Asymmetric Effects of Exchange Rate Changes on Domestic Production and Stock Prices in Pakistan

Submitted by:

Shujaat Hussain
PIDE2016FMPHILEAF20

Supervised by:

Supervisor: Dr. Hafsa Hina
Assistant Professor
PIDE

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CERTIFICATE

This is to certify that this thesis entitled **"Asymmetric effects of exchange rate changes on domestic production and stock prices in Pakistan"** submitted by **Mr. Shujaat Hussain** is accepted in its present form by the Department of Economics and Finance, Pakistan Institute of Development Economics (PIDE) Islamabad as satisfying the requirements for partial fulfillment of the Degree of Master of Philosophy in Economics and Finance.

External Examiner:

Dr. Muhammad Jamil
Assistant Professor,
QAU, Islamabad.

Internal Examiner:

Dr. Ahmad Fraz
Assistant Professor,
PIDE, Islamabad.

Supervisor:

Dr. Hafsa Hina
Assistant Professor,
PIDE, Islamabad.

Head of Department of Economics and Finance:

Dr. Ahsan Ul Haq
PIDE, Islamabad

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Dedicated

to

my beloved Parents, Teachers and Friends

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Shujaat Hussain

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ABSTRACT

This study focuses on examining the nature of impact i.e. 'Symmetric or Asymmetric', of exchange rate on output and stock prices in Pakistan. The study uses Linear and Non-linear Autoregressive Distributed Lag models on monthly data of macro-economic variables from the period January 2001 to November 2017. From the results, the study concludes that exchange rate has asymmetric impact on output in both short-run and long run while impact on stock prices is asymmetric in the short-run only. Moreover, results revealed that different sectors of the economy react differently to the changes in macroeconomic variables and exchange rate. Exchange rate changes have been found to have asymmetric effects on the stock price indices of three sectors (Energy, Cement and Textile) in Pakistan. The study recommends various policies that can be implemented to avoid exchange rate fluctuation risk.

CHAPTER I

INTRODUCTION

Domestic production and stock prices have been proved to be significantly affected by the exchange rate changes along with other macroeconomic variables. For instance, devaluation induces the consumer to save less and consume more resulting in a decrease in the aggregate demand and output in the economy. Similarly, devaluation also affects the output through the negative real balance effect as a result of the higher price level. Likewise, if the price elasticities of export and imports are very low, the trade balance voiced in terms of domestic currency will get worsened and will lead to a recessionary impact in the economy Krugman and Taylor (1978).

In addition to these demand-side effects, there are also several supply-side channels through which devaluation can be contractionary. Exchange rate depreciation raises the cost of foreign inputs leading to an increase in cost of production resulting in decrease of aggregate supply. Moreover, exchange rate depreciation may also raise domestic interest rate as well as wage level through an increase in price level. This may lead to a reduction in aggregate supply in the economy (Kalyoncu et al., 2008)

The model presented by the standard textbook (Dronbusch, 1988) explains that the depreciation of home currency will make exports cheaper for foreign customers and will make foreign goods relatively expensive for domestic customers. Dronbusch, (1988) argues that devaluation is adopted as a strategy to increase the exports and move their demand towards the domestically produced products resulting in shifting of the aggregate demand curve to the rightwards. Furthermore, in the short run, once the economy starts to function at a positively sloped aggregate supply curve then

depreciation of domestic currency will lead to increase the output in the economy (*ibid)*. However, in the long run, once the economy starts working on a vertical sloped aggregate supply curve then the price will rise proportionally having no effect on the output.

Countries devalue or depreciate their currencies to increase their export, which in turn increases domestic output. However, depreciation or devaluation might increase the cost of import leading to increase in the cost of production. Therefore, the effect of devaluation or depreciation is ambiguous on output, because former channel will increase the aggregate demand and later will decrease the aggregate supply (Krugman and Taylor, 1978).

Since late 1973, various studies have examined the problem of whether devaluation is expansionary or contractionary (Shahbaz et al., 2012). argue that economists have approached this problem and most have supported the view that developing countries, who rely upon foreign inputs, will experience a strong fall in aggregate supply as compared to the aggregate demand. This will lead to a decrease in domestic production. As a result, net exports component and aggregate demand will rise more than the fall in aggregate supply. However, devaluation or depreciation are said to be expansionary if mentioned channel holds otherwise, it is said to be contractionary.

In economics, it is not hard to attach one macroeconomic variable to another variable therefore, the relationship between exchange rate and stock price is obvious (Bahmani-Oskooee and Sohrabian, 1992). Stok market seems to be one of the most important performance indicator for any economy, the reason could be that it impounds shock and policy changes (Shiskin and Moore, 1968)

The portfolio approach is considered as a starting point to examine the link between exchange rate and stock price. This approach infers that decreasing stock price would

discount the wealth of domestic investor which will decrease the demand for money resulting in decrease of interest rate, This, decreasing interest rate will close the avenues for foreign investors inflicting capital outflows; hence, the domestic currency will depreciate (Ajaz et al., 2017). Alternatively, goods market approach to exchange rate determination implies that depreciation in domestic currency may improve exports and have appreciative effect for export-oriented firm. As export-oriented firm will account the high profit margin which further will increase the share price. However, this is not the case for import oriented firm as an import-oriented firm will be adversely affected by the domestic currency depreciation. Reason will be the higher cost of production which shrinks the profit of such firms and affect the stock prices (Ajaz et al., 2017). So, it means stock price may move in either direction. There are a few other macroeconomic variables such as money supply, inflation, industrial production, interest rate, oil prices, etc. which could influence stock prices as well. In theory, the value of a firm's stock should equal to the present value of the expected future cash flow. Furthermore, the future cash flow is dependent on the performance of the firm. Moreover, the performance of the firm relies on the changes in numerous macroeconomic variables of a country. Therefore, changes in any macroeconomic variables could influence stock prices

In the earlier cases, the information of the overall stock market was aggregated by employing the composite stock market index at a country level. However, composite data can suffer from the problem of aggregation bias since composite data does not reveal how each of the different sectors in a specific country are affected by changes in various macroeconomic variables. There are different industrial sectors in any specific country that will react differently to the changes in macroeconomic variables.

Therefore, it is important to disaggregate data by taking the sectoral stock price indices for Pakistan.

Symmetry assumption presumes that the effect of appreciation and depreciation of a currency is symmetric. This suggests that if we are inclined towards the positive relationship then appreciation of home currency will hurt the stock prices and output and depreciation of home currency will improve the countries stock prices and output with the same size of changes in both cases. However, this might not always be the case, as appreciation and depreciation will not carry the similar effect in terms of the size and sign on stock prices and output (Bahmani- Oskooee and Mohammadian, 2016) questioned this symmetry assumption and discussed the asymmetric effects. In their views, increase in stock prices and output due to the depreciation of domestic currency might not match the amount of decrease in stock prices and output due to the appreciation of domestic currency.

Asymmetry can arise in two different ways, the first asymmetry in terms of the sign which implies that different countries or industries react in different ways to the changes. Secondly, asymmetry in terms of magnitude (Bahmani-Oskooee and Saha, 2016). The reason could be the changes in expectation; trader's reaction towards the depreciation might be different from their reaction towards the appreciation. Furthermore, (Bussiere, 2013) has proved that import and export prices react to depreciation and appreciation in a different way due to rigidities and different response time or lag structure.

1.1 Problem Statement

The existing literature related to the effect of exchange rate on domestic production and stock prices is not sufficient to highlight the problem of asymmetry. Since in the literature, most of the studies have used the symmetric effect of exchange rate on both

domestic production and stock prices, individually and at a sectoral level. However, asymmetric effects have rarely been studied in the existing literature particularly in the case of Pakistan. Pakistan is the country with a history of destabilization of governance and fluctuations in the economy. As a result, expectations and reactions of traders towards appreciation and depreciation may not be stable and may change for sign and magnitude, consequently arising asymmetry. Since appreciation and depreciation in currency have serious implications for the agents in the economy, their misspecification can have drastic consequences. This study aims at examining the asymmetric effects of exchange rate on domestic production and stock prices. While investigating asymmetric effects, sectors are important to consider because it will help us to make guidance for policymakers regarding the crucial importance of exchange rate appreciation and depreciation.

1.2 Objective of Study

The objectives of the study are;

- To examine the asymmetric effect of exchange rate on domestic production and stock prices of Pakistan.
- To examine the asymmetric effect of exchange rate on stock prices of firm at the sectloral level(Energy, Cement and Textile).

1.3 Hypothesis of Study

H_{a1}: There is asymmetric effect of exchange rate changes on domestic production

H_{b1}: There is symmetric effect of exchange rate changes on domestic production

H_{a2}: There is asymmetric effect of exchange rate changes on stock prices.

H_{b2}: There is symmetric effect of exchange rate changes on stock prices.

1.4 Significance of Study

This study explores the asymmetric effect of exchange rate changes on domestic production and stock prices for the economy of Pakistan by using the recently developed technique NARDL. This asymmetric effect of exchange rate will help the policy makers to form their policies by considering the different response of time and lag structure to preserve or hedge from the exchange rate fluctuation risk while making the investment strategies for different sectors. This will be also beneficial for trade analysist and brokers to keep close eye on this asymmetry.

1.5 Organization of Study

The first chapter includes introduction, significance of the study, objectives of the study and hypothesis. The second chapter will discuss the literature review. The third chapter will include methodology, data source, definition of variables and econometric technique to examine the asymmetric effect of exchange rate on domestic production and stock prices. Chapter number four will discuss the results and discussion and chapter number five will discuss the conclusion and policy recommendation.

CHAPTER II

LITERATURE REVIEW

2.1 Introduction

This chapter presents a brief explanation of information in literature review. It provides the foundation to develop the hypothesis regarding area under the consideration. (related to the determinants of output and stock prices along with other macroeconomic variables).

Literature review is divided into two section 2.2 encompasses the studies regarding exchange rate and output, whereas, section 2.3 have included the review about the exchange rate and stock prices with other macroeconomic variables and lastly, we have summarized the main conclusion and findings and highlighted the research gap.

2.2 Exchange Rate and Output

To bring into line with the aim of the current study**,** we briefly review the literature on the relationship between exchange rate and output. In literature, devaluation is shown to have a significant impact on output (Domac, 1997; Acar, 2000; Shah *et al.,* 2011; Mujahid and Zeb, 2014). (Domac, 1997) concludes that the effects of anticipated devaluation on domestic output are positive, whereas, the impacts of unanticipated devaluation are not shown to have a significant impact on domestic output for the economy of turkey (Acar, 2000)concludes in short-run devaluation is contractionary while in the medium run it is expansionary and is neutral in long- run. (Asif et al., 2011) find the positive and significant impact of currency devaluation on production growth of the economy in both short –run as well as in long –run separately.(Muhammad et al., 2011) findings confirm that devaluation has a contractionary effect on economic growth.

(Khattak et al., 2012) affirm that actual depreciation will raise the output gap in Pakistan. Moreover, a movement near to the more flexible exchange rate system raises the output gap. Meanwhile, (Mujahid et al., 2014) confirm that devaluation is contractionary in Pakistan. Moreover, they validate the long run relationship between the variables.

However, devaluation or depreciation is also found to have a negative impact on output as a study by (Christopoulos, 2004) confirms the reduction in economic growth of Pakistan due to the currency devaluations. Macroeconomic variables, such as money supply, short-term interest rate, and real output are also negatively affected by contractionary devaluation. In contrast to this, (Choudhary and Chaudhry, 2007) find contrary results as their study supports the positive effect of devaluation on output and negative impact on the price level, therefore their study is not in favor of the contractionary devaluation in Pakistan. (Upadhyaya et al., 2004) finds the expansionary effect of currency depreciation on output in the short run while neutral in the long run. Moreover, (Asif et al., 2011)find the significant and positive relationship between money supply and devaluation in both the short and long run. However, impacts of depreciation on output can vary along with a short run and long run as a study by Kanchan (2012) concludes that the effects are expansionary in short -run while contractionary in long –run. (Bahmani-Oskooee and Mohammadian, 2017)investigate the asymmetric impact of exchange rate adjustment on the domestic yield, their results confirm the short run asymmetry adjustment other than this they also retrieve the long run asymmetric effects of exchange rate changes on domestic output in Japan.

2.3 Exchange Rate and Stock Prices

Since the aim of the study is to investigate the impacts of exchange rate depreciation on output and stock prices, this section presents relevant literature on the relationship between exchange rate changes with stock prices.

(Aggarwal, 2003)investigates the association between exchange rate and stock prices and finds that stock prices are changed due to changes in exchange rate and they have a positive correlation such that a dwindle in the value of the dollar is related to a decrease in stock prices. (Soenen et al., 1988) conduct study on stock prices response of seven industrial sectors in the US to change in exchange rate. They found a negative relationship between stock prices and exchange rate. (Bahmani-Oskooee and Sohrabian, 1992) conclude that the dollar stock prices and real effective exchange rate are non-stationary variables. In addition to that, findings also suggest no co-integration between two variables. However, they found causality only in the short run.

(Granger et al., 2000) conduct study on the relationship between stock prices and exchange rate on the nine East-Asian countries. They conclude that the exchange rate affects stock prices in eight of the nine countries. (Muhammad et al., 2002) discover the relationship between share prices and the exchange rate for both short run and long run. The study does not support short-run relationship rather favors long-run relationship. Additionally, the study reports a negative relationship between share prices and exchange rate and this relationship exists from share price to exchange rate. The rationale behind this relationship is individuals holding domestic and foreign assets and currencies. (Nieh et al., 2001) examine the dynamic relationship between stock prices and exchange rate in G-7 countries, reported that no long-run relationship exists between stock prices and exchange rate in all G-7 countries, certain countries show significant short-run relationship for a very short span of time usually for one day only.

(Smyth and Nandha, 2003) reveal that no long-run relationship found between exchange rate and stock prices. Furthermore, they also conclude that exchange rate granger cause stock prices (Ravazzolo, 2005) conclude the positive relationship between stock prices and exchange rates. In contrast, (Rahman and Uddin, 2009) find neither causality relationship nor long-run relationship in either direction between the two variables. The study further suggests using information in one market cannot assist the participant to forecast another market. (Ismail and Bin Isa, 2009) using a Markov-switching VAR model and assuming that the relationship between exchange rate and stock prices is regime dependent for Malaysia to examine the non-linear relation between exchange rates and stock prices. They find no evidence of cointegration between the exchange rates and stock prices. The study concludes that the non-linear model is more appropriate to model the series then the linear model.

(Aslam et al., 2013) study the impacts of diverse variables on stock prices by applying the two different approaches NLS and ARMA they set up a negative impact of the two variables domestic interest rate and price increases on KSE 100 index, per capita income, REER index put a positive impact on stock prices. Discount rate exaggerated stock price index the most. While (Ali et al., 2014) find no evidence of a relationship between exchange rates and stock returns in long run. (Yang et al., 2014) conclude that the feedback relation exists among all sample countries except Thailand in two variables (i.e., stock market returns and exchange rate). In Thailand, stock returns lead exchange rates. The heterogeneous causal effects are found in among different quantiles and in different time periods. They also found a negative correlation between stock prices and foreign exchange rates.(Bahmani-Oskooee and Saha, 2016) investigate the relationship between exchange rate and stock price by using other Macroeconomic variables like money supply industrial production consumer price index their results

confirm the asymmetric effect of exchange rate on stock prices. (Khalid, 2017) considers the impacts of interest rate and currency changes on the" performance of the stock market" by using the two alternative approaches (JJ) and (ECM). Which shows that in the long run interest rate have a negative and currency changes have a positive effect on the stock market unpredictability.

2.4 Conclusion and Contribution of the Study

In the light of above-mentioned studies that examine the relationship between output and exchange rate as well stock prices and exchange rate along with the determinants of both output and stock prices, we come up with the conclusion that the existing literature belongs to output and exchange rate suggest the mixed result regarding devaluation or depreciation and its impact on output. It divides the studies into three different categories some studies found the depreciation to be expansionary in short run and contractionary into long run while others found contractionary in short run and expansionary into long run. However, few studies have found it to be a neutral in medum or long run. On the other hand, studies that belongs to exchange rate and stock prices suggests that both have relationship in short run while in long run they have a very little or no relationship. Moreover, the above studies have a feature that they assume exchange rate have a symmetric effect however, asymmetric literature is belonging to internationally, this study is going to contribute in existing literature by examining the asymmetric effects of exchange rate on output and stock price for Pakistan. Moreover, the similar analysis is conducted on the sectoral level by using the recently developed technique NARDL by (Shin et al., 2014).

CHAPTER III

METHODOLOGY AND DATA

3.1 Introduction

In this chapter, we have given the theoretical framework for output and stock prices separately. The rest of chapter is organized as follow. In section 3.2, we have provided the theoretical framework for output and its determinants whereas section 3.3 represents the theoretical framework regarding the determinants of stock prices. Section 3.4 deals with the econometric models.

3.2 Theoretical Framework of Output and its Determinants

According to domestic output of the economy is a function of several variables such as Exchange rate, monetary policy, fiscal policy, wage rate, and oil prices

3.2.1 Output and Monetary Policy

An increase in interest rate is expected to lead to decrease in investment and aggregate demand eventually leading to a decrease in output hence, the relationship between the two is negative.

3.2.2 Output and Fiscal Policy

Expansionary fiscal policy (decrease in taxes) results in increase of disposable income of household leading to increase in consumption expenditure, which results in increased output. So, the expected sign of correlation between taxes and output is negative.

3.2.3 Output and Oil Price

Increase in oil prices is expected to increase the price of input which lead to an increase in the cost of production which lead to decrease in aggregate supply. Eventually output will decrease so the relationship between the oil price and output is negative.

3.2.4 Wage Rate and Output

The relationship between the wage rate and output is likely to be negative because higher wages leads to an increase in cost of production and lead to a decrease in aggregate supply in the economy hence, output is going to decrease.

3.2.5 Real Effective Exchange Rate and Output

Exchange rate can affect both positively and negatively to output depending on whether the depreciation is expansionary or contractionary. A decrease in real effective exchange rate is expected to reflect the real depreciation of rupee and if it is to be expansionary then it will increase the output in the economy. However, if it is contractionary then it reflects the appreciation of rupee which will lead to decrease the output in the economy

3.3 Theoretical Framework of Stock Prices and its Determinants

According to (Bahmani-Oskooee and Saha, 2016), stock price depends upon several variables such as exchange rate, output, monetary policy, and inflation. The detail description of each variable with stock price is provided as.

3.3.1 Stock Prices and Exchange Rate

The relationship between exchange rate and stock prices can be positive or negative depending on whether firms are export oriented or import oriented. If the firm is export oriented, then major part of revenue is in foreign currency resulting in increased stock prices due to depreciation / devaluation. Whereas in case of import-oriented firm, major part of cost will be in foreign currency resulting in decrease stock prices due to depreciation / devaluation.

3.3.2 Stock Price and Inflation

Inflation usually leads to an increase in input prices and production cost. Increased costs are expected to hurt profit margins and hence stock prices. Therefore, the relation between two is negative, However, if stocks are held over longer time horizons, stocks are considered or expected to be a good inflation hedge and thus a positive relationship between inflation and stock prices is possible (Anari and Kolari, 2001).

3.3.3 Stock Prices and Money Supply

Increase in money supply will lead to decrease in interest rate hence investment will increase leading increased output. This eventually leads to an increase in stock prices. (Fama, 1981) argued that increase in money supply could lead to inflation which in turn might decrease stock prices, as discussed above. Empirical literature supports both effects.

3.3.4 Stock Prices and Output

Industrial production and stock prices are positively related because increase in economic activity is expected to lead to increase in higher corporate earnings. Higher corporate earnings lead to higher expected cashflows of firm resulting in increased stock prices (Chen et al., 1986).

3.4 Econometric Methodology

Based on the theoretical framework, the simple linear econometric model for output and stock prices is given as

$$LnY_t = \delta_0 + \delta_1 LnREX_t + \delta_2 LnT_t + LnSRi_t + LnOil_{prices} + LnW_t + \varepsilon_t \quad \text{.....3.1}$$

Where

Y= Output
SRi= Monetary policy
T= Fiscal policy

REX=Real effective exchange rate
OP = Oil price
W= Overall wage index in Pakistan

$$LnSPi^{t} = \theta_0 + \theta_1 lnEX_t + \theta_2 lnY_t + \theta_3 lnPrices_t + \theta_4 lnM_t + \eta_t \quad \text{.....3.2}$$

Where
SP = stock price index
EX= Nominal effective exchange rate
Y=industrial production index (used as a measure of domestic economic activity)
CPI= Consumer Price Index
M= Money Supply
Since we are interested to investigate the effect of exchange rate on stock prices at a sectoral level. Therefore,

$$LnSPt^{i} = \theta_0 + \theta_1 lnEX_t + \theta_2 lnY_t + \theta_3 lnCPI_t + \theta_4 lnM2_t + \varepsilon_t \quad \text{.....3.3}$$

Where
i=1,2,3
1=Textile
2=Cement
3=Energy
Since we are dealing with the time series data and time series data has a property of unit root. In the presence of unit root estimation of equation 3.1, 3.2 and 3.3 with simple OLS method will lead to providing the spurious results. To avoid the problem of spurious regression our solution is to estimate the model.

$$\Delta LnY_t = \psi_0 + \sum_{j=1}^{l1} \psi 1j \Delta lnY_{t-j} + \sum_{j=2}^{l2} \psi 2j \Delta lnREX_{t-j} + \sum_{j=3}^{l3} \psi 3j \Delta lnT_{t-j} +$$

$$\sum_{j=4}^{l4} \psi 4j \Delta lnM_{t-j} + \sum_{j=5}^{l5} \psi 5j \Delta lnOil_{pricet-j} + \sum_{j=6}^{l6} \psi 6j \Delta lnW_{t-j} + \lambda \varepsilon_{t-1} + U_t \quad (3.4)$$

$$\Delta LnY_t = \psi_0 + \sum_{j=1}^{l1} \psi 1j \Delta lnY_{t-j} + \sum_{j=1}^{l2} \psi 2j \Delta lnREX_{t-j} + \sum_{j=1}^{l3} \psi 3j \Delta lnT_{t-j} +$$

$$\sum_{j=1}^{l4} \psi 4j \Delta lnM_{t-j} + \sum_{j=1}^{l5} \psi 5j \Delta lnOil_{pricet-j} + \sum_{j=1}^{l6} \psi 6j \Delta lnW_{t-j} + \alpha_0 lnY_{t-1} +$$

$$\alpha_1 lnREX_{t-1} + \alpha_2 lnT_{t-1} + \alpha_3 lnSR_{i_{t-1}} + \alpha_4 lnOil_{pricet-1} + \alpha_5 lnW_{t-1} + U_t \quad \text{.....(3.5)}$$

$$LnSP_t = \rho_0 + \sum_{j=1}^{l1} \rho 1j \Delta SP_{t-j} + \sum_{j=0}^{l2} \rho 2j \Delta lnEX_{t-j} + \sum_{j=0}^{l3} \rho 3j \Delta lnY_{t-j} +$$

$$\sum_{j=0}^{l4} \rho 4j \Delta lnCPI_{t-j} + \sum_{j=0}^{l5} \rho 5j \Delta lnM_{t-j} + \pi_1 lnSP_{t-1} + \pi_2 lnEX_{t-1} + \pi_3 lnY_{t-1} +$$

$$\pi_4 lnCPI_{t-1} + \pi_5 lnM_{t-1} + U_t \quad \text{.....(3.6)}$$

$$LnSPi^t = \rho_0 + \sum_{j=1}^{l1} \rho 1j \Delta SP^i{}_{t-j} + \sum_{j=0}^{l2} \rho 2j \Delta lnEX_{t-j} + \sum_{j=0}^{l3} \rho 3j \Delta lnY_{t-j} +$$

$$\sum_{j=0}^{l4} \rho 4j \Delta lnCPI_{t-j} + \sum_{j=0}^{l5} \rho 5j \Delta lnM_{t-j} + \pi_1 lnSP^i{}_{t-1} + \pi_2 lnEX_{t-1} + \pi_3 lnY_{t-1} +$$

$$\pi_4 lnCPI_{t-1} + \pi_5 lnM_{t-1} + U_t \quad \text{.....(3.7)}$$

From the above equation (3.5) and (3.6) and (3.7) we can retrieve both the short term and long-term coefficients. The short-run estimates of coefficients are retrieved by the coefficients of lagged first differenced variables and long-run coefficients are calculated by the coefficients of lagged level variables for the co-integration test we are going to test the joint significance through F test.

$$\alpha_1 = \alpha_2 = \alpha_3 = \alpha_4 = \alpha_5 = 0$$

Describe no co-integration among the variables

$$\pi_2 = \pi_3 = \pi_4 = \pi_5 = 0$$

For co-integration,(Pesaran et al., 2001) provide the two set of critical values upper bound and lower bound critical values. For co-integration we, match the F value derived from bound test to the critical values provided by the Pesaran. If computed value of F test is greater than the critical values, we can conclude that the cointegration will exist among the variables.

Since linear ARDL works under the assumption that the effect of independent variables is symmetric. However, it may not be true in case of asymmetric effect. So, the NARDL methodology is developed to incorporate the asymmetric effect.

3.5 Non-Linear Models

Earlier studies while using the same model have principally assumed that the effect of exchange rates on domestic production and stock prices is symmetric. However, this might not always be the case. The appreciation and depreciation may not have a similar effect in terms of magnitude and sign on domestic production and stock prices. Since it's not necessarily the case that changes in output and stock prices due to appreciation or depreciation of currency be equal in magnitude or in sign. They may vary in magnitude and sign thereby creating the asymmetric effect. Therefore, it can be concluded that the effect of changes in exchange rates on domestic production can be asymmetric. Therefore, to reach this (Shin et al., 2014) decompose the effect of a variable into two components by a partial sum approach. At the same time to incorporate the asymmetric effects of exchange rate on output and stock prices, we are going to decompose the exchange rate into two components (appreciation and depreciation) by partial sum approach. $\Delta LnREX_t = \Delta lnREX_0 + \Delta lnREXt^+ + \Delta lnREX^-$ Where as $\Delta lnREX_0$ means no change in exchange rate.

$$POS = LnREXt^+ = \sum_{j=1}^{t} \Delta lnREXj^+ = \sum_{j=1}^{t} max\,(\Delta lnREX, 0) \quad \text{.....(3.8)}$$

$$NEG = LnREXt^- = \sum_{j=1}^{t} \Delta lnREXj^- = \sum_{j=1}^{t} min\,(\Delta lnREX, 0) \quad \text{.....(3.9)}$$

$\Delta lnREXt^+$ Represent a positive change in exchange rates and $\Delta lnREXt^-$ represent the negative changes in exchange rate.

For the stock price model, we have taken the nominal effective exchange rate, therefore, we decompose it by the partial sum approach given by (Shin et al., 2014)

$$POS = LnEXt^+ = \sum_{j=1}^{t} \Delta lnEXj^+ = \sum_{j=1}^{t} max\,(\Delta lnEX, 0) \quad \text{.....(3.10)}$$

$$NEG = LnEXt^- = \sum_{j=1}^{t} \Delta lnEXj^- = \sum_{j=1}^{t} min\,(\Delta lnEX, 0) \quad \text{.....(3.11)}$$

Where $\Delta lnEXt^{+}$ represent a positive change in exchange rates and $\Delta lnEXt^{-}$ represent the negative changes in exchange rate.

By introducing the POS_t and NEG_t into the linear ARDL the new model is thought as a Non-linear model because non linearity comes from the construction of two new time series variables POS reflect the appreciation of domestic currency and NEG reflect the depreciation of domestic currency.

Following the above specification, we obtained the Nonlinear equations for stock prices and output

$$LnY_t = \beta_0 + \beta_1 POS_t + \beta_3 NEG_t + \beta_4 lnFical\ policy + \beta_4 lnMonetary\ policy + \beta_5 lnOil + \beta_6 lnW_t + \varepsilon_t \quad \text{.....(3.12)}$$

$$LnSP_t = \theta_0 + \theta_1 POS_t + \theta_2 NEG_t + \theta_3 lnY_t + \theta_4 lnCPI_t + \theta_5 lnM2_t + \varepsilon_t \quad \text{.....(3.13)}$$

$$LnSPt^{i} = \theta_0 + \theta_1 POS_t + \theta_2 NEG_t + \theta_3 lnY_t + \theta_4 lnCPI_t + \theta_5 lnM_t + \varepsilon_t \quad \text{.....(3.14)}$$

The error correction model is

$$\Delta LnY_t = \psi_0 + \sum_{j=1}^{l1} \psi 1j \Delta lnY_{t-j} + \sum_{j=0}^{l2} \psi 2j \Delta POS_{t-j} + \sum_{j=0}^{l3} \psi 3j \Delta NEG_{t-j} + \sum_{j=0}^{l4} \psi 4j \Delta lnT_{t-j} + \sum_{j=0}^{l5} \psi 5 \Delta lnSR_{i\,t-j} + \sum_{j=0}^{l6} \psi 6 \Delta lnOil_{pricet-j} + \sum_{j=0}^{l7} \psi 7 \Delta lnW_{t-j} + \alpha_0 lnY_{t-1} + \alpha_1 POS_{t-1} + \alpha_2 NEG_{t-1} + \alpha_3 lnT_{t-1} + \alpha_4 lnSR_{i\,t-1} + \alpha_5 lnOil_{pricet-1} + \alpha_6 lnW_{t-1} + \varepsilon_t \quad \text{.....(3.15)}$$

$$\Delta LnSPt^{i} = \rho_0 + \sum_{j=1}^{l1} \rho 1j \Delta SP^{i}{}_{t-j} + \sum_{j=0}^{l2} \rho 2j \Delta POS_{t-j} + \sum_{j=0}^{l3} \rho 3j \Delta NEG_{t-j} + \sum_{j=0}^{l4} \rho 4j \Delta lnY_{t-j} + \sum_{j=0}^{l5} \rho 5j \Delta lnCPI_{t-j} + \sum_{j=0}^{l6} \rho 6j \Delta lnM_{t-j} + \pi_1 lnSP^{i}{}_{t-1} + \pi_2 POS_{t-1} + \pi_3 NEG_{t-1} + \pi_4 lnY_{t-1} + \pi_5 lnCPI_{t-1} + \pi_6 lnM_{t-1} + \eta_t \quad \text{.....(3.16)}$$

$$\Delta LnSPt^{i} = \rho_0 + \sum_{j=1}^{l1} \rho 1j \Delta SP^{i}{}_{t-j} + \sum_{j=0}^{l2} \rho 2j \Delta POS_{t-j} + \sum_{j=0}^{l3} \rho 3j \Delta NEG_{t-j} +$$

$$\sum_{j=0}^{l4} \rho 4j \Delta lnY_{t-j} + \sum_{j=0}^{l5} \rho 5j \Delta lnCPI_{t-j} + \sum_{j=0}^{l6} \rho 6j \Delta lnM2_{t-j} + \pi_1 lnSP^{i}{}_{t-1} +$$

$$\pi_2 POS_{t-1} + \pi_3 NEG_{t-1} + \pi_4 lnY_{t-1} + \pi_5 lnCPI_{t-1} + \pi_6 lnM_{t-1} + \eta_t \quad \text{.....(3.19)}$$

(Shin et al., 2014) agreed that the ARDL method of cointegration that was developed by (Pesaran et al., 2001)will also be applied to the non-linear models. Therefore, the standard F test criteria of (Pesaran et al., 2001) be applied. The short-run impacts are derived by the estimates of the coefficients of the lagged variables. First, short-run adjustment asymmetry is observed if $\Delta POS and \Delta NEG$ variables take different lag orders. Second, short-run asymmetric effects of exchange rate are established if size or sign of short-run coefficient estimates obtained for ΔPOS are different than those obtained from ΔNEG. Third, short-run cumulative or impact asymmetry will be established if $\sum \psi 2j^{\wedge} \neq \sum \psi 3j^{\wedge}$ finally, long-run asymmetry is established if normalized estimates of $\alpha 1^{\wedge} \neq \alpha 2^{\wedge}$.We apply the Wald test to check the latter two-asymmetry hypothesis.

3.6 Assumption of ARDL Co-integration Method

A series containing past effect is said to be integrated and therefore non-stationary because its future path is being reliant on the past influence. To check for such nonstationary researcher have developed many tests out of which one of them is Dickey and Fuller (1997) test and it has a special feature that it will use to tackles the problem of serial autocorrelation by incorporating the lagged values of the dependent variable as an additional repressor in the equation.

The ADF equation in general form is given below

$$\Delta Y_t = \alpha + \beta_t + \rho Y_{t-1} + \sum_{i=1}^{l+1} \gamma_{t-i} \Delta Y_{t-i} + \varepsilon_t$$

Where i=1.2.3…..n

Estimating the difference form equation by OLS, we test the hypothesis

$$H_0: \rho = 0$$

$$H_0: \rho < 0$$

Since the standard t- statistics do not apply to non-stationary series due to downward bias in ADF distribution, that's why we compare the estimated ADF with the critical values given by Mackinnon (1990).

3.7 Diagnostic Test

Residual follows the assumption of no-autocorrelation and no heteroscedasticity

3.7.1 Langragian Multiplier (LM) Test

In time series analysis it is important to make sure that the error terms are white noise. If errors are autocorrelated then the estimators will not remain efficient anymore. In order to confirm the error terms are free from the problem of auto correlation, the lagrangian multiplier test is performed.The LM statistic follows a chi-square distribution (χ^2) , and the order of lag is equal to the frequency of the data

3.7.2 Ramsey Regression Specification Test (RESET)

RESET test is used to check the misspecification of the functional form in the regression model, it follows a chi-square distribution with one degree of freedom and its critical value is 3.84 at 5% significance level.

3.7.3 CUSUM and CUSUM SQ

The stability of parameters of ECM during the analysis, the period will be confirmed by applying the method Cumulative Sum of Residual (CUSUM) and Cumulative Sum of Residual Square (CUSUM SQ) developed by Brown *et al*. (1975) is adopted

Table 3. 1: Variables Definition and Data Sources

Variables	Symbols	Definition and measurement	Data source
Output	Y	IPI industrial production	International financial statistics (IFS)
Monetary Policy	M2	Real money supply as a measure of monetary policy	Monthly Statistical bulletin published by State Bank of Pakistan
Treasury bill	Sri	As a measure of monetary policy	Monthly Statistical bulletin published by State Bank of Pakistan
Fiscal policy	Tax	TAX rate measure of fiscal policy	Monthly Statistical bulletin published by State Bank of Pakistan
Real Effective Exchange Rate	REER	Real Effective Exchange rate Nominal exchange rate[$*(CPI_{USA}/CPI_{PAK})$]	International financial statistics(IFS)
Nominal effective exchange rate	NEER	Nominal effective Exchange Rate weighted average pak rupee with multiple other countries	International financial statistics (IFS)
Wage rate	W	Nominal Wage rate index	Bhatti (2017)
Share Prices	SP	Stock price index	Karachi Stock Exchange
Oil prices	OP	World crude oil price index	EIA
Price level	CPI	Consumer price index	International financial statistics (IFS)

Data is collected monthly from 2001M1 TO 2017M11
Except for tax rate all variables are in log form. The log is taken to remove the problem of heteroscedasticity and make an interpretation in percentage term.

The movement in exchange rate is going to affect the cashflows of firms as we know that stock prices are the present value of expected cashflows, the movement in exchange rate affects stock prices. The argument of this study is that it is not necessary for the stock price of each and every firm be affected by the exchange rate in the same way. It

is quite possible for one firm in one industry to have its revenue being exposed to the changes in exchange rate and for the other firm in other industry to have its costs being exposed to changes in exchange rate resulting in different impact of exchange rate. Furthermore, our motivation for this study is to analyze the non-linearity in the effect of exchange rate rendering an analysis at the firm level being cumbersome. In order to address this vexatious exercise, we resort to constructing sectoral index.

For construction of sectoral index, we have selected three sectors which represent a major share in the total market capitalization of stock exchange, have either revenue or costs being influenced greatly due to changes in exchange rate along with being relevant to foreign direct investment and CPEC. We have not included the financial sector although it represents a share of around 20% in the total market capitalization of stock exchange because it is not relevant to discussions involving foreign direct investment and CPEC. Furthermore, the capital structure and the working of financial sector has a huge difference compared to the three sectors selected in this study.[1] Similarly, Tobacco sector represents a major share in total market capitalization but has not been included in our study because of not being relevant to discussion of foreign direct investment and CPEC.

Cotton and cotton manufacture (a part of textile sector) has more than 50% share in total exports of Pakistan. Major reason is attributed to the award of GSP plus status and this has increased the exports in this sector.[2] Even though the textile sector suffered due to chronic energy crisis still it enjoys the highest share in total exports of Pakistan.

Net Foreign Direct Investment in the energy sector (which includes power along with oil and gas exploration) stood at $953 Million. This represents 39.52% of the total net

[1] A Decomposition Analysis of Capital Structure: Evidence from Pakistan's Manufacturing Sector (Lahore Journal of Economics page 9)
[2] Pakistan Economic Survey 2016-17

foreign direct investment in Financial Year 2017.[3] As China Pakistan Economic Corridor (CPEC) includes projects related to the energy sector in the early harvest 2015-2019 category, this has also played a role in such a huge figure for net foreign direct investment.[4]Although the share of energy sector has decreased from over 50% in the Financial Year 2015, still the dollar amount has increased substantially. It is evident from the fact that many firms in the power generation and distribution sector have been newly listed within the timespan of last 8 to 10 years.

The cement sector which happens to be a major sector representing almost 4% of the total market capitalization of Pakistan Stock Exchange is important because most of the short-term projects up to 2022 included in CPEC relate to roads and Gawadar Development etc.[5] Similarly Housing sector is on the rise as well. Currently Pakistan is facing twin deficits along with a huge burden of debt. The reason for huge burden of debt is being attributed to the import of machinery etc. in order to increase the capacity of industries like cement to meet the increased demand being created due to CPEC projects.

So in the light of above discussion these three sectors are very crucial for discussion on nonlinear impact of exchange rate on stock returns.For selection of firms within the sector we have followed following criteria:

1) The firm has to be listed for a continuous period of study and its share price data has to be available.
2) We have obtained the number of shares data from the various issues of "Analysis of Financial Statements", published by State Bank of Pakistan. So, if

[3] State Bank of Pakistan Annual Report 2016-17 (State of the Economy)
[4] CPEC and Pakistani Economy: An Appraisal
[5] ibid

a firm is not included in those publications then such a firm has been dropped from analysis.

3) If a firm is thinly traded where there are a number of days when turnover is zero, such firms have also been dropped from the analysis.
4) We begin with a total of x firms and after dropping the y firms we are left with z firms.

3.8 Construction of Index

The sectoral level index is constructed to check its asymmetric response towards exchange rate. Three sectors i-e textile, cement, and energy are considered based on their respective share in KSE 100 index. For the construction of index, this study uses the definition of the price that it is a present value of expected future cash flow because price reflects the overall information that would be required for construction of an index. From textile sector, 152 firms are considered out of which 106 firms are selected from energy sector 16 firms out of 35 and 13 firms out of 21 are taking from cement sector. The selection procedure of the firm is based on the availability of data, from the period of 2001 to 2017. Data for share prices have been taken from the Karachi Stock Exchange website for all companies however the data of number of shares are extracted from the Balance Sheet Analysis published by State Bank of Pakistan. Since for index, study required the number of shares for all companies, therefore, to compute number of shares it assumes the par value for each company is to be RS 10 as a benchmark and by dividing the value of share capital with par value, it gets the number of shares for each company. Hence, by multiplying the value of the number of shares with their share prices for each company, the study gets the market value for each company and by adding market value for all company, it extract the market capitalization and by using this market capitalization the value of index is calculated for each particular sector by

taking a base of 1000. One issue related to this index is that we have to revise the index by computing the new devisor whenever we observed the changes in a number of share or company.

Let suppose:

P = Share price

X = Book Value of Share Capital

For number of share par value of each firm is RS 10

λ = par value

$\frac{X}{\lambda}$ = Number of shares

Let X_{it} denote the share capital for i^{th} company in period t

The number of shares for i^{th} company in period t is attained by dividing $\delta_{it} = \frac{X_{it}}{\lambda}$ (1)

Market capitalization for i^{th} firm is constructed as

$$MC = \sum P_{it} * \delta_{it} \quad (2)$$

Where i ranges from 1 to n.

Base period index is given by:

$$Index_{t_0} = \frac{\sum P_{it_0} * \delta_{it_0}}{\sum P_{it_0} * \delta_{it_0}} X\ 1000 \quad (3)$$

Where i ranges from 1 to n and $t_0$represents the base period.

Change in index value is captured by:

$$Index_t = \frac{\sum P_{it} * \delta_{it_0}}{\sum P_{it_0} * \delta_{it_0}} X\ 1000 \quad (4)$$

Where i ranges from 1 to n and t ranges from 1 to T with t_0 representing the base period. Equation (4) is used for calculating index value as long as there is no change in number of shares. Change in number of shares need adjustment, to remove the impact of change in number of shares on index value and necessitates the calculation of new devisor. This necessity is faced because we are using market capitalization weighted index and such an index depends on market price of share along with number of shares. The sole reason of constructing index is to capture the change in prices, so if index value is affected by change in number of shares then we need to remove this impact and calculate the new divisor which will replace the divisor being used in equation (4). Suppose we have three time-periods $t-1, t, t+1$ with $t+1$ representing the period when number of shares for some companies changes necessitating calculation of new divisor.

$$new\ devisor_{t+1} = \left(\frac{\sum P_{it} * \delta_{it+1}}{\frac{\sum P_{it} * \delta_{it_0}}{\sum P_{it_0} * \delta_{it_0}} X\ 1000} \right) * 1000 \qquad (5)$$

Where denominator represents the index value for time period t from equation (4) and numerator represents the market capitalization with changed number of shares but previous period prices. The idea is to have the market capitalization in numerator which would have been in the time period t if the number of shares of time period $t+1$ had prevailed in time period t.

Now the index value for time period $t+1$ is given by

$$Index_{t+1} = \frac{\sum P_{it+1} * \delta_{it+1}}{new\ devisor_{t+1}} X\ 1000 \qquad (6)$$

Now for $Index_{t+2}$, $Index_{t+3}$ etc., the $new\ devisor_{t+1}$ and δ_{it+1} will remain the same but P_{it+1} will change corresponding to the subscript of $Index$, for example P_{it+2} will be used for $Index_{t+2}$. This process will continue until the change in number of shares. Every time there is a change in number of shares this whole exercise will be repeated.

CHAPTER IV

RESULTS AND DISCUSSION

4.1 Introduction

The chapter discusses the results of linear and nonlinear ARDL co-integration approach to empirically evaluate the symmetric and asymmetric effects of exchange rate on output, stock prices, and stock prices for three sectors i.e. textile, cement, and energy. Section 4.2 reports the results of ADF and Phillip Perron test for stationarity while section 4.3 discusses the effects of exchange rate on output. Section 4.4 reports results for effect of exchange rate on stock prices and section 4.5 explains the effects of exchange rate on stock prices at sectoral level.

4.2 Unit Root Tests

Stationarity of time series is tested using Dickey & Fuller test but when autocorrelation is suspected then Augmented Dickey and Fuller test will be used. However, Phillip Perron test is used to fix the problem of autocorrelation but not by increasing the lags of dependent variable The requirement of ARDL and NARDL is I(0) or I(1) or the combination of both. However, if there is a variable at a 2^{nd} order then Engle granger and JJ techniques are appropriate.

Table 4.1 Unit Root Test ADF

Variables	At level				At first Difference				Conclusion
	t_{cal}	t_{tab}	Drift	Trend	t_{cal}	t_{tab}	Drift	Trend	
Y_t	-2.33	-2.88	Yes	No	-4.80	-1.94	No	No	1(1)
Oil_t	-1.87	-2.88	Yes	No	-10.83	-1.95	No	No	1(1)
$Tbill$	-0.62	-1.94	No	No	-17.48	-1.95	No	No	1(1)
Tax	-3.57	-3.43	Yes	Yes	___	___	___	___	1(0)
$Wage$	-1.85	-1.95	Yes	Yes	-4.33	-2.94	Yes	Yes	1(1)
$REER$	-1.98	-3.44	Yes	Yes	-12.78	-1.95	No	No	1(1)
CPI	-2.48	-3.53	Yes	Yes	-13.01	-194	No	No	1(1)
$M2$	-2.89	-2.88	Yes	No	-3.74	-3.43	Yes	Yes	1(1)
$NEER$	-2.69	-3.43	Yes	Yes	-14.69	-1.95	No	No	1(1)
SP	-1.61	-3.42	Yes	Yes	-13.27	-1.95	No	No	1(1)
$Textile$	-2.49	-3.43	Yes	Yes	-13.33	-1.95	No	No	1(1)
$Energy$	-1.43	-2.86	Yes	No	-14.14	-1.94	No	No	1(1)
$Cement$	-1.31	-2.81	Yes	No	-12.68	-1.95	No	No	1(1)

Table 4.2 Unit Root Test PP

Variables	At level				At first Difference				Conclusion
	t_{cal}	t_{tab}	Drift	Trend	t_{cal}	t_{tab}	Drift	Trend	
Y_t	-1.66	-2.88	Yes	No	-18.2	-1.95	No	No	1(1)
Oil_t	-1.90	-2.88	Yes	No	-10.81	-1.95	No	No	1(1)
$Tbill$	-0.75	-1.94	No	No	-17.11	-1.95	No	No	1(1)
Tax	-3.52	-3.47	Yes	Yes	___	___	___	___	1(0)
$Wage$	-1.83	-1.95	Yes	Yes	-4.56	-2.94	Yes	Yes	1(1)
$REER$	-1.43	-3.45	Yes	Yes	-12.75	-1.95	No	No	1(1)
CPI	-2.59	-3.43	Yes	Yes	-13.43	-1.95	No	No	1(1)
$M2$	-1.92	-3.43	Yes	Yes	-15.40	-1.95	No	No	1(1)
$NEER$	-2.73	-3.43	Yes	Yes	-14.69	-1.94	No	No	1(1)
SP	-1.67	-3.45	Yes	Yes	-13.30	-1.95	No	No	1(1)
$Textile$	-1.94	-3.43	Yes	Yes	-13.44	-1.95	No	No	1(1)
$Energy$	-1.32	-2.81	Yes	No	-14.19	-1.95	No	No	1(1)
$Cement$	-1.40	-2.86	Yes	No	-12.66	-1.95	No	No	1(1)

Results for both the unit root tests are provided in Table 4.1 & 4.2 Both the ADF and PP are applied to check whether the variables have a unit root or not. The decision rule is when the critical value is greater than calculated value, null hypothesis is rejected which here means that series is non-stationary. The results show all the variables are

stationary at the 1st difference except for tax rate which is stationary at level. Hence, the requirement of stationarity is in favor of ARDL and NARDL for this study.

Table 4. 3: Effect of Exchange Rate on Output

Estimates of linear model

Panel A: Short run			**ARDL Order (5,5,4,1,5,0)**				
Variables	**Lags**						
	0	**1**	**2**	**3**	**4**	**5**	**6**
ΔlnY		0.18^{**}	0.12^{*}	0.26^{***}	-0.12^{*}	-0.15^{**}	
		(2.35)	(1.75)	(3.76)	(-1.77)	(-2.15)	
$\Delta lnSRi$	-0.00	0.01	-0.00	0.02^{**}	-0.01^{*}	0.01^{**}	
	(-0.80)	(1.51)	(-0.66)	(2.75)	(-1.69)	(2.05)	
ΔlnT	0.06^{***}	0.17^{***}	0.21^{***}	0.15^{***}	0.11^{***}		
	(3.25)	(5.56)	(6.24)	(5.14)	(5.39)		
$\Delta lnOil$	-0.03	-0.10^{*}					
	(-0.71)	(-1.99)					
ΔlnW	1.05	2.08	-4.76^{**}	4.24^{**}	-3.12	3.11^{*}	
	(0.64)	(1.09)	(-2.45)	(2.20)	(-1.60)	(1.94)	
$\Delta lnREX$	-0.68^{*}						
	(-1.87)						

Panel B: Long run

lnSRi	***lnT***	***lnOil***	***lnW***	***lnREX***	***Constant***
0.01^{***}	-0.31^{***}	-0.03	0.92^{***}	-0.08	0.84
(-2.96)	(-3.13)	(-0.61)	(4.38)	(-0.18)	(0.69)

Panel C: Diagnostics

F bound test	ECM_{t-1}	*LM auto*	ARCH LM	*RESET*	$\overline{R}^2$	$CS(CS)^2$	ARCH LM
3.87	0.34^{***}	0.37		0.21	0.43	S	0.29
	(-5.31)						

Estimates of Non-Linear Model

Panel A: Short run			**ARDL Order(6,6,6,0,6,4,6)**				
Variables	**Lags**						
	0	**1**	**2**	**3**	**4**	**5**	**6**
ΔlnY		0.20^{***}	0.28^{***}	0.31^{***}			-0.20^{***}
		(3.10)	(4.34)	(4.74)			(-3.46)
$\Delta lnSRi$			0.01^{**}	0.02^{***}		0.01^{**}	0.01^{**}
			(2.23)	(3.73)		(2.59)	(2.28)
ΔlnT					-0.04^{**}	-0.09^{***}	-0.06^{***}
					(-2.39)	(-4.62)	(-3.29)
$\Delta lnOil$	-0.13^{**}						
	(-2.47)						
ΔlnW					-2.07^{***}		1.85^{*}
					(-3.24)		(1.91)
ΔPOS	-1.15^{**}				-1.09*		
	(-2.06)				(-1.93)		
ΔNEG							
					1.37^{*}		1.25^{*}
					(1.92)		(1.74)

Panel: B long run

lnSRi	***lnT***	***lnOil***	***lnW***	***POS***	***NEG***	***Constant***
-0.01^{***}	0.01	0.03^{**}	0.35^{***}	-0.06	0.16	-0.05
(-5.59)	(0.50)	(2.40)	(4.03)	(-0.46)	(1.03)	(-1.15)

Panel C: Diagnostic

F bound	ECM_{t-1}	***LM***	**ARCH LM**	***RESET***	$\overline{R}^2$	$cs(cs)^2$	***Wald(SR)***	***Wald(LR)***
11.61	-0.04^{***}	0.10	0.61	2.1	0.40	S	2.06	3.94
	(-8.74)						$[0.000]^{***}$	$[0.04]^{*}$

Note: a. Numbers inside parentheses are absolute value of the t-ratios.
b. Numbers inside the brackets are the p-values. * indicates a significant Wald statistic.
c.*** indicate significance at 1%

Results for short run coefficients are reported in panel A where each coefficient has a significant value implying that these variables have a short run effect on output. Whereas exchange rate carries a significant negative coefficient showing that the real depreciation of currency is expansionary. To confirm that whether these short run effects last into long run as well. Panel B provides long run estimates where except for the coefficient of exchange rate and oil prices all variables take a significant coefficient indicating that these variables have long run impact on output. This long run relationship will hold only when the cointegration among the variables exist. Bound test approach is used to check co-integration among the variables. Results reveal that no co-integration exists among the variables. Another approach for checking co-integration is to look at the value of EC term. In this study results, it has a negative and significant coefficient indicating the co-integration among the variables and 34% of the adjustment is carried in one month.

On bottom of the table, results for nonlinear model are reported. In short run, each variable has a significant coefficient as compared to linear model which shows that appreciation is expansionary. Whereas, the outcome of non -linear model indicates that in short run output responds to depreciation positively and appreciation negatively. Appreciation and depreciation have a different lag structures supporting the assumption of short run adjustment asymmetry in model. In long run both appreciation and depreciation take insignificant coefficients indicating that the real depreciation is neutral. However, wage rate, oil prices and Treasury bill rate carry a significant coefficient, implying that higher interest rate has an expansionary effect on output. Increase in taxes has crowded out some other factors of the aggregate demand. Improved wages encourage the people to spend more causing rise in the aggregate demand more than the decline in aggregate supply because of higher cost of production. The effect of oil prices is not according to the expectations of the model as it has a positive coefficient suggesting that increase in oil prices will not hurt the domestic production in economy. Panel C deals with the diagnostic tests for the non-linear model.

Here bound test supports the evidence of co-integration among the variables however, other diagnostic tests are also insignificant implying model has no any problem.

Table 4. 4: Effect of Exchange Rate on Stock Prices

Estimates of linear model							
Panel A: Short run ARDL Order (1,3,0,0,0)							
Variables	**Lags**						
	0	1	2	3	4	5	6
$\Delta lnSP_t$		0.08 (1.15)					
$\Delta lnEX_t$	-0.05 (-0.54)	0.22^{***} (4.73)	-0.50^{***} (8.68)	0.24^{***} (3.89)			
$\Delta lnIPI_t$	0.02 (0.65)						
$\Delta lnCPI_t$	-0.06 (-1.24)						
ΔlnM_t	0.18^{***} (3.01)						
Panel B: Long Run							
LnEX	***LnIPI***	***LnCPI***	***LnMt***	***Constant***			
1.20^{***} (3.47)	0.28 (0.65)	-0.70 (-1.35)	2.14^{***} (4.67)	-12.74^{***} (-5.58)			
Panel C: Diagnostics							
F bound test	ECM_{t-1}	***LM auto***	**ARCH LM**	***RESET***	$\overline{R}^2$	$CS(CS)^2$	
3.47	-0.08^{***} (-4.38)	1.6	0.67	1.14	0.08	S	
Estimates of Non-Linear model							
Panel A: Short Run ARDL Order (3,6,6,5,2)							
Variables	**Lags**						
	0	1	2	3	4	5	6
$\Delta lnSP_t$				-0.12 (-0.91)			
ΔPOS_t			-0.24^{**} (-2.11)	0.18^{*} (1.63)	-0.17 (-1.54)	-0.26^{***} (-2.33)	0.26^{**} (2.28)
ΔNEG_t	2.46^{***} (4.44)		-0.27^{*} (-1.78)		0.98^{*} (1.81)	1.62^{***} (2.90)	-2.11^{**} (-2.44)
$\Delta lnIPI_t$	0.08 (1.23)	0.06 (0.89)				0.11^{*} (1.67)	
$\Delta lnCPI_t$							
ΔlnM_t	-0.57^{*} (-1.93)		-0.60^{**} (- 2.12)				
Panel B: Long Run							
POS	***NEG***	***LnIPI***	***LnCPI***	***LnMt***	***Constant***		
-6.69 (-1.60)	2.52 (1.01)	-0.07 (-0.13)	-0.15^{**} (-2.70)	0.31^{**} (2.24)	-0.94 (-1.22)		
Panel C: Diagnostics							
F bound test	ECM_{t-1}	***LM auto***	**ARCH LM**	***RESET***	$\overline{R}^2$	$CS(CS)^2$	
4.35	-0.12^{***} (-3.70)	7.14	0.34	5.21	0.28	S(S)	
Wald SR asymmetry		***Wald LR (Asymmetry)***					
15.32 [0.000]***		0.20 [0.65]					

Note: a. Numbers inside parentheses are absolute value of the t-ratios.
b. Numbers inside the brackets are the p-values. * indicates a significant Wald statistic.
c.*** indicate significance at 1%

Short run coefficient estimates are reported in panel A using 10% level of significance. It's clear that only changes in money supply and exchange rate have short run impacts on stock prices. However, in long run both money supply and exchange rate have a significant effect on stock prices. For the validation of these long run effects, co-integration must be set up. For this calculated value of the F test is 3.47 which is less than the upper bound critical value of 3.52, indicating no cointegration. However, the alternative test for co-integration, EC term, supports the evidence of cointegration. Coefficient size implies 8% speed of adjustment in one month.

Results for non-linear model are reported in section 2 of table 4.3. Results show that both appreciation and depreciation have significant coefficients with different lag structures implying the evidence of short run adjustment asymmetry in model. However, in long run coefficient of CPI is significant having negative sign indicating inflation has a negative impact on stock prices. It seems that both pos and neg carry the insignificant coefficients. Again, for long run relationship to be valid, co-integration must be checked. In results, the calculated value of F test is 4.35 which is greater than the upper bound critical value of 3.79 at 5% level of significance supporting the evidence of cointegration. Moreover, the value of EC term is negative and significant implying the 12% speed of adjustment in one month. For further justification of asymmetry, Wald test clearly indicates that asymmetric effects are present in short only.

4.5 Sectoral Results

Since stock price index suffers from the problem of aggregation bias which may not reveal how each sector is affected by the exchange rate shifting, therefore, index has been constructed for different sectors including textile, cement and energy and is estimated by disaggregating the data for Pakistan.

Table 4. 5: Effect of Exchange Rate on Stock Prices of Textile Sector

Estimates of linear model

Panel A: Short run **ARDL (2,0,1,0,2)**

Variables	**Lags**						
	0	**1**	**2**	**3**	**4**	**5**	**6**
$\Delta lnSP_t$		0.09	-0.09				
		(1.40)	(-1.38)				
$\Delta lnEX_t$	-0.04						
	(-0.35)						
$\Delta lnIPI_t$	-0.04	0.25^{***}					
	(-0.70)	(3.56)					
$\Delta lnCPI_t$	-0.09						
	(-0.43)						
$\Delta lnM2_t$	0.07	0.32	-0.74^{***}				
	(0.29)	(1.17)	(-2.78)				

Panel B: Long run

$LnEX$	$LnIPI$	$LnCPI$	$LnM2$	$Constant$
0.10	-3.21^{*}	-1.76	3.15^{*}	2.29
(0.13)	(-1.87)	(-0.99)	(1.67)	(0.48)

Panel C: Diagnostics

F	ECM_{t-1}	$LM\ auto$	ARCH LM	$RESET$	$\overline{R}^2$	$CS(CS)^2$
2.44	-0.04^{***}	3.7	0.61	5.14	0.32	S
	(-3.87)					

Estimates of Non-Linear model

Panel A: Short Run **ARDL Order (4,6,6,6,3,6)**

Variables	**Lags**						
	0	**1**	**2**	**3**	**4**	**5**	**6**
$\Delta lnSP_t$		0.10	-0.16^{***}	-0.07	-0.12^{*}		
		(1.46)	(-2.26)	(-1.07)	(-1.72)		
ΔPOS_t		-0.07		0.14	-0.08		0.11
		(-0.58)		(1.16)	(-0.71)		(0.92)
ΔNEG_t			-0.95	-0.87			1.16^{*}
			(-1.59)	(-1.43)			(1.93)
$\Delta lnIPI_t$	0.28^{***}	0.40^{***}	0.14	0.23^{**}	0.14^{*}	0.15^{*}	0.12
	(2.87)	(4.05)	(1.52)	(2.53)	(1.67)	(1.76)	(1.46)
$\Delta lnCPI_t$		0.45^{*}		0.29			
		(1.93)		(1.21)			
$\Delta lnM2_t$		-0.44	-0.48	0.47		0.35	1.29^{**}
		(-0.91)	(-1.17)	(1.27)		(0.98)	(2.54)

Panel B: Long Run

POS	NEG	$LnIPI$	$LnCPI$	$LnM2$	$Constant$
-0.11	1.87	-0.36^{***}	-0.19^{**}	0.39^{***}	-0.36
(-0.14)	(0.87)	(-3.51)	(-2.67)	(2.86)	(-0.66)

Panel C: Diagnostics

F	ECM_{t-1}	LM	ARCH LM	$RESET$	$\overline{R}^2$	$CS(CS)^2$
3.82	-0.02^{***}	5.2	0.45	9.11	0.19	S(S)
	(-6.16)					

$WALD\ TEST\ (SR)$	$WALD\ TEST\ (LR)$
2.21	0.72
$[0.04]^{*}$	[0.39]

Note: a. Numbers inside parentheses are absolute value of the t-ratios.
b. Numbers inside the brackets are the p-values. * indicates a significant Wald statistic.
c.*** indicate significance at 1% * indicate significance at 10%

Table 4. 6: Effect of exchange rate on stock prices of cement sector

Estimates of linear model (CEMENT SECTOR)							
Panel A: Short run ARDL Order (2,4,2,0,0)							
Variables	**Lags**						
	0	**1**	**2**	**3**	**4**	**5**	**6**
$\Delta lnSP_t$		0.09	0.17^{**}				
		(1.37)	(2.49)				
$\Delta lnEX_t$	2.25^{***}	-0.27	-1.67^{**}	0.7	1.80^{***}		
	(3.79)	(-0.43)	(-2.61)	(1.22)	(3.10)		
$\Delta lnIPI_t$	0.20^{**}	0.20^{**}	-0.13				
	(2.00)	(2.05)	(-1.41)				
$\Delta lnCPI_t$	-0.02						
	(-0.07)						
$\Delta lnM2_t$	0.12						
	(0.31)						

Panel: B Long Run				
LnEX	***LnIPI***	***LnCPI***	***LnM2***	***Constant***
3.03	-0.42	-2.64	4.40^{*}	-29.35
(1.48)	(-0.21)	(-1.18)	(1.79)	(-1.71)

Panel C: Diagnostics						
F	$\boldsymbol{ECM_{t-1}}$	***LM***	**ARCH LM**	***RESET***	$\overline{R}^2$	$\boldsymbol{CS(CS)^2}$
2.15	-0.04^{***} (-2.85)	7.76	0.34	2.82	0.41	S

Estimates of Non-Linear model							
Panel A: Short Run ARDL Order (5,6,5,6,4)							
Variables	**Lags**						
	0	**1**	**2**	**3**	**4**	**5**	**6**
$\Delta lnSP_t$		0.16^{**}		-0.12^{**}			
		(2.48)		(-2.08)		0.12^{**}	
						(2.00)	
ΔPOS_t			-0.40^{**}	0.34^{**}			1.02^{***}
			(-2.73)	(2.34)			(6.90)
ΔNEG_t						1.40^{*}	
	2.66^{***}					(1.92)	
	(3.73)						
$\Delta lnIPI_t$							
$\Delta lnCPI_t$							-1.04^{***}
							(-3.87)
$\Delta lnM2_t$				1.36^{***}	1.68^{***}		
				(3.52)	(4.02)		

Panel B: Long Run					
POS	***NEG***	***LnIPI***	***LnCPI***	***LnM2***	***Constant***
-6.69^{*}	2.52	0.01	-0.00	0.08	-0.51
(-1.72)	(0.19)	(0.18)	(-0.07)	(0.60)	(-0.59)

Panel C: Diagnostics						
F	$\boldsymbol{ECM_{t-1}}$	***LM***	**ARCH LM**	***RESET***	$\overline{R}^2$	$\boldsymbol{CS(CS)^2}$
1.09	-0.05^{***}	5.8	0.51	3.21	0.38	S(S)
	(-5.11)					

$\boldsymbol{WALD\ TEST\ (SR)}$	$\boldsymbol{WALD\ TEST\ (LR)}$
15.32	0.63
$[0.000]^{***}$	[0.42]

Note: a. Numbers inside parentheses are absolute value of the t-ratios.
b. Numbers inside the brackets are the p-values. * indicates a significant Wald statistic
c.*** indicate significance at 1%

Table 4.7: Effect of exchange rate on stock prices of energy sector

Estimates of linear model (ENERGY SECTOR)

Panel A: Short run ARDL Order (3,1,0,0)

Variables	Lags						
	0	**1**	**2**	**3**	**4**	**5**	**6**
$\Delta lnSP_t$							
$\Delta lnEX_t$	-0.06	-0.05	-0.22^{**}	0.30^{**}			
	(-0.61)	(-0.52)	(-2.03)	(2.76)			
$\Delta lnIPI_t$	-0.03	0.15^{**}					
	(-0.61)	(2.53)					
$\Delta lnCPI_t$	0.04						
	(0.22)						
$\Delta lnM2_t$	-0.05						
	(-0.02)						

Panel B: Long run

LnEX	***LnIPI***	***LnCPI***	***LnM2***	***Constant***
0.16^{***}	-0.42	-0.68	1.30^{**}	-4.42^{*}
(3.16)	(-0.76)	(-1.09)	(2.16)	(-1.89)

Panel C: Diagnostics

F	ECM_{t-1}	***LM***	**ARCH LM**	***RESET***	$\overline{R}^2$	$CS(CS)^2$
2.70	-0.09^{***} (-4.42)	3.1	0.31	2.8	0.38	S

Estimates of Non-Linear model

Panel A:Short Run ARDL Order (6,6,6,4)

Variables	Lags						
	0	**1**	**2**	**3**	**4**	**5**	**6**
$\Delta lnSP_t$				-0.20^{***}			0.12^{*}
				(-3.01)			(1.68)
ΔPOS_t			(-0.23)	0.26^{**}	-0.26^{**}	-0.38^{***}	0.45^{***}
			(-0.32)	(2.56)	(-2.62)	(-3.75)	(4.11)
ΔNEG_t	1.13^{**}				1.58^{***}	1.10^{**}	-0.97^{*}
	(2.31)				(3.26)	(2.16)	(-1.90)
$\Delta lnIPI_t$							
$\Delta lnCPI_t$							
$\Delta lnM2_t$					0.50^{*}		
					(1.97)		

Panel B: Long Run

POS	***NEG***	***LnIPI***	***LnCPI***	***LnM2***	***Constant***
-0.57	0.18	0.03	-0.03	0.02	0.42
(-1.24)	(0.15)	(0.76)	(-0.69)	(0.28)	(0.93)

Panel C: Diagnostics

F	ECM_{t-1}	***LM***	**ARCH LM**	***RESET***	$\overline{R}^2$	$CS(CS)^2$
2.00	-0.13^{***} (-6.46)	6.8	0.72	4.3	0.34	S

WALD TEST (SR)	***WALD TEST (LR)***
9.36[0.000]***	0.07[0.78]

Note: a. Numbers inside parentheses are absolute value of the t-ratios.
b. Numbers inside the brackets are the p-values. * indicates a significant Wald statistic
c.*** indicate significance at 1%

Panel A of table 4.4 to 4.6 reports the short run effects. Money supply has a significantly negative coefficient for textile sector which means positive effect of increase in money supply leading to increase in investment level is being offset by the negative effect of increase in money supply leading to increase in inflation. CPI has found no effect in short run for all three sectors. Furthermore, IPI has a significant positive coefficient for two out of three sectors while, exchange rate affects the stock price in two sectors.

Panel B indicates that IPI has a negative and significant coefficient for textile sector. Money supply has a significant positive coefficient for all three sectors. Whereas, exchange rate affects stock prices only in energy sector, which supports the existing literature that stock prices and exchange rate have a very little or no effect in long run. Long run relationship is valid only when the co-integration among the variables is established. The calculated value of F test for all three sectors is below the value of upper bound critical value of 4.01 suggesting no cointegration. The alternative test for cointegration suggests that EC term carry a significant and negative coefficient for all three sectors. Under panel C, the LM statistic is insignificant RESET test and ARCH LM test is also insignificant in all models it can be inferred from the above tables that the all the models are stable.

The results of the non -linear models for sectoral analysis depict the reverse picture as compared to the aggregate stock price model here textile sector has a significant coefficient for currency depreciation with positive sign showing that textile sector has a gain in case of currency depreciation. While other two sectors have a significant coefficient for both appreciation and depreciation reflecting the evidence of adjustment asymmetry in the models because they have a different sign and magnitude. Furthermore, short run and long run asymmetry is confirmed by the significant Wald test which shows the significant Wald test for short run only. However, one important

aspects of these models is that different sectors react macroeconomic variables differently. Other diagnostics shows that models are free from the problem of autocorrelation, heteroscedasticity and they are correctly specified and stable.

CHAPTER V

CONCLUSION AND POLICY IMPLICATION

The present study has investigated that whether the shifting in exchange rate have symmetric or asymmetric effects on output and stock prices for Pakistan and the dynamic relationship between output and macroeconomic variables as well as stock prices and macroeconomic variables, particularly focusing on the effects of exchange rate on output and stock prices.

As depreciation is said to be a contractionary if it increases the cost of foreign inputs which may lead to decrease in aggregate supply and output. However, this effect of decrease in output is more than the output offset by increase in aggregate demand. Meanwhile, if depreciation increases the net export component then depreciation is said to be expansionary. Export oriented countries will experience the expansionary depreciation while import oriented economies will experience the contractionary depreciation. Several studies conducted in this domain, but they all assume that exchange rate change a symmetric effect on output. Our findings of ARDL model supports the assumption of expansionary depreciation in short run while in long run we found exchange rate depreciation is neutral. Since we are interested in the asymmetric effects of exchange rate on output. Therefore, we have applied the nonlinear ARDL models and found the surprising results we found exchange rate depreciation is to be contractionary in short run. However, in long run we found exchange rate depreciation to be neutral. Whereas asymmetric effects of exchange rate are also found in both short run and long run by the significant value of Wald test.

As export-oriented firm will get the benefit from depreciation of domestic currency by increasing their exports whereas, import oriented firm will incur the loss from the

depreciation of domestic currency due to increase in cost of imported inputs. This will lead to decrease in their profitability hence stock prices will be decreased. Our findings for stock prices model show that the effect of exchange rate changes is asymmetric only in short run. Furthermore, previous studies considered data on composite (aggregate) stock price index to bring out the analysis and so they might suffer from the problem of aggregation bias so here we disaggregate the data for textile cement and energy sector to see whether they supports the previous arguments or not .We found that the effects of exchange rate are asymmetric only in short run and the sectoral model react the macroeconomic variables in different way than the main model.

It can be concluded that the exchange rate changes have asymmetric effects on domestic production and stock prices of Pakistan. These results also have policy implications. Based on sensitivity to either appreciation or depreciation of currency, the sectors can adopt policies to preserve or hedge from exchange rate fluctuation risk. Investors should also consider the asymmetric effect of exchange rate for specific sectors and form their expectations accordingly. Furthermore, there can be different policy implications for both the tradable and non-tradable sectors, as tradable sector is affected more by exchange rate changes than non-tradable sector. If a sector includes both the tradable and non-tradable components, then during exchange rate fluctuations, it is better for these sectors to switch investment plans from tradable to non-tradable product to safe guard or hedge from exchange rate risk. It will be a key factor for the policy analysts to make sure that whether the tradable sector is affected more by increase or decrease in exchange rate. Both the depreciation and appreciation of currency will carry out the different policy implications. Whenever, economy is jammed in a recessionary phase or economy is uncompetitive then the depreciation of domestic currency will provide him a benefit. During Boom, depreciation may result in inflation while during

recession, inflation is dubious to happen, however appreciation of currency can target import-oriented sector that will lead to decrease in cost of input prices resulting inflation will decline. Therefore, this study will help to capture both the form of asymmetries so that countries will choose different policies for different sectors.

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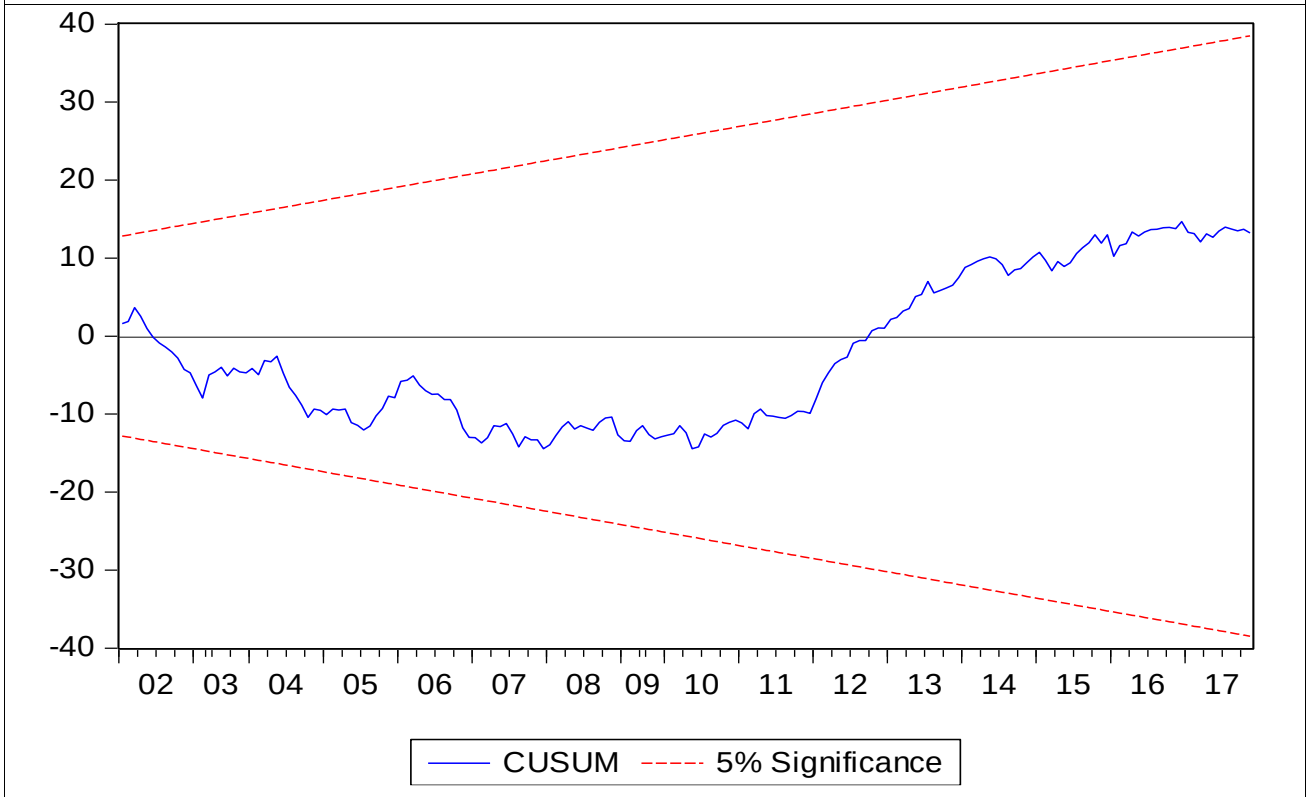
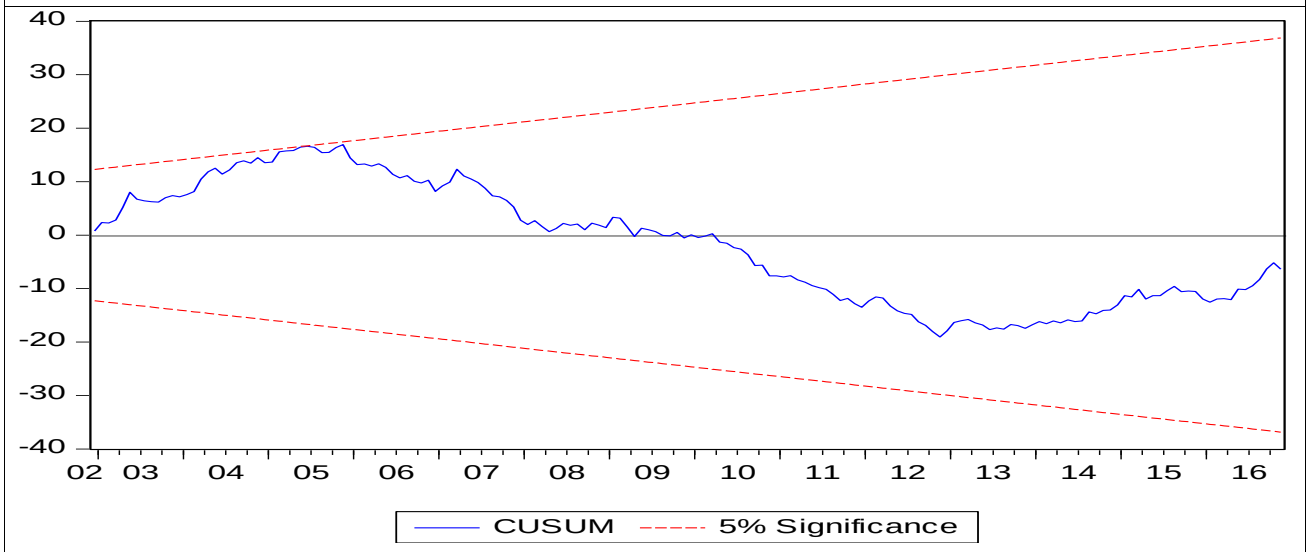
APPENDIX

Output and Exchange Rate

Q SUM OF LINEAR MODEL

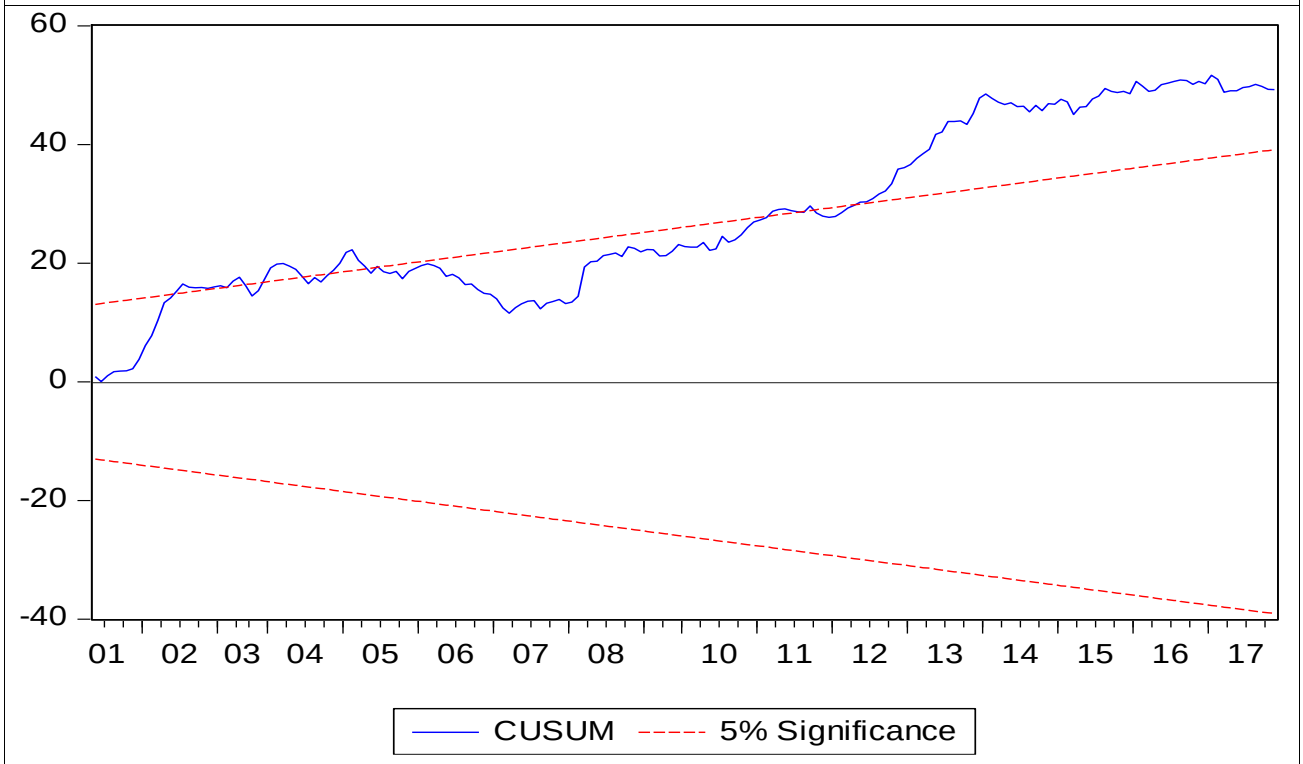


Q SUM OF NON-LINEAR MODEL

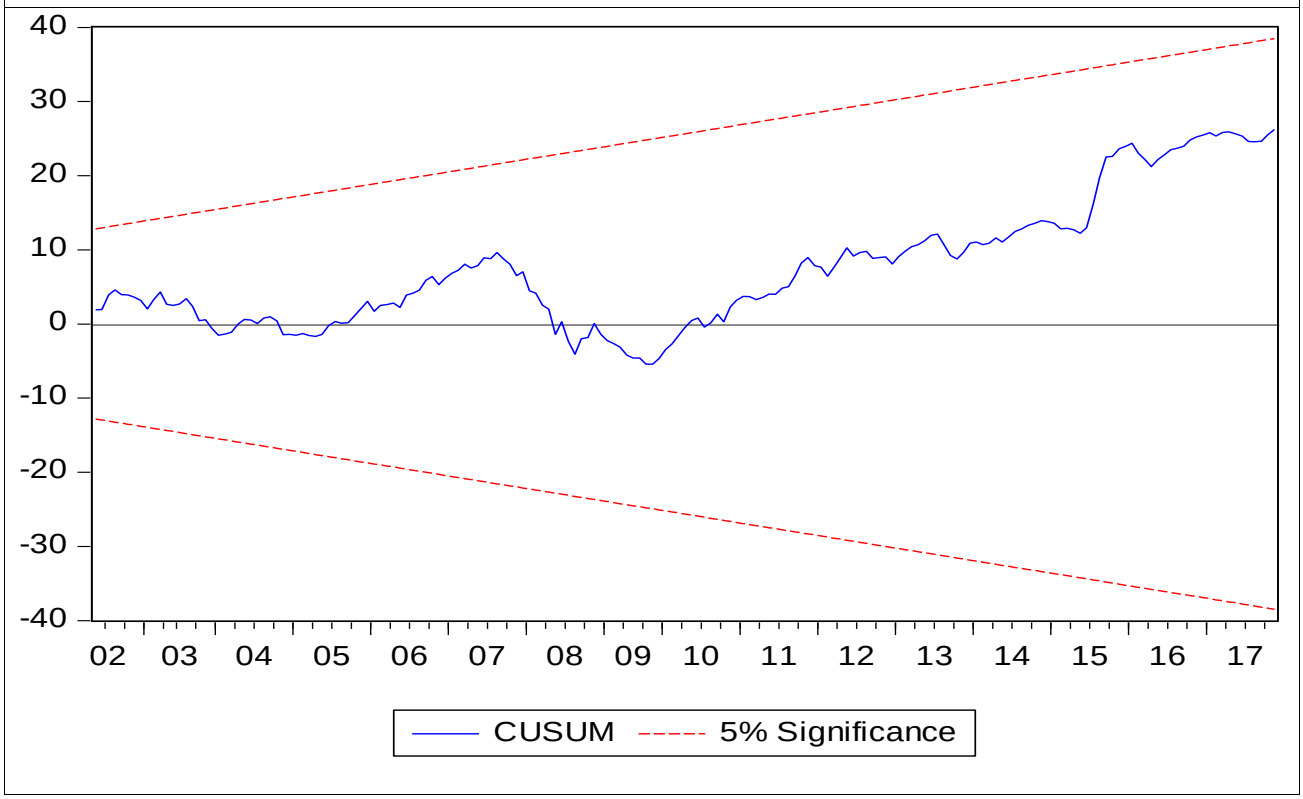


Stock prices and Exchange rate

Q SUM OF LINEAR MODEL

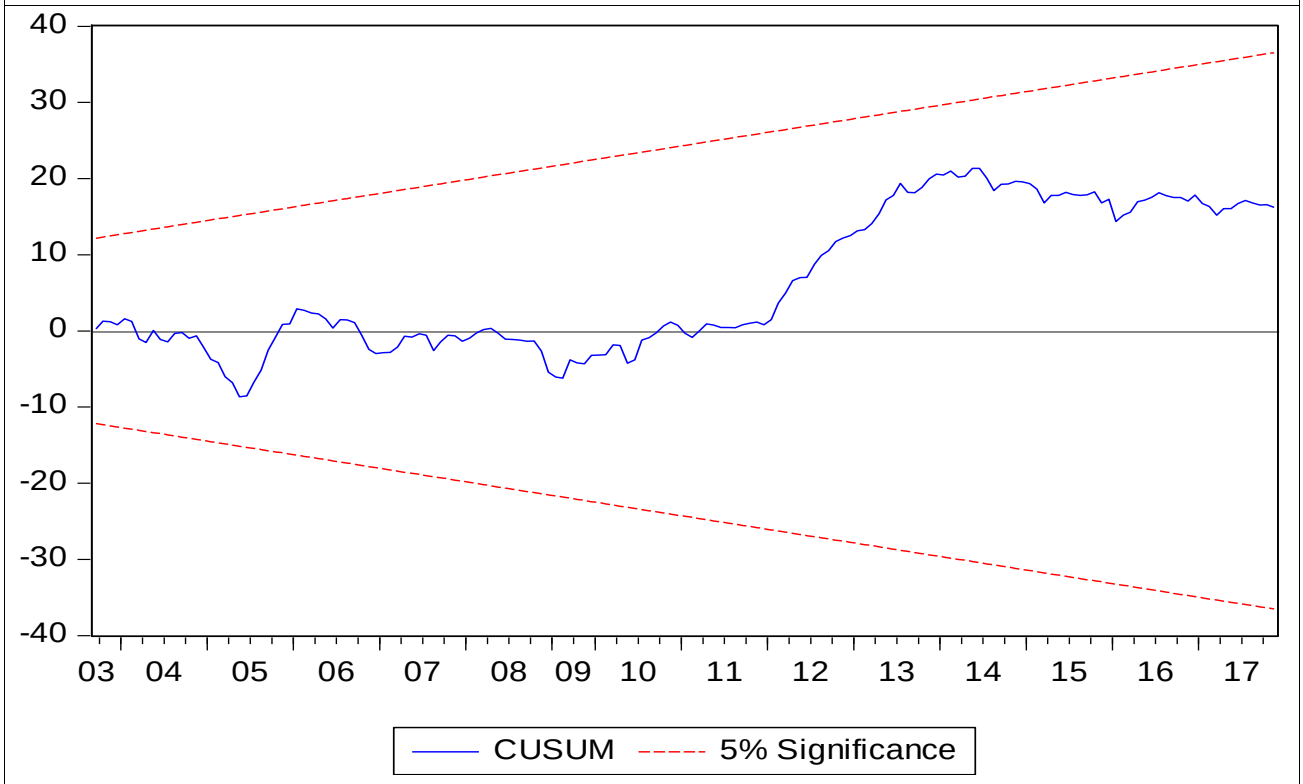


Q SUM OF NON LINEAR MODEL

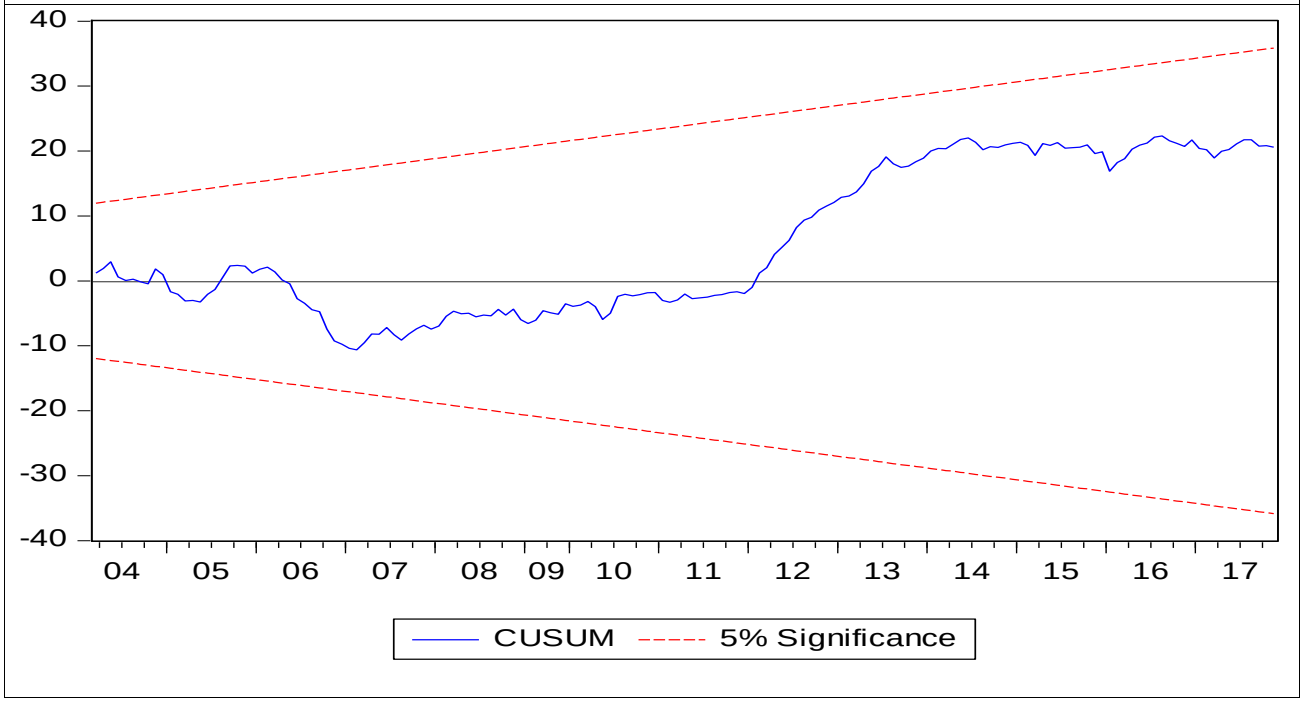


Cement and Exchange rate

Q SUM OF LINEAR MODEL

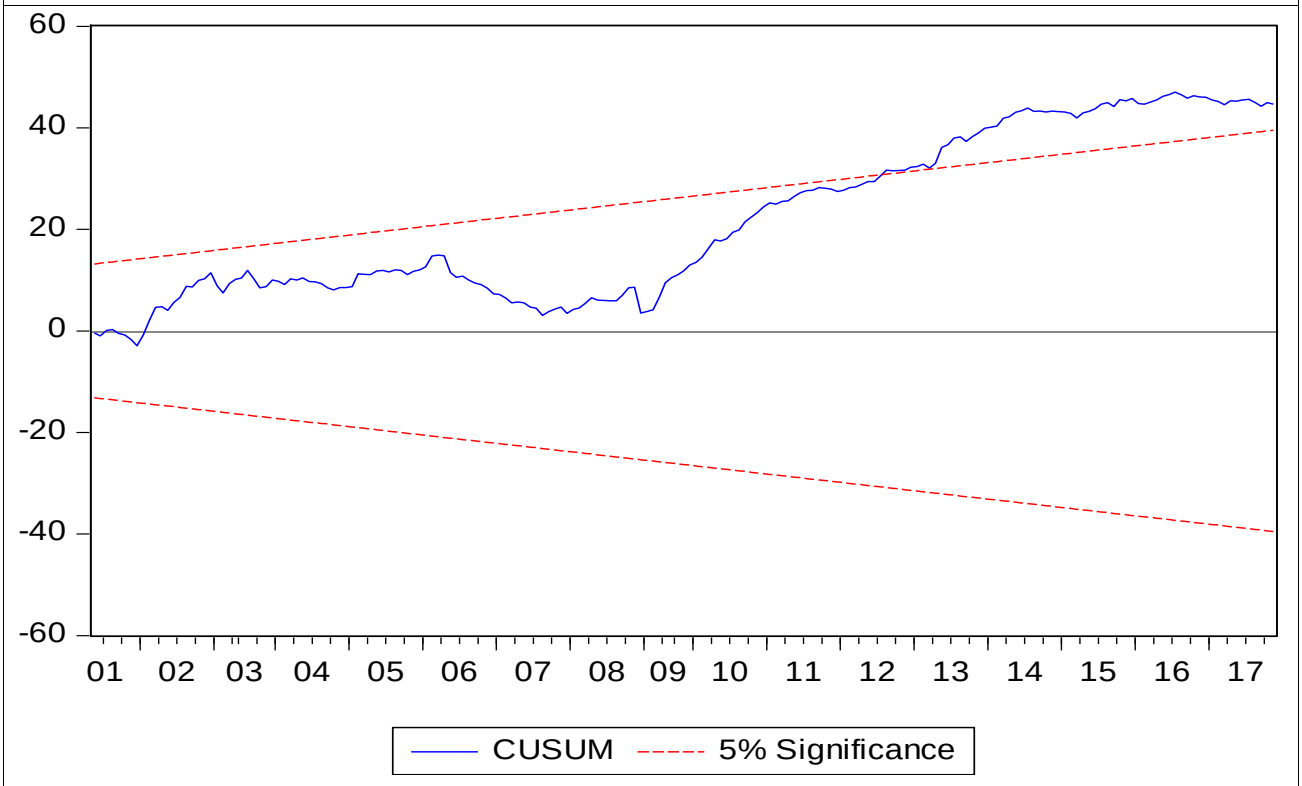


Q SUM OF NON LINEAR MODEL

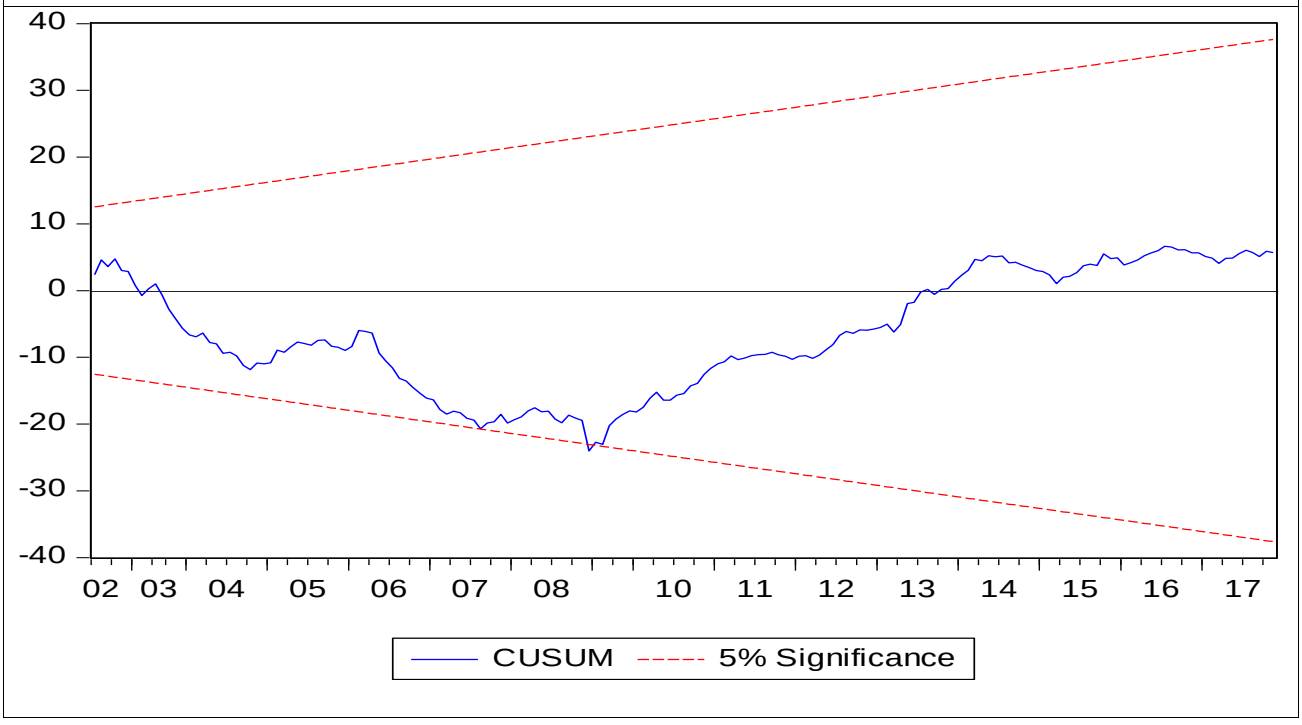


: Textile and Exchange rate

Q SUM OF LINEAR MODEL

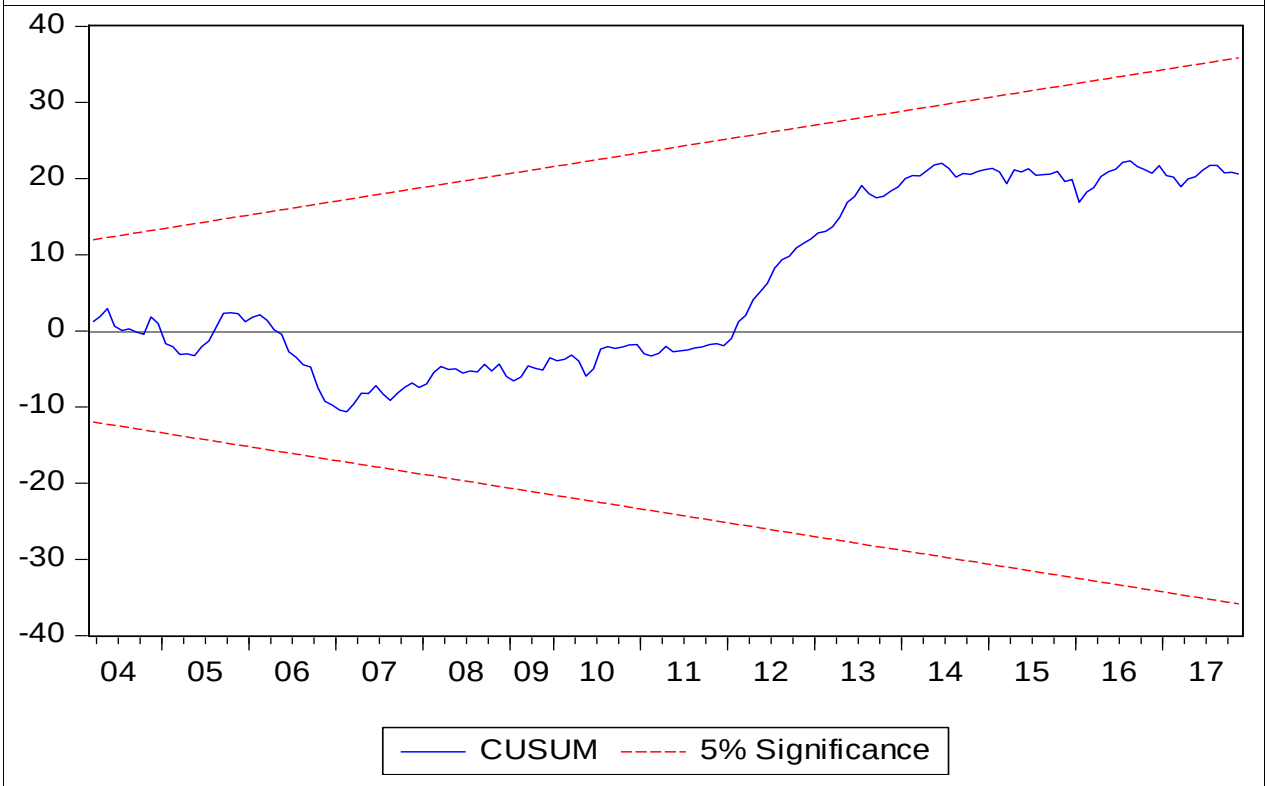


Q SUM OF NON -LINEAR MODEL



Energy and Exchange rate

Q SUM OF LINEAR MODEL



Q SUM OF NON LINEAR MODEL