis that the depreciation in the currency in case of Pakistan does improve the export competitiveness and it would be helpful in boosting the exports. The coefficients are positive and significant for the export sectors.

**Table-5.** GARCH Export Sectors: Method: ML – ARCH

	Coefficient	z-Statistic	Prob	R-squared	Durbin-Watson stat	F-statistic Prob (F-statistic)
<b>Food Group</b>						
Ex	0.69	21.35	0.00	0.98	1.61	419.01 0.00
Fg(-1)	0.13	2.80	0.05			
ARCH	0.34	0.08	0.57			
GARCH	0.71	2.09	0.04			
<b>Textile Group</b>						
Ex	1.74	4.68	0.00	0.49	2.19	11.87 0.00
Atexgroup(-1)	0.31	3.39	0.01			
ARCH	0.13	0.33	0.74			
GARCH	0.86	5.13	0.00			
<b>Overall Manufacturers</b>						
Ex	2.02	4.62	0.00	0.79	2.15	46.47 0.00
Omanu(-1)	0.62	10.30	0.00			
ARCH	-0.08	-0.81	0.43			
GARCH	1.06	8.90	0.00			

**Note:** Ex: Exchange rates, FG (-1): one period lag value of food exports.  
 ATEXGROUP (-1): period lag value of textile exports.  
 OMANU (-1): period lag value of manufacturing exports

These findings also are in agreement with major researches conducted with reference to Pakistan as well as other economies such as (Hasan& Khan, 1994), (Zehra&Auranzeb, 2000) they did find a significant and positive effects of the exchange rates depreciation in improving the export sector of Pakistan. Wijnbergen (1986) confirmed that through devaluation the exporting firms benefits from the lower price which is true in case of Pakistan. Most of the exporting firms in Pakistan are related to one major agriculture product, cotton, and these firms have developed their capacity to compete at international level under favorable conditions. Berthou (2008) also found the negative effects of currency appreciation on the overall export volumes of the country.

The effects of increased exchange rate volatility is confirmed by De Grauwe (1988), increase in the exchange rate volatility results in the increase in the risk and uncertainty which may induces the double effects on the exports, which is not the case with Pakistan as the currency of Pakistan does not fluctuates against the major currencies on major terms and the relative volatility is low which does not leave any major significant impact on the trade, though the effects are significant on certain major sectors but they are not up to the level of any major impact. The other reason as to why Pakistan is not able to use its exchange rates policy in improving its trade balance is that it is heavily reliant on one major agricultural commodity i.e. cotton and it has not been able to diversify its export base to other sectors as 60% of its export are from textile production. (Forbes, 2002) indicated that through the economic growth and improvement the depreciating currency can have the expansionary effects, again the depreciating currency could not be utilized fully for improving the export of Pakistan. As the currency in Pakistan depreciates, it also have certain inflationary effects domestically as indicated by Berman and Berthou (2006) that depreciation should not be transmitted to the domestic prices, i.e. it should not produce domestic inflationary effect that might dampen the export competitiveness.

Pakistan is also struggling against the difficult economic circumstances and its macroeconomic indicators are not favorable to adopt more flexibility as indicated by (Sozovska, 2004). Pakistan should give serious consideration in the selection of appropriate exchange rate system. It is indicated by Hussain (2006) also that the countries with low economic diversification (measured by its share of primary export commodities in overall exports) must avoid choosing pegs and moving towards more flexible regimes as more diversified economies are less vulnerable to the shocks.

## CONCLUSION

This study attempts to find the empirical relationship between the exchange rates and the volatility associated with it with respect to the import and the export sectors of Pakistan. The results of the Cointegration test indicate the existence of a long-run relationship between the exchange rates and the major import and the export sectors. The OSL time series estimation results and the GARCH estimation are also applied to obtain the long-run coefficients and to check the effects of exchange rates volatility respectively. The results from the OLS estimation indicate that the export sectors of Pakistan exhibits a positively significant relationship between the exchange rates and its lag dependent variable of the sector. The GARCH equations of both the mean and the variances indicates the same positive significance which reveals the effects of the exchange rates volatility on the export sectors, that indicates and supports the part of the literature indicating the positive relationship of the exports with the exchange rates which means that the depreciation in the currency boosts the exports. The diagnostic tests are also insignificant showing no presence of any autocorrelation, Heteroskedasticity and non normality.



In addition the trade orientation of Pakistan is extremely low, presenting a case against the flexibility. Though different standards of capital market development like the Morgan Stanley Capital Investments (MSCI), International Finance Corporation (IFC), JP Morgan ranks the capital markets of Pakistan in relatively developed one (Hussain, 2006) which favors moving towards flexibility. On the other hand there is a complete lack of stabilization in the Pakistan's economy which is a strong case of moving against the flexible exchange rates, as fixed exchange rates regimes are preferable for the economies which are less diversified and aims to controls inflation and move towards the overall stabilization policies. As indicated earlier in the analysis of the study that the export sector has a strong positive relationship with the exchange rates, which suggest the price competitiveness of major exports of Pakistan, keeping in view the competitiveness of the exports there is a need for exchange rate policy that supports the export sector. With that there is an urgent need for the resolution of the energy crisis and diversification of the overall export base. As Pakistan is a country with low international trade orientation and diversification along with lack of financial market development through which exporting firms could not mitigate the risk associated with the exchange rate movements, the exporters and the government should work out a long term policy to remove the deficiencies present in the economic and financial structure.

### **Policy Implications**

Although Pakistan today is suffering from economic destabilization and lack of credibility on the issues of economic policy front and has been forced once again to move towards restructuring under the agreement of IMF but there are still some basic recommendations on the issues of Pakistan's international trade:

1. In view of the trade dynamics of Pakistan the imports had always been over shadowing the exports sectors. There is a strong need of a policy to impose restriction on the less important import commodities, and a need to encourage technological innovations, adopt structural changes to encourage industrialization and trade diversification and efficient allocation of the resources. That would help in the reduction of the trade deficit and bring the balance of payment in equilibrium.
2. There is an earnest need for the diversification not only in the trade but also on the issues of finding new market for the exports where there is a demand for the export commodities, as recently the share of the exports of Pakistan have increased towards the Asian economies (43%) which resulted in the relative increase in the overall exports value.
3. Pakistan is depending heavily on few sectors in the exports as the textile sector accounts for 65% of total exports which resulted in critical situations when faced with the energy crisis and the slash in the commodity prices. More diversifies exports would put Pakistan in a strong position to hedge against commodity price shock in one sector. As in the case of Iran which moved from major oil exporting exports and diversified its export to major benefits after 1990's and the currency depreciation had positive expansionary effects on the economy (Oskooee and Kandil, 2007).
4. Pakistan has adopted a pegged exchange rate system for long by pegging its currency to the basket of currencies but recently its policy has shifted towards the adoption of more flexibility in its exchange rates with managed float exchange rate system. Although Pakistan might have certain level of international integration in financial term, it is suffering from high inflation, and less diversified production and low level of industrialization which limits its capacity

building, trade orientation. The lack of stability indicates a case against more flexibility and supports moving towards the other pole of the exchange rates systems.

As indicated earlier in the analysis of the study that the export sector has a strong positive relationship with the exchange rates, which suggest the price competitiveness of major exports of Pakistan, keeping in view the competitiveness of the exports there is a need for exchange rate policy that supports the export sector. With that there is an urgent need for the resolution of the energy crisis and diversification of the overall export base. As Pakistan is a country with low international trade orientation and diversification along with lack of financial market development through which exporting firms could not mitigate the risk associated with the exchange rate movements, the exporters and the government should work out a long term policy to remove the deficiencies present in the economic and financial structure.

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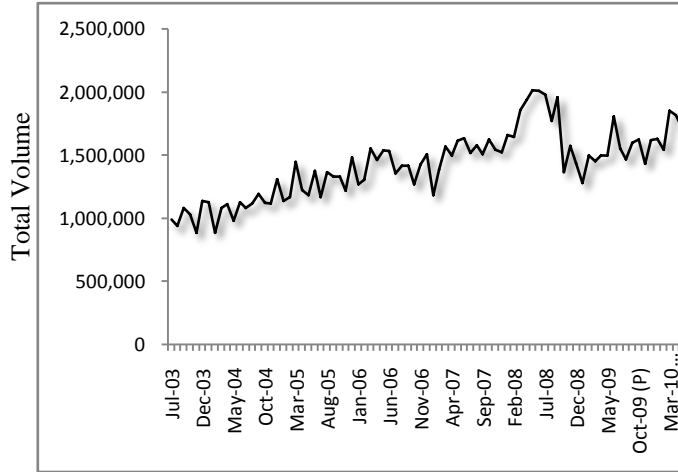
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## Annexure-I

### Graphical Representation of All the Import and Export Sectors:

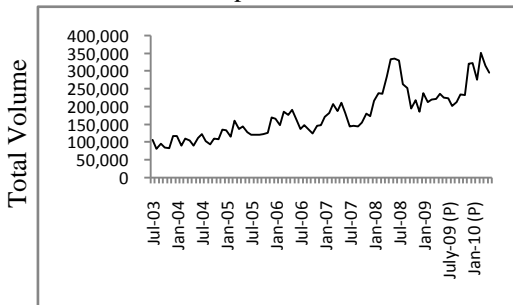
#### Export Sector

The overall export sector



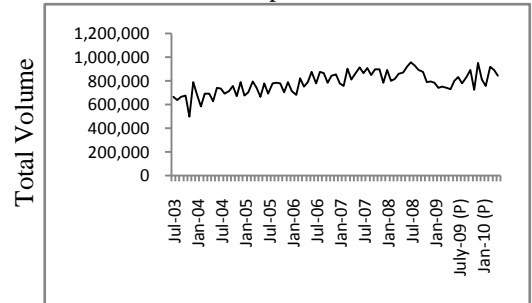
Years

Food export sector



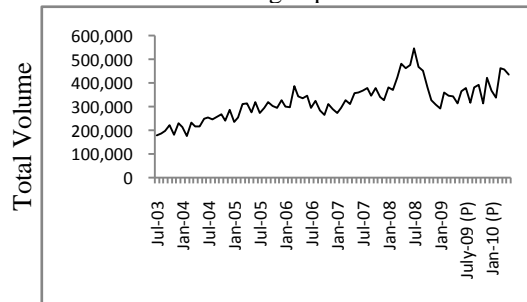
Years

Textile export sector



Years

Manufacturing export sector



Years