EQUILIBRIUM EXCHANGE RATE AND MISALIGNMENT:
A CASE STUDY OF PAKISTAN

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DECLARATION

I **Muhammad Umair Husnain**, son of **Muhammad Banaras Khan**, student of M.Phil Economics & Finance, Registration No. PIDE2016FMPHILEAF22, Pakistan Institute of Development Economics, Islamabad, do hereby declare that the thesis **"Equilibrium Exchange Rate and Misalignment: A Case Study of Pakistan"** submitted for the partial fulfillment of Master of Philosophy (M.Phil) degree in Economics and Finance, is my own work. All the error and omission are purely on my part and also somberly pronounce that it will not be submitted for attaining any other degree in future from any institute.

Muhammad Umair Husnain

DEDICATION

I would like to dedicate my Research work to my Parents who's day and night struggle, sufferings and prayers make me capable to be at this position today, to accomplish my research work in time.

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ABSTRACT

There have been a lot of studies conducted on exchange rate around the globe as well as in Pakistan. But still various areas of exchange rate remain needed to be disclosed in academia. However, this study aims to investigate the long run relationship among real effective exchange rate (REER) and its macroeconomic fundamentals for Pakistan against its main trading partner USA, UK and Japan. The key macroeconomics fundamentals of exchange rate includes interest differential, term of trade, trade openness, relative price of non-tradable to tradable, government consumption and foreign exchange reserves. Along with these variables this study also includes another important variable in analysis to assess the impact of democratic effectiveness on exchange rate in Pakistan. In this regards, two different models are estimated based on behavioral equilibrium exchange rate (BEER) approach developed by (Clark and MacDonald, 1998). The Johansen cointegration approach and Vector error correction (VECM) model is also utilized to estimate the parameters of long run cointegration equation. This study found a long run relationship among REER and its fundamentals variables and indicate a significant impact of democratic effectiveness on REER in Pakistan. Moreover to bridge the research gap, this study has also calculated misalignment of REER from its equilibrium level for the period of 1975 to 2017. The level of misalignments varies from 17% to 48%, which can be categorized as large deviation from equilibrium exchange rate.

Keywords:

Real Effective Exchange Rate (REER), Behavioral Equilibrium Exchange Rate (BEER), Vector Error Correction model (VECM), Johansen Cointegration.

CHAPTER 1

INTRODUCTION

Exchange rate determination and its misalignment is the burning issue of global network economies either they are developed or developing. An overvalued exchange rate deteriorates country competitiveness in international market. It adversely affects the export sector through which overall economic growth impedes. Moreover, overvalued exchange rate hampers economic growth of the country, reducing investment, saving and productivity which ultimately causes unemployment in the long run (Ghura & Grennes, 1993; Shatz & Tarr 2001). One of the most important current issues of the Pakistan economy is the equilibrium level of exchange rate which is highly discussed by policymakers and researchers (Javed et al., 2016). Therefore the interest of various stakeholders linked with exchange rate movement. So, the current study appends to investigate whether the exchange rate in Pakistan is aligned with the key macroeconomic fundamentals of economy or not?

The State Bank of Pakistan (SBP) is responsible for directing the exchange rate policy in Pakistan. The objective of foreign exchange policy is the sustainability of foreign exchange market in Pakistan[1]. Moreover, there are number of interest groups who keep close eyes on the movement of exchange rates in the economy. These interest groups include the regulatory authority, business groups, investor and political governments. Exchange rate determination is also important because the benefits of interest groups

[1] See Foreign Exchange Regulation Act 1947, of EPD.

are attached with exchange rate movements, as domestic product competitiveness is linked with true exchange rate movement the business group and government are much interested in exchange rate value which is matched with fundamentals of domestic economy.[2]

Moreover the real exchange rate is an important macroeconomic indicator of economic health of the country. The relative prices and the external balance of the country are linked with true equilibrium exchange rate and so, poor exchange rate determination may cause loss of international competitiveness of the country and trade opportunities in international markets (Hinnosaar et al., 2005). They also identify that overvalued exchange rate cause's loss of the country trade competitiveness in international market where as undervalued exchange rate has inflationary effect on economy. Therefore central banks and policy makers intend to keep eyes on equilibrium exchange rate which is aligned with fundamentals macroeconomic variable of country. In addition as international transactions made in foreign currency at governmental level (interest payment on debt etc.) thus political government's interest is also linked with exchange rate movement. Historically different approaches were adopted by economist to assess the equilibrium exchange rate. The most well-known approaches include the Purchasing Power Parity (PPP) approach[3] and monetary approach to balance of payment[4]. However from past two decade number of research are conducted on behavioral link of macroeconomic fundamentals with exchange rate. Furthermore exchange rate movements also affect the local as well as international investment in the domestic

[2] See (Edwards, 1986a, 1986c; Edwards & Wijnbergen, 1987; Mussa, 1986; Pinto, 1988)

[3] (Cassel, G. 1918; Peter, I. 1977)

[4] Frenkel, J. (1976). The Monetary Approach to Exchange Rate

economy.[5] The study is conducted to address the issue of misalignment and identify the period of overvaluation and undervaluation for which current prevailing exchange rate is misaligned from its true value that is determine after inclusion of all macroeconomics factors in exchange rate determination. The current study employ Behavioral equilibrium exchange rate (BEER) approach developed by Clark and MacDonald (1998) and also incorporates key macroeconomic indicators of Pakistan in analysis. The benefits of employing BEER approach is that it provides relationship among exchange rate and its fundamentals variables without achieving the internal and external balance as in fundamental equilibrium exchange rate (FEER) approach[6].

1.1. Defining the Equilibrium Exchange Rate

"The rate which is determined by the supply and demand forces of foreign currency" is known as equilibrium exchange rate. However, there are number of other macroeconomic fundamentals in the economies, which influence the demand and supply of exchange rate and ultimately equilibrium exchange rate is determined through these foreign exchange market driven forces. These key macroeconomic fundamentals include the interest differential, relative price of non-tradable to tradable goods, term of trade, trade openness, government consumption, and foreign exchange reserves (Edwards, 1988; Elbadawi, 1994; Clark & MacDonald, 1998) and these should be incorporated while analyzing equilibrium exchange rate. Same variables are used in

[5]See (Serven & Solimano, 1991) has argued that stable RER has significant positive impact on private investment.

[6] See (Clark & MacDonald, 1998)

different studies conducted in Pakistan, to assess the behavior of exchange rate in response to these variables (Siddiqui et al., 1996; Hyder & Mehboob 2006).

1.2. Research Gap

This study employs behavioral equilibrium exchange rate (BEER) with the aim, to estimate equilibrium exchange rate by using key macroeconomic fundamental without considering the internal and external balance of country. Numerous studies conducted on equilibrium exchange rate in Pakistan, hardly any study provides the extent of exchange rate misalignments. While previous studies[7] include several macroeconomic variables in the analysis of equilibrium exchange rate, but none of them considered the role of democratic effectiveness in determination of exchange rate however, it is plays important role in assessing political government performance. The importance of political party interest discussed in the different studies[8], but these studies don't provide empirical evidence to support this point of view above mentioned.

The current study attempts to bridge the following gap by providing the extent of misalignments and incorporating democratic effectiveness variable in the analysis of equilibrium exchange rate which may provide some insight for policy maker and open further way in the field of exchange rate determination.

[7] (Edwards, 1988; Elbadawi, 1994; Clark & MacDonald, 1998; Siddiqui et al., 1996; Hyder & Mehboob, 2006)

[8] See Javed. et al., 2016

1.3. Objectives of the Study

The study specifies some objectives for empirical estimation which is as follow:

- To determine the equilibrium level of exchange rate consistent with key macroeconomic fundamentals.
- To identify the periods of over and under valuation of Pakistan Rupee.
- To find out misalignment between current and equilibrium exchange rate.

1.4. Research Problem and Hypothesis

The study identifies issue of exchange rate misalignments in the Pakistan and role of democratic effectiveness in exchange rate analysis. So, the current study appends to investigate the following questions;

- Is the exchange rate aligned with the key macroeconomic fundamentals of Pakistan economy?

In this context the research hypothesis is made where hypothesis of study explain whether there is exchange rate misalignment exist in Pakistan?

Hypothesis:

H_0 = There is no existence of exchange rate misalignment in Pakistan.

H_1 = There is existence of exchange rate misalignments in Pakistan.

1.5. Significance of The Study

This study will provide empirical evidence on equilibrium exchange rate by incorporating the key macroeconomic fundamentals of Pakistan's economy. Moreover, it will address the democratic government's interest with exchange rate level as devaluation of domestic currency is considered as bad performance. Therefore, ruling political party try to maintain exchange rate for longer duration and avoid from major fluctuation in exchange rate in the economy. The study will provide some empirical evidence to address the issue of political interest in exchange rate determination and also discuss the consequences of resultant issue arise due to this fact. Furthermore, it is beneficial for regulatory authorities in the determination of exchange rate for future and also open-up the way to provide some necessary information for researchers who are interested in the field of international finance and trade.

1.6. Organization of the study

The structure of the study is as follows; chapter 2 provides a brief insight of economy of Pakistan and the role of equilibrium exchange rate in Pakistan. Whereas, chapter 3 will provide theoretical background of equilibrium exchange rate determination and also include empirical evidence on exchange rate around the world as well as available in Pakistan. Further, chapter 4 is about the data and methodology along with preliminary tests and also includes information about data set use in this study. Chapter 5 provides the results of the study and discussion. Finally, conclusion and recommendation is in last chapter 6.

CHAPTER 2

REVIEW OF EXCHANGE RATE REGIMES IN PAKISTAN

This chapter provides brief history of exchange rate policy and its determination in Pakistan. It also includes discussion on the exchange rate behavior's in Pakistan through graphical approach.

2.1. Historical Background

Exchange rate is an important macroeconomic variable which linked both assets and financial markets of domestic and international economies. The disturbance or disequilibrium in exchange rate will affect the balance of payment account and level of economic activities of country. Therefore policymakers and regulatory authorities have taken an appropriate measure to formulate the exchange rate policy which provides sound base for economic activities and growth. Foreign Exchange Regulation Act (1947) provides guideline for conducting international transaction of securities and import and export of currency[9] and bullion in Pakistan. Foreign exchange[10] is define as all transaction payable or receivable in any foreign currency whereas section (16) of the custom Act 1969 provides information regarding the restriction on import and export of foreign currency. Exchange policy department (EPD) is responsible for formulating and implementation of foreign exchange policy of Pakistan which is aligned with federal

[9]"Currency" includes all coins, currency notes, bank notes, postal notes, money orders, cheques, drafts, traveller's cheques, letters of credit, bills of exchange and promissory notes.

[10] Refer to clause (8) of section 17 of the State Bank of Pakistan Act, 1956.

government and SBP policies objective. The objective of policy is the stability of foreign exchange market in Pakistan which is aligned with macroeconomic environment of country. The historical collapse of Bretton Wood System in 1970s cause for end of fixed exchange rate system in many economies. In past the economy of Pakistan gone through with different exchange rate regimes and lots of fluctuation in internal and external environment of country. Before the (1999) Pakistan follow the fixed exchange and manage floating exchange policy but after May (1999) Pakistan adopted the market determining/floating exchange rate policy till now.

There are two basic conditions on which the exchange rate of a country is overvalued or undervalued. First it can be viewed as against the purchasing power parity and second it can be viewed against the presumed level of current account. So in this study an attempt is made to estimate it as the difference between the actual real exchange rate and fundamentals variable based exchange rate. For the time being to get some idea regarding overvaluation and undervaluation we calculate it as difference between PPP based exchange rate and actual exchange rate.

Table 2.1: Overvaluation and Undervaluation of PPP Based Exchange Rate

Year	Current Exchange Rate	PPP Based Exchange Rate	Over (+) Under (-) Valuation
2004	58.40	34.19	-24.20
2005	59.58	36.80	-22.78
2006	60.27	38.92	-21.35
2007	60.72	41.02	-19.70
2008	70.62	55.26	-15.35
2009	81.57	72.81	-8.76
2010	85.11	85.11	0
2011	86.27	93.60	7.32
2012	93.28	108.75	15.47
2013	101.50	125.605	24.09

2014	100.95	131.76	30.81
2015	101.29	135.40	34.11
2016	102.65	140.60	37.94
2017	104.66	146.09	41.68

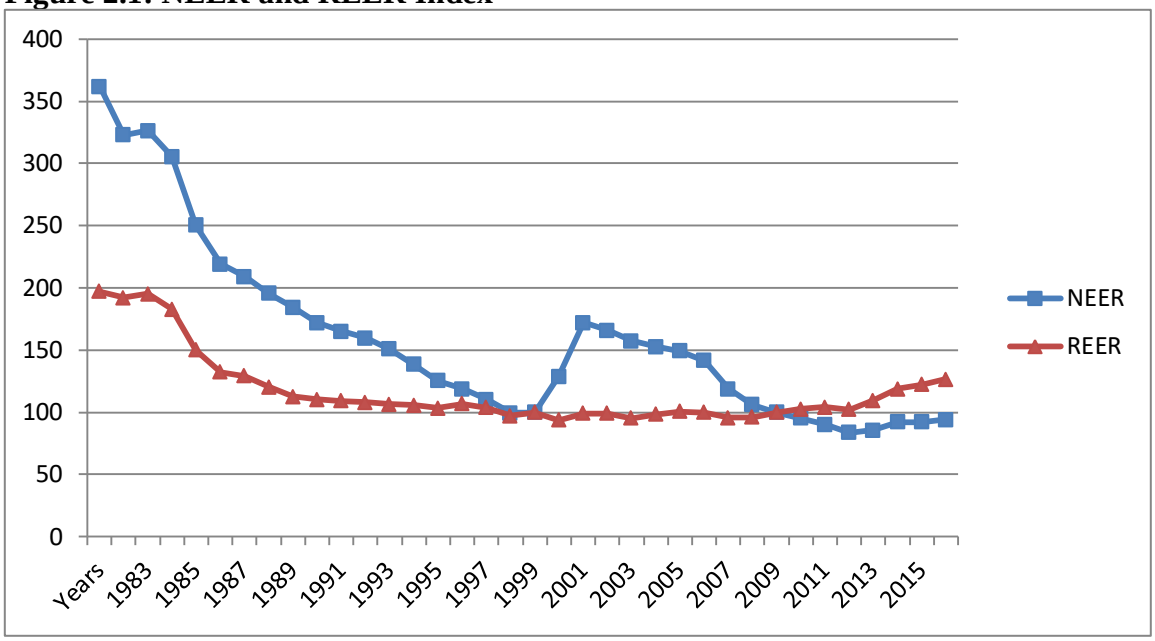
Source: Author's computation

The above table 2.1 provides approximate results about the overvaluation and undervaluation of exchange rate of Pakistan. For this purpose the data of exchange rate and CPI of Pakistan & US took from State Bank of Pakistan (SBP) and International Financial Statistic (IFS) respectively and calculate overvaluation and undervaluation as difference between PPP based exchange rate and actual exchange rate. Historically the exchange rate of Pakistan remained undervalue till 2010 but afterward it shows overvaluation till 2017.

2.2. Graphical Analysis

In this section graphical representation is provided to analyze the information more clearly and check the trend of nominal effective exchange rate (NEER) and real effective exchange rate (REER) over the time period of 1982 to 2017. The figure 2.1 below depicts the deviation in NEER and REER. Since the beginning of 1982 which has proved that under fixed exchange rate regime the gap between real and nominal exchange rate is wider as compare to flexible exchange rate regime as shown in above graph. NEER and REER become equal in 1999 because during this period of time State Bank of Pakistan had adopted the flexible exchange rate policy. After sharp upward trend in (1999) due to change in exchange rate policy, again NEER showed declining trend onward. On the other hand after 2010 REER becomes greater than NEER till now.

Figure 2.1: NEER and REER Index



Source: Author's computation

Thus, the short glance of real and nominal effective exchange rate data indicate that the exchange rate remains misaligned over the period of time but after 2010 a consistent overvaluation is founded which is bad for economic health of country. So an overvalued exchange rate retard the economic growth of country and lower the demand of domestic product and creates the unemployment in the country, furthermore the local industry become uncompetitive as import become cheaper. Moreover due to higher demand of foreign products the current account deficit increases so ultimately economic condition worsens. Another indication observed from graphical analysis is that exchange rate is not completely market driven there is some other sources including economic and social variables those cause for deviation of nominal exchange rate from real exchange rate. Therefore, to empirically prove these outcomes the study has to append econometric analysis and conclude on the basis of that estimation results.

CHAPTER 3

LITERATURE REVIEW

In previous chapter, briefly explained the overview of exchange rate regime in Pakistan and also check the exchange rate fluctuation with the help of data and graphical approach. Now in this chapter, the study going to provide the brief literature on theoretical validation of econometric model in section (3.1) and explain the transmission mechanism of impact of change in macroeconomic fundamentals on exchange rate in the section (3.2). While, empirical literature is in section (3.3) which is subdivided as the empirical studies around the world and available in Pakistan. Finally, summary of this chapter discussed in section (3.4).

3.1. Theoretical Framework

This section will provides some theoretical background of study on the area of exchange rate. Historically there are three main approaches use for determination of equilibrium level of exchange rate. These are named as purchasing power parity (PPP), balance of payment approach and monetary approach to exchange rate which stated that exchange rate should be treated as an asset, because it is traded in market like other assets. In subsequent subsections will discuss each theory precisely to get some idea and then highlight the behavioral equilibrium exchange rate approach at last.

3.1.1. Purchasing power Parity (PPP) Theory

An arbitrage opportunity arises due to difference between two currencies, so it is necessary to adjust (appreciate or depreciate) domestic currency to bring back exchange

rate at its equilibrium level. The initial approach or arbitrage condition that is widely used for the analysis of equilibrium exchange rate by most of economist's in earlier 20th century was Purchasing Power Parity (PPP) presented by Cassel (1918) in his paper "Abnormal Deviation in International Trade". Furthermore an advocate of PPP theory includes (Krugman, 1978; Rogoff, 1996).

There are two form of PPP theory one is absolute PPP and second is relative PPP. The absolute PPP theory based on hypothesis law of one price an absolute form of PPP theory state that price of same basket of goods in two different countries should be identical. Moreover it also suggests that the price of homogeneous product in domestic country should equal to price of foreign product when converted into exchange rate. However this assumption is not realistic because product in two counties is not perfectly substitute although the factor of production are same or the manufacturing company of the product is also same there is little bit difference in the product in two country.

Second problem is with "α" that is weight to aggregate individual price of product produce in domestic and foreign country$\sum_{i=1}^{n} \alpha_i = 1$. According to PPP hypothesis it should be same in both country but actually it is not possible especially for two countries which are at different stage of development. It is rational that consumption bundle of two countries are different which are at different stage of development. Third problem with PPP hypothesis is selection of measure of price level e.g. (CPI, WPI, and SPI) and as well as which type of good are included in price index. Either the traded and non-traded goods or only use the price of traded goods.

Finally the issue related with PPP hypothesis is the absence of transaction cost. In absolute form of PPP theory transaction cost is missing, it is rational thinking that there should be some cost to move product from one place to another place or there is some cost associated with transaction of financial asset. Thus to deal with this problem the relative form of PPP theory is introduce which include the transaction cost in exchange rate determination. MacDonald (1999) states that purchasing power parity (PPP) approach to equilibrium exchange rate is inconsistent because it depends on relative prices of traded goods and ignores the services sector and real side variable of balance of payment account which include net foreign assets and capital flow effect on exchange rate. Furthermore the assumption of perfect substitution in between economies that is $\alpha = 1$, exclusion of non-traded goods and measurement issue dimes its validation in determining equilibrium exchange rate.

3.1.2. Uncovered interest Parity (UIP)

Further development in the field of exchange rate study is uncovered interest parity (UIP) theory. UIP theory paly important role in number of exchange rate models like monetary model, Dronbusch's overshooting model and as well as initial condition in behavioral exchange rate models. The UIP hypothesis state that any interest rate differential between domestic country and foreign country is equal to expected change in exchange rate between two countries. It explains simple relationship of interest rate on similar asset denominated in other's countries and is linked with future expectation of arbitrage opportunity due to interest rate differential.

One major problem with UIP theory is that the general expectation regarding the future value of exchange rate is not directly observable or it is unavailable so that's way the study can't predict the true exchange rate forecast.

3.1.3. Balassa-Samuelson Approach (BSA)

The Balassa-Samuelson approach is extension of PPP approach as it deals with the issue of traded and non-traded sector in analysis that is missing in earlier theory of PPP. Balassa-Samuelson approach of exchange rate determination is derived from two sectors model, traded sector and non-traded sector. It decomposes CPI into external relative price and internal price ratio. Whereas the real exchange rate reflects both the traded goods sector and non-traded goods sector. Balassa-Samuelson hypothesis stated that the greater the productivity differential in the production of traded goods sector between the countries, the larger will be difference in wages and price of services and corresponding PPP and equilibrium exchange rate.

Balassa-Samuelson hypothesis has some assumption regarding the factor of production. First one is capital is assumed to be perfectly mobile within the sector and also across the countries where as labor is perfectly mobile within the sector but not across the countries. According to second assumption law of one price must holds for tradable sector and nominal wages are determine in tradable sector. Finally the third assumption is capital and labour is fully employed. The overall results from different studies suggest that the law of one price does not hold for Balassa-Samuelson approach for real exchange rates.

3.1.4. Balance of Payment Approach (BPA)

The earlier work on the exchange rate associated with Plock (1943) which includes number of macroeconomic variables in analyses other than price level e.g. consumption, investment, government spending and export and import. The stance of proponent of balance of payment approach that all the macroeconomic variable plays important role in the exchange rate movements in the long run not only the price level as stated in Purchasing Power Parity (PPP) approach. Mundell (1962) and Fleming (1962) explain the role of fiscal and monetary policy in exchange rate determination.

3.1.5. Behavioral Equilibrium Approach to Exchange Rate (BEER)

Behavioral Equilibrium Exchange Rate (BEER) is a modeling based empirical technique. As reflected with its name, it is largely depend on behavior of exchange rate in response to change in fundamentals macroeconomic variables under analysis. BEER approach defines the misalignment as the difference between the actual value of exchange rates and the value determine after the inclusion of fundamentals variables (Clark & MacDonald, 1998).

In addition to above nature of BEER approach, generally it is distributed in different vector which explains the long, medium and short run effect of fundamentals variables on exchange rate. Furthermore misalignment is decomposing into current and total misalignments, where the current misalignment is simply defined above and total misalignments as the difference between actual real exchange rate and the real exchange rate given by macroeconomic fundamentals. This study will follow BEER approach to

exchange rate by utilizing vector error correction model (VECM) and estimate the misalignments as defined above.

3.2. Transmission Mechanism

This section explains the transmission mechanism of macroeconomic fundamental variables that affect the exchange rate in long run. These fundamentals variables include interest differential (ID) term of trade (TOT), trade openness (TOP) which is proxy of trade liberation, price of tradable to non-tradable (TNT), government consumption (GC), foreign exchange reserves (FOREX) and finally the democracy (DEMCY).

3.2.1. Real Effective Exchange Rate (REER)

The real effective exchange rate is defined as price of foreign currency per unit in term of domestic currency so an increase in real effective exchange rate is indicate appreciation and vice versa. It is calculated as weighted average of trading partner discuss in this study.

3.2.2. Interest Rate Deferential (ID)

If domestic interest rate is higher the foreign interest rate then the investment in domestic country is more attractive therefore leads to depreciation of exchange rates and vice versa in case of lower domestic interest rate. The interest rate differential is calculated as the gap between the domestic interest rate and the weighted average of major trading partners of Pakistan.

3.2.3. Term of Trade (TOT)

Term of trade (TOT) is relative price of exportable to importable and final impact of term of trade on real exchange rate depends on income and substitution effect. If income effect of TOT is strong then nation income rise and therefore demand for non-tradable good increase, which in turn appreciate the real exchange rate. Whereas if substitution effect is stronger than income effect in that case result will be reverse REER will depreciate. The general consensus on effect of improvement in TOT is that it will appreciate the REER. Various studies support this fact including (Edward & Wijnbergen, 1987; Gregorio & Wolf, 1994; Hyder & Mahboob, 2006) and number of other studies show similar results of REER appreciation in result of TOT improvement.

3.2.4. Trade Openness (TOP)

Trade openness is use as a measure of commercial policy and it is taken as ratio of GDP to tradable goods as proxy of trade openness. Generally a reduction in tariff will lead to exchange rate depreciation. A lower tariff will decrease the price of importable good there for increase the demand of foreign currency so according to Marshall-Lerner the real exchange should be depreciated to achieve equilibrium level of exchange. Studies like (Hyder & Mahboob, 2006; Zakaria & Ghauri, 2011) support the same argument that increase in TOP will leads to REER depreciation but on the other hand (Edward, 1989) ; Calvo & Drazen,1997) argue that due to improvement in trade openness REER would be appreciated due to increase consumption of non-tradable goods as well.

3.2.5. Relative Price of Tradable to Non-tradable (TNT)

Productivity in tradable sector increase the cost of production in non-tradable sector to higher wage therefor it will appreciate the exchange rate of country. This relation explained by Asea and Mendoza (1964) through famous Balassa-Samuelson hypothesis. So if productivity of country is higher, then their effects transmit through non-tradable sector and REER appreciate. Whereas if productivity of country is low relative to its trading partner, then in that case REER will depreciate.

3.2.6. Government Consumption (GC)

The impact of government consumption on real exchange rate transmit with two channels the (1) the resources withdrawal and (2) consumption tilting channel identify by Balvers and Bergstrand (2000), however most of studies emphasize on resource withdrawal channel because it is most prominent in nature and it transmit via consumption on tradable and non-tradable sector. Generally resource withdrawal has two effect (1) income or wealth effect and (2) substitutions effect. Now if government consumption is directed toward the non-tradable sector then real exchange rate will be appreciated and exhibit the income effect and if vice versa situation holds then REER will depreciate (Frenkel & Razin, 1986; Afridi, 1995; Hyder & Mahboob, 2006). So the final impact of government consumption (GC) on REER is depends on allocation of resources which have income and substitution effects.

3.2.7. Foreign Exchange Reserves (FOREX)

Another important fundamental of real exchange rate is foreign exchange reserves which plays crucial role in appreciation (depreciation) of REER. Generally accumulation of foreign exchange reserves depreciates the REER. Aizenman and Crichton (2008) support this idea of REER depreciation due to accumulation of foreign exchange reserves. Because, reserves accumulation is consider as monetary tool to stabilized exchange rate volatility.

3.2.8. Democracy (DEMCY)

Democratic government interest is highly linked with macroeconomic condition of country because there future is at stake that's way aims of political ruling party to ensure the exchange rate stability. It has two implication first one a stable exchange rate is beneficial for ruling party and second it also stabilize the debt settlement otherwise if exchange rate of country appreciate (local currency devalued) the inflation will increase and in result payment made in form of foreign debt servicing will increase (Javed et al., 2016). A general conscience on impact of democracy (DEMCY) on exchange rate is that increase democratic effectiveness towards exchange rate policy lead to depreciation REER.

3.3.Empirical Evidence

In this section briefly discuss the empirical literature around the world as well as available in Pakistan on equilibrium exchange rate and its misalignment.

3.3.1. Empirical Evidence from World Economies

Mongardini (1998) studies the Egypt's equilibrium exchange rate by applying ERER technique using time series data for the period of 1987-1996 for Egyptian economy. This study includes key macroeconomic fundamental of Egyptian economy such as debt serving ratio, government consumption as percentage to GDP, and total factor productivity as proxy of technological progress. The finding of study reveals that before the 1993 the Egyptian Pound remains overvalued. Moreover study also identifies after 1993 its extent of misalignment start decreasing and until 1996 it was near to equilibrium value of exchange rate.

Whereas, Rahman and Basher (2001) analyze the exchange rate misalignments in Bangladesh by applying single equation approach using annual time series data form 1977 to 1998. They found exchange rate overvaluation during late 70's and in 80's however, in 90's Bangladesh currency was closer to its equilibrium value. The studies also identifies the importance of key macroeconomic fundamentals including capital flow, term of trade, government consumption and debt servicing play critical role in determination of exchange rate in Bangladesh economy. The results of study are also aligned with theory that explains the relationship between different fundamentals variables and exchange rate. Similarly, Egert (2002) estimates the equilibrium exchange rate for 5 central Europe's transition economies (CEE) [Czech Republic, Hungary,

Poland, Slovakia and Slovenia] by applying VAR system of analysis utilizing quarterly data for the period of 1992 to 2001 by. He found undervaluation during 1990's in case of Hungary and Slovenia which is about 10% whereas in the case of Czech Republic, Poland and Slovakia it is overvalued about 15% during second half of 1990's and decrease to 7%-8% until 2001. Moreover study identify that problem of misalignment is feature of more flexible exchange rate as 1990's first half appreciation in CEE economies is associated with interest rate differential.

However, Jeong and Mazier (2003) estimates the equilibrium exchange rate for three Asian countries [Japan, China and South Korea]. Results identifies during mid of 80's. Japanese Yen and Korean Won was undervalued about 20%, 19% respectively against dollar in real term whereas, Chinese Yuan was overvalued during mid of 80's about 30%. However, after second half of 90's Yen and Won was closer to its equilibrium level but Yuan was undervalued about 33% in real term against the dollar. Besides, Cheng and Orden (2005) highlight the importance of exchange rate misalignment and its impact on agriculture sector. They also estimate the misalignment of exchange rate in India and China by applying BEER approach using annual time series data for the period of 1975-2002 in case of India and 1978-2002 for China. The result shows that India rupee remains overvalued most of time and period average of misalignments was about 10% to 3 % whereas on the other hand Chines Yan remains 20% undervalued over the time period. Likewise, Hinnosaar et al., (2005) use BEER approach to equilibrium exchange rate for Estonian Kroon over the period of 1995 to 2002. The result of study was summarized on the bases of co-integration approach and indicate that exchange rate remain undervalued about 15% during initial time period of study.

However it was become near to equilibrium exchange rate determined by fundamentals in later part. Similar kind of study is conducted by Saayman (2007) and use VECM approach to estimate the equilibrium exchange rate and misalignment for the African Rand against US dollar for the period of 1978 to 2005 by using quarterly data set. Results are based on three different approach of real exchange rate estimation. RER based on CPI indicate that exchange rate remain undervalued till 2005 however other two measure give indication of overvaluation but all model shows the misalignment of African Rand against US dollar.

Therefore, Jongwanich (2009) estimates exchange rate misalignments for Asian countries, in [China, Hong Kong, India, Indonesia, Korea, Malaysia, Singapore and Thailand]. Fundamental equilibrium exchange rate (FEER) technique was applied by using quarterly data for the period of 1995 to 2008. He founds overvaluation around 10% to 20% during financial crisis of 1998 however, after that many in Asian countries exchange rate undervaluation trend was observed. Moreover he also found significant relation between exchange rate and export competiveness as theory suggested and he also identify that exchange rate misalignment has bad impact on export competiveness of Asia countries. Additionally, Ajevskis et al. (2012) study examine the different approaches (RERE, BEER, NATREX and SVAR) to estimate equilibrium exchange rate in Latvia over the period of 2001 to 2010 by using quarterly data. The results indicate that's Latvia currency slightly overvalued and undervalued during the crises period in 2009. However the overall result indicates that actual REER remain stable with equilibrium level of exchange rate.

Furthermore, Chou and Lin (2011) conducted the study for assessing the relation of key fundamentals and exchange rate rotation by using quarterly data of 1992 to 2010 against the sixteen trading partners of Taiwan. Results indicate that through multilateral exchange rate there is co-integration among macroeconomic fundamentals. However bilateral exchange rate fails to develop any co-integration among fundamentals variables and exchange rate in case of Taiwan.

3.3.2. Empirical Evidence from Pakistan

In case of Pakistan certain studies available in which Bhatti (1996) test PPP for Pakistan against eight countries and use quarterly data for the period of 1982 to 1984. By apply Cointegration approach he found supportive result in case of Pakistan and also identify that State Bank of Pakistan has not independent monetary policy. A similar kind of study conducted by (Qayyum et al., 2004; Khan & Qayyum, 2007) they also use cointegration approach to test PPP theory and determine equilibrium exchange rate in Pakistan. They found that in long-run PPP hold for Pakistan and there is high level of integration between goods and foreign exchange market. Moreover the adjustment process is slow and misalignment takes long period of time for adjustment. However short-run fluctuations are main concern of PPP approach. Finally they also suggest that there is need of appropriate model which include the effect of macroeconomic variable in exchange rate determination.

Moreover, Hussain (2009) conducted a research on exchange rate misalignment in Pakistan by using annual time series data from 1960 to 2007. He concluded that exchange rate in Pakistan was remained overvalued over the time period and capital

flow, government consumption and term of trade are major factor of misalignments in Pakistan. He also identify that real equilibrium exchange rate is an important policy variable but still no considerable attention paid to this issue. Whereas, Zardad et al. (2013) conducted study on the exchange rate determinant in Pakistan for the period of 1980 to 2010 by using annual data series. They found long run relation between REER and productivity differential, term of trade, trade openness and government consumption by using EVCM and GARCH model. They also highlight the exchange rate misalignment and state that these factors play important role in exchange rate determination in Pakistan.

Further, Akhtar et al. (2014) use annual data for the period of 1980 to 2011 to test PPP for Pakistan rupee against the US dollar. They are interested in exploring factor behind the deviation from PPP theory they found that in case of Pakistan and US it holds for some extent. While, Minhaj and Fatima (2016) test the PPP theory in Pakistan against its 13 trading partners and apply co-integration and ECM approach by using quarterly data over the period of 1972 to 2012 and found long-rung existence of PPP against its all trading partner countries. Moreover they also identify that inflation is not only the driving component of exchange rate in Pakistan.

However, Afridi (1995) use the REER technique to assess the behavior of exchange rate by using macroeconomic variables and determination of equilibrium exchange rate in Pakistan over the period of 1960 to 1990. The result found from study indicate that the variable use in study has significant an important in exchange rate determination only the term of trade are not statistically significant. Likewise, Siddiqui et al. (1996) employed the simultaneous equation model for equilibrium exchange rate determination

to address the issue of simultaneous biasness bay applying 2SLS approach and found results that are more reliable to explain equilibrium exchange rate path in Pakistan as compare to single equation model.

3.4. Summary of Literature Review

Concluded on the bases of above analysis of theoretical and empirical literature including the validation of econometric model and transmission mechanism of all the variables and literature it has been found that equilibrium exchange rate is an important issue in the develop and as well as in developing economies. Moreover, misalignment of exchange rate leads to loss of international competiveness of country when country experience over and undervaluation of exchange rate. However an appropriate policy to adjust fundamentals of exchange rate can bring back exchange rate to its equilibrium level. Empirical evidence from Pakistan show exchange rate is an important macroeconomic variable but hardly any study highlights the extent of misalignment of exchange rate. The greater and comparatively better results can be obtained by utilizing longer term data and appropriate econometric model. So, the next chapter provides the methodological framework for current study.

CHAPTER 4

DATA AND METHODOLOGY

4.1. Introduction

In previous chapter, the theoretical and empirical literature is discuss for major world economies which gives inside to the study on equilibrium exchange rate (EER) and its misalignment around the globe. This study aims to measure the EER and its misalignments in Pakistan against its three main trading partners UK, USA and Japan by utilizing vector error correction (VECM) model. Study will estimate two different models where first model estimates the relationship among REER and interest rate differential, term of trade, trade openness, relative price of tradable to no-tradable goods, government consumption and foreign exchange reserves and second model includes the same variable with addition to democratic effectiveness to capture its impact on exchange rate. So the Section 4.2 of this chapter provides the information regarding data description and its sources while, methodological framework for this study highlights in section 4.3.

4.2. Data Sources

This section provides information about data set utilized in this study. The annual time series data of different variables are collected including exchange rate, gross domestic product (GDP), different price indices, discount rate, volume of export and import, government consumption and foreign exchange reserves. Moreover study also incorporates the democracy indicator over the time period of 1973 – 2017.

Table 4.1: Data Description

Variables	Description	Units
REER	Real Effective Exchange Rate	Log REER (2010 Base)
ID	Interest Differential	Weighted average of trading partner countries
TOT	Term of Trade (PX/PM)	Log TOT (2010 Base)
TOP	Term Openness (X+M/ GDP)	Log TOP (2010 Base)
TNT	Price of Tradable to Non-Tradable goods	Log TNT (2010 Base)
GC	Government Consumption	Log GC (2010 Base)
FOREX	Foreign Exchange Reserves	Log FOREX(2010 Base)
DEMCY	Democracy measure in term of effectiveness	Rate lower DEMCY effectiveness 0 to higher 8 point.

Source of Data: State Bank of Pakistan (SBP), Pakistan Bureau of statistics (PBS) and International Financial Statistics (IFS).

These data sets are collected from various sources including state bank of Pakistan (SPB) handbook 2015 and annual reports, Pakistan bureau of statistics (PBS) and international financial statistic (IFS). The variables selection is made on the bases of fundamentals of exchange rate theories (Edwards, 1987; Clark MacDonald, 1998).

4.3.Methodological Framework

For this study Vector Error Correction Model (VECM) is employed to measure the equilibrium exchange rate and its current misalignments in Pakistan. There are four step involves in VECM process, first one is that data must be stationary of same order of integration, second selection of lag criteria, third is testing the long run relationship among variables and finally estimation of VECM parameters.

4.3.1. Preliminary Tests

This section elaborate the each of preliminary test one by one in details for this study including ADF test for stationarity of data, lag selection and Johansen cointegration test for testing long run relationship among variables.

4.3.1.1. Stationarity Test

First step of VECM is to make sure that all the variables are stationary of same order of integration. For this purpose we check the stationarity of our data set through Augmented Dickey Fuller (ADF) statistics. ADF test equation is presented below in equation (4.1) as;

$$\Delta Y_t = \alpha_0 + \alpha_{1t} + \delta Y_{t-1} + \sum_{i=1}^{k} \Delta Y_{t-i} + \epsilon_t \qquad \textbf{(4.1)}$$

The null hypothesis of ADF statistics $H_0 = \delta$ on the bases of t-statistic which is there is unit root or meaning that data series is non-stationary against the alternative hypothesis of there the series is stationary. As we reject the null hypothesis we can conclude that series is stationary and also proceed for further analysis.

4.3.1.2. Lag Length Criteria

As identify the order of integration with the help of ADF test, the next step is to determine the optimal lag length for conducting further test and estimation of VECM. AS the selection of optimal lag length can safe from misspecified results. There are three main criteria for selecting the optimal lag length of model, known as Likelihood

Ratio (LR) test, Akaike Information criteria (AIC) test and third is Schwarz information criteria (SC).

Moreover it is observed that "there are maximum 3 optimal lag in case of time series data that will help to capture the dynamics of system". The mathematical expression of these test are represented below;

$$\mathbf{LR} = (\mathbf{T} - \mathbf{n})(\mathbf{ln}|\sum\mathbf{r}| - \mathbf{ln}|\sum\boldsymbol{\mu}|) \quad \textbf{(4.2)}$$

$$\mathbf{AIC} = \mathbf{T}\,\mathbf{ln}(\sum) + \mathbf{2N} \quad \textbf{(4.3)}$$

$$\mathbf{SC} = \mathbf{T}\ \mathbf{ln}(\sum) + \mathbf{N}\,\mathbf{ln}(\mathbf{T}) \quad \textbf{(4.4)}$$

In the above expression the usable observation is 'T', whereas 'n' is estimated parameter, and '$\sum r$' and '$\sum \mu$' are corresponding variance and covariance matrix. On the basis of above mentioned formulas, test the lag length criteria. While, generally lag length are selected on the bases of most of lag indicated by selection criteria.

4.3.1.3. Cointegration Test

From above analysis when it is confirm that our data series under analysis are stationary of same order of integration e.g. I (1) [mostly financial time series data are integrated of order I (1)], the next important step in VECM is determining the long run relationship among variables. For this purpose Johansen cointegration test is employed when there is two or more than two independent variable are included in analysis.

Now suppose that $X_{i,t} \sim (d_i)$ which is set of variable are identically distributed of order (d_i), where (d_i) is (1) for set of $X_{i,t}$ and identify the cointegration relation with

the help of Johansen test. VECM form presented in equation (4.5) for Johansen cointegration test is as follow;

$$\Delta \boldsymbol{Y_t} = \boldsymbol{\Pi Y_{t-k}} + \boldsymbol{\Gamma_1 \Delta Y_{t-1}} + \boldsymbol{\Gamma_2 \Delta Y_{t-2}} + \cdots + \boldsymbol{\Gamma_{k-1} \Delta Y_{t-(k-1)}} + \boldsymbol{\mu_t} \quad \textbf{(4.5)}$$

Where $\Pi = \left(\sum_{i=1}^{k} \beta_i\right) - I_g$ and $\Gamma_i = \left(\sum_{j=1}^{i} \beta_j\right) - I_g$, in this VECM equation g is dependent variable and (k-1) is difference of dependent variable whereas Γ is cointegration matrix attached with each difference. One another important step involves in test are determining the optimal lag length which affects the result of Johansen test, as already discussed the lag selection criteria in above section.

Furthermore there are two test statistics are use in Johansen cointegration test, the first one is trace statistic and second one is maximum eigenvalue statistic. The testing criteria for both of test statistics are given below in equation (4.6) and (4.7) respectively as;

$$\boldsymbol{\lambda_{trace}}(\boldsymbol{r}) = -\boldsymbol{T} \sum_{\boldsymbol{i=r+1}}^{\boldsymbol{g}} \mathbf{ln}(\mathbf{1} - \boldsymbol{\lambda_i}) \quad \textbf{(4.6)}$$

&

$$\boldsymbol{\lambda_{max}}(\boldsymbol{r}, \boldsymbol{r+1}) = -\boldsymbol{T ln}(\mathbf{1} - \boldsymbol{\lambda_{i+1}}) \quad \textbf{(4.7)}$$

In above testing criteria "r" define as cointegration vector, λ_i is estimated value of eigenvalue associated with Π matrix. If larger the λ_i, ln (1 - λ_i) will be larger and negative. So t-statistic should be larger and if it is significant it indicates the cointegration vector.

Now trace statistic is more general as null hypothesis is "r" cointegration vector $H_0 = 0$ against the alternative that there is more than one cointegration vector i = 1….g.

whereas λ_{max} has null of "r" cointegration against alternative of (r + 1) cointegration vector. The Johansen cointegration has series of null and there corresponding alternative hypothesis presented as below;

Table 4.2: Null and Alternative Hypothesis of Johansen cointegration Test

Null Hypothesis	**Alternative Hypothesis**
$H_0 : r = 0$	$H_1 = 0 < r \leq g$
$H_0 : r = 1$	$H_1 = 1 < r \leq g$
$H_0 : r = 2$	$H_1 = 2 < r \leq g$

Table 4.3 present the null and alternative hypothesis of Johansen cointegration test. We test the Johansen cointegration on the bases of t-statistic; if t-statistic is greater than critical value at 0.05 level of significant we can reject the null hypothesis. The first null hypothesis of Johansen test is there is no cointegration equation against the alternative of there is at least one cointegration equation, if we reject the null meaning that there is cointegration vector and we can proceed to second null of Johansen test which is there are at most one cointegration equation against the alternative of more the one cointegration equation and this process will continue in following null hypothesis where the null do not rejected and maximum cointegrated equation are determined by Johansen test.

4.3.2. Vector Error Correction Model (VECM) Specification

The specification of VECM is that there should be cointegration or long run relationships exist between variables. The concept of cointegration was introduced by (Engle & Granger, 1987) whereas earlier work on Vector Error Correction Model

(VECM) was associated with Surgan (1964) however a full analysis of vector error correction model (VECM) was presented by Johansen (1996).

From the above three step we full fill the basic criteria to estimate the parameters of vector error correction model (VECM), which is as follow the variables should be integrated of same order. Second there should be optimal lag select for evaluating long run relationship among variables and third is Johansen cointegration test should show cointegration vector or cointegration relationship.

$$\mathbf{\Delta y_t = \beta_0 + \sum_{i=1}^{n} \beta_1 \Delta y_{t-i} + \sum_{i=1}^{n} \delta_i \Delta x_{t-i} + \Psi Z_{t-1} + \mu} \quad \mathbf{(4.8)}$$

The equation (4.8) is represent the VECM process, where term Δy_t represent the change in y which is function of previous changes in Δy_{t-i} and as well as in change Δx_{t-i} the vector of fundamentals variables which are treated as endogenous represented and Z_{t-1} is error correction term in equation (4.9) whereas $\beta_0, \beta_1, \delta_i$ and Ψ all are coefficient's of parameters.

$$\mathbf{x_t = [ID, ToT, TOP, TNT, GC, FOREX, DEMCY]} \quad \mathbf{(4.9)}$$

Equation 4.9 presents the set of fundamentals use in this study which is represented with notation of Xt where fundamental variables are interest differential (ID), term of trade (TOT), trade openness (TOP), relative price of tradable to non-tradable (TNT), government consumption (GC), foreign exchange reserves (FOREX) and democratic effectiveness (DEMCY).

$$\mathbf{z_{t-1} = ETC_{t-1} = y_{t-1} - \beta_0 - \beta_1 x_{t-1}} \quad \mathbf{(4.10)}$$

Z_{t-1} is the error correction term of long run cointegration process represented by equation (4.10) where Ψ is coefficient of ECT which shows the speed of adjustment how quick Y (dependent variable) moves to equilibrium after the change in X_{t-1}.

Finally, we made comparison between the actual exchange rate and the equilibrium exchange rate that is estimated through VECM after including all the macroeconomic fundamentals in analysis to assess the extent of misalignment of exchange rate in Pakistan.

CHAPTER 5

RESULTS AND DICUSSION

This chapter refers to the results that have drawn on the basis of described methodology. Therefore, the study comprises two models; where first model estimate the long run relationship between REER and its fundamentals i.e. interest differential (ID), term of trade (TOT), trade openness (TOP), relative price of tradable to non-tradable (TNT), government consumption (GC) and foreign exchange reserves (FOREX). Whereas, the second model contain one extra variable of democracy (DEMCY) and rest of variables are similar as in first model. In this regards, first apply certain preliminary tests to fulfill the basic requirement of the VECM model and later on interpret the coefficients of both models as well as made comparison along with the discussion of exchange rate misalignment.

5.1 Preliminary Tests

In this part following preliminary tests applied for VECM model i.e. Unit Root Test, Lag Length Selection Criteria and Johansen Cointegration Test.

5.1.1 Unit Root Test

The study has utilized the Augmented Dickey Fuller (ADF) test, to check the stationary of the time series dataset. The null and alternate hypothesis of ADF test as;

Table 5.1: ADF Test Result

	At Level			At First Difference		
	t-statistics	p-values	Level of Integration	t-statistics	p-values	Level of Integration
LNREER	-1.07	0.71	I(0)	-4.91***	0.00	I(1)
ID	-1.35	0.59	I(0)	-4.83***	0.00	I(1)
LNTOT	-2.02	0.27	I(0)	-5.95***	0.00	I(1)
LNTOP	-2.31	0.17	I(0)	-5.71***	0.00	I(1)
LNRTNT	-1.84	0.35	I(0)	-8.04***	0.00	I(1)
LNGC	-0.42	0.89	I(0)	-6.27***	0.00	I(1)
LNFOREX	-0.99	0.74	I(0)	-8.35***	0.00	I(1)
DEMOY	-2.02	0.27	I(0)	-6.20***	0.00	I(1)

ADF based t-statistic where sign of stearic (***) show the 10% level of significance.

Table 5.1 show the results of ADF test at level and at first difference along with their t-statistic and P-values. Stationarity of data is an important, therefore set the direction about which estimation technique should be utilized under specific level of integration. Thus, results indicate that all the variables become stationary at first difference and integrated of order I (1). The study will apply VECM technique to long run equilibrium exchange rate and further second step refers to optimal lag length.

5.1.2 Lag Length Selection Criteria

Lag selection is second important step in VECM analysis. There are various lag selection criteria including Akaike information criteria (AIC), Schwarz information criteria (SC) and Hannan-Quinn information criteria (HQ) to determine the optimal lags for model. The rule for lag selection is the least statistic given under each lag selection criteria is selected as optimal lag for model.

Table 5.2: Lag Selection Criteria

Lag	*LogL*	*LR*	*FPE*	*AIC*	*SC*	*HQ*
1	74.44070	NA	7.37e-10*	-1.183289*	0.823660*	-0.443188*
2	114.4766	54.00196	1.30e-09	-0.766355	3.247543	0.713846

Note: The most optimal lag identifies by each criteria is represented by (*) sign in table.

Table 5.2 represents the result of lag selection criteria, where six different lag selection criteria are available. According to likelihood ratio (LR), final prediction error (FPE), (AIC), (HQ) and (SC) identifies only one optimal lag length for our models. On the basis of above information, the study will utilized only one lag for analysis which is stated by most of lag selection criteria for both models.

5.1.3 Johansen Cointegration Test

The next step is to apply johansen cointegration test to analyze the long run cointegration among variables for both models. It is mandatory for johansen cointegration test that all the variables must be integrated at same order of integration as mentioned in methodological section. Moreover, it provides two types of test criteria; first one is to trace statistic and second is maximum eigenvalue statistic. In this regards, there are series of hypothesis under Johansen cointegration test each will identify the number of cointegration equation of undersigned model. The maximum number of cointegration equation set at the point where the null hypothesis of maximum cointegration is does not rejected. Following are Johansen cointegration hypothesis. As study estimates two models for comparison, thus this section will apply Johansen cointegration test for each model separately and also discuss their results. Later on these results will utilize in VECM estimation.

Table 5.3: Johansen Cointegration Test (Trace Statistic)

First Model			Second Model		
Hypothesized No. of CE(s)	***Trace Statistic***	***Prob.*****	***Hypothesized No. of CE(s)***	***Trace Statistic***	***Prob.*****
None *	160.32	0.00	None *	221.16	0.00
At most 1 *	99.97	0.02	At most 1 *	155.06	0.00
At most 2	61.84	0.18	At most 2 *	107.40	0.00
At most 3	37.07	0.34	At most 3	68.75	0.05
At most 4	21.43	0.33	At most 4	47.49	0.05
At most 5	12.98	0.11	At most 5	24.87	0.16
At most 6	5.41	0.01	At most 6	12.36	0.14
			At most 7	5.69	0.01

The sign of (*) show the significant number of cointegration equation.

The above table 5.3 represents the Johansen cointegration Trace Statistics for both models. The maximum cointegration indicated by trace statistic for first model is two whereas for second model the optimal cointegration equations are four. The maximum cointegrating equations are selected on the base of above describe criteria where last null hypothesis in sequence does not rejected due to high probability (value is greater than 0.05). In table 5.3 the null hypothesis of at most 2 cointegration does not rejected and confirm the 2 optimal lag for first model whereas in second model null hypothesis of at most 3 cointegration does not rejected which confirm the 3 optimal lag. However to select the number of cointegration equations the results of maximum eigenvalue is also considered and then made the final decision.

Table 5.4: Johansen Cointegration Test (Maximum Eigenvalue)

First Model			Second Model		
Hypothesized No. of CE(s)	***Max-Eigen Statistic***	***Prob.*****	***Hypothesized No. of CE(s)***	***Max-Eigen Statistic***	***Prob.*****
None *	60.34	0.00	None *	66.10	0.00
At most 1	38.13	0.08	At most 1 *	47.65	0.03
At most 2	24.77	0.40	At most 2	32.65	0.26
At most 3	15.64	0.69	At most 3	27.26	0.24
At most 4	8.44	0.87	At most 4	22.61	0.19
At most 5	7.57	0.42	At most 5	12.51	0.49
At most 6	5.41	0.01	At most 6	6.674	0.52
			At most 7	5.69	0.01

The sign of (*) show the significant number of cointegration equation.

The table 5.4 represents the maximum eigenvalue of Johansen cointegration test for both models. Maximum eigenvalue statistics indicates only one cointegration equation for model 1. Whereas maximum 2 cointegrating equations is indicates for second model. As both trace statistic and maximum eigenvalue statistic indicates different numbers of cointegration equation so, this study will utilized the number of cointegration equation which is jointly assign by both trace and maximum eigenvalue test. In the next step study utilized these numbers of cointegrating equation and estimates the VECM parameters for both models.

5.2 Vector Error Correction (VECM) Model

The basic objective of VECM model is to estimate the parameters of long run relationship among variables by utilizing Johansen cointegration approach. In VECM all the variables are treated as endogenous and it is appropriate when model contains

two or more than two variables. Thus study utilized VECM for analyzing long run cointegration among real effective exchange rate (REER) and its fundamentals which are same for both model except democracy (DEMCY) which is additional in second model to check the impact of effectiveness of democratic rights on exchange rate. Therefore, in the above section all the necessary step of vector error correction (VECM) model is satisfy and now in this section VECM estimates are provided with their optimal lag length and cointegration equations.

5.2.1 Empirical Result

According to above steps the parameters of both models are estimated on the basis of specification that is set after above preliminary testing. The study utilized the optimal lag length 1 and one cointegration equation for first model which test the relationship among REER and ID, TOT, TOP, TNT, GC and FOREX. While, second model estimates with similar set of variables plus DEMCY with optimal lag length 1 and one cointegrating equation. The following subsection presents the long run and short run dynamics of VECM for both models respectively.

5.2.1.1 Long Run VECM Model

Here the long run cointegration result of VECM model is presented which supports the long run association among real equilibrium exchange rate and its fundamentals.

Table 5.5: Long Run Cointegration Results First Model

Cointegrating Eq:	*CointEq1*	*Standard Error*	*t-statistics*
LNREER (-1)	1.00		
ID(-1)	-0.16	0.02	-7.57
LNTOT(-1)	3.79	0.55	6.86
LNTOP(-1)	-0.12	0.23	-0.56
LNTNT(-1)	9.94	1.34	7.39
LNGC(-1)	-0.81	0.17	-4.67
LNFOREX(-1)	0.58	0.13	4.51
C	-63.98		

The above table 5.5 shows the long run results of first model of the study where column two shows coefficients of each variable contributed in long run equation. Column three depicts standard error and column four show t-statistics. The results found that fundamentals of exchange rate has significantly account in misalignments of REER in first model. Moreover the long run model and error correction term is presented as below;

$$\mathbf{REER = 63.98 + 0.16*ID_{t-1} - 3.79*LNTOT_{t-1} + 0.12*\ LNTOP_{t-1} - 9.94*LNTNT_{t-1} + 0.81*LNGC_{t-1} - 0.58*LNFOREX_{t-1}} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \mathbf{(5.1)}$$

Equation 5.1 represents the long run form of vector error correction (VECM) for first model where all the variables are statistically significant and perfectly associated according to theory. Interest differential, trade openness and government consumption has positive impact on REER and appreciate the REER in long run. Whereas, term of

trade, relative price of tradable to non-tradable and foreign exchange reserves has negative impact and depreciate the REER in long run.

$$\mathbf{ECT = 1.00\ (LNREER)_{t-1} - 0.16\ (ID)_{t-1} + 3.79\ (LNTOT)_{t-1} - 0.12\ (LNTOP)_{t-1} + 9.94\ (LNTNT)_{t-1} - 0.81\ (LNGC)_{t-1} + 0.58\ (LNFOREX)_{-1} - 63.98 \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (5.2)}$$

The above equation 5.2 represents the contribution of all variables in error correction term (ECT). The ECT represent the speed of adjustment of long run form of VECM model that how quick the undersigned model will return to its equilibrium level. In above ECT equation LNREER, LNTOT, LNTNT and LNFOREX has positive contribution whereas ID, LNTOP and LNGC negatively contributed in ECT.

Table 5.6: Long Run Cointegration Results Second Model

Cointegrating Eq:	*CointEq1*	*Standard Error*	*t-statistics*
LNREER (-1)	1.00		
ID(-1)	-0.18	0.02	-6.84
LNTOT(-1)	4.65	0.81	5.67
LNTOP(-1)	-0.87	0.39	-2.22
LNTNT(-1)	12.57	1.99	6.29
LNGC(-1)	-0.42	0.24	-1.70
LNFOREX(-1)	1.04	0.17	5.96
DEMCY	0.07	0.03	2.47
C	-80.34		

Table 5.6 represents the long run coefficient of second model where all the variables are statistically significant except government consumption (GC), one interpretation of

insignificance of GC is due to addition of DEMCY in analysis which is significant. As our hypothesis suggest that period of democracy influence the REER negatively and decrease the impact of other macroeconomic variables in REER determination. So, on the base of this hypothesis it can be concluded that more effective democratic period results in more REER misalignments. The following equation 5.3 represents the long run form of second model where ID, TOP, GC has positive impact but GC is statistically insignificant. Whereas TOT, TNT, FOREX and DEMCY has negative impact on exchange rate and depreciate the exchange rate in the long run.

$$\mathbf{REER = 80.34 + 0.18{*}ID_{t-1} - 4.65{*}LNTOT_{t-1} + 0.87{*}\ LNTOP_{t-1} - 12.57{*}LNTNT_{t-1} + 0.42{*}LNGC_{t-1} - 1.04{*}LNFOREX_{t-1} - 0.07\ DEMCR_{t-1} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ (5.3)}$$

The error correction term (ECT) for second model is presented in equation 5.4 below which show the speed of adjustment in case of second model.

$$\mathbf{ECT = 1.00\ (LNREER)_{t-1} - 0.18\ (ID)_{t-1} + 4.65\ (LNTOT)_{t-1} - 0.87\ (LNTOP)_{t-1} + 12.57\ (LNTNT)_{t-1} - 0.42\ (LNGC)_{t-1} + 1.0\ (LNFOREX)_{t-1} + 0.07\ (DEMCR)_{t-1}\ \ (5.4)}$$

In ECT of second model ID, TOP, and has negatively contributed on ECT term to bring back REER to its equilibrium level and TOT, TNT, FOREX and DEMCR has positively contributed in ECT.

5.2.1.2 Short Run VECM Dynamics

The short run dynamics of vector error correction model are presented in table 5.7 below. The result of short run dynamics indicates that in the short run only three variables out of six are statistically significant in case of Pakistan. These variables includes trade openness (TOP) which appreciate the REER by 0.82 % in short run,

TNT and FOREX has also significant and positive impact and appreciate the REER by 1.06 % and 0.14 % respectively.

Table 5.7: Short Run VECM Model Results First Model

Variables	*Coefficient*	*Std. Error*	*t-Statistic*	*Prob.*
Coint Eq 1	-0.19	0.04	-4.59	0.00
D(LNTOP(-1))	0.82	0.18	4.54	0.00
D(LNTNT(-1))	1.06	0.50	2.10	0.04
D(LNFOREX(-1))	0.14	0.05	2.62	0.01

Furthermore these short run dynamic based on ordinary least square (OLS) estimates of VECM approach whereas appendix 1 provides complete statistics of the VECM for first model. Moreover on the bases of above short run dynamic results are summarized as follow;

- **Cointegration Term:** The previous period deviation from long run equilibrium is corrected in the current period at the adjustment speed of 0.19% percent.
- **LNTOP:** An increase of one percentage point of trade openness to GDP is associated with 0.82 % percent appreciation of REER on average.
- **LNTNT:** An increase of one percent of relative price of tradable to non-tradable is associated with 1.06 % percent appreciation of REER on average.
- **LNFOREX:** An increase of one percent in foreign exchange reserves (FOREX) is associated with 0.14 % percent appreciation of REER on average.

Table 5.8: Short Run VECM Model Results Second Model

Variables	*Coefficient*	*Std. Error*	*t-Statistic*	*Prob.*
Coint Eq 1	-0.12	0.03	-3.79	0.00
D(LNTOP(-1))	0.76	0.19	3.97	0.00
D(LNRTNT(-1))	1.02	0.54	1.90	0.06
D(LNFOREX(-1))	0.13	0.05	2.28	0.02

Similarly in case of second model only three variables are significant but there coefficients are significantly different from first model. Table 5.8 represents the short run statistic of second model where TOP, TNT and FOREX appreciate the REER by 0.76 %, 1.02 % and 0.13 % respectively in short run.

- **Cointegration Term:** The previous year deviation from long run equilibrium is adjusted in the current year at the adjustment speed of 0.12 % percent.
- **LNTOP:** An increase of one percentage point of trade openness to GDP is associated with 0.76 % percent appreciation of REER on average.
- **LNTNT:** An increase of one percent of relative price of tradable to non-tradable is associated with 1.02 % percent appreciation of REER on average.
- **LNFOREX:** An increase of one percent in foreign exchange reserves (FOREX) is associated with 0.13% percent appreciation of REER on average.

5.2.1.3. Result Discussion

The results of study are consistent with economic theory as well as sign and coefficients of this study are also matched with previous studies conducted on equilibrium exchange rate. The final impact of term of trade and government depends upon income and substitution effect in case of term of trade the study found that

substitution effect is stronger as suggested by Afridi (1995) therefor leads to REER depreciation. Whereas in case of government consumption income effect is stronger than substitution effect which implies that government consumption is more directed towards non-tradable sector hence cause for REER appreciation (Frenkel & Razin, 1986; Afridi, 1995; Hyder & Mahboob, 2006) also found that government consumption has income effect on REER. An increase in trade openness mean country is more open for international trade and study found the similar results as (Edward, 1989; Calvo & Drazen, 1997). Due to increases in trade openness the consumption of tradable as well as non-tradable increases which leads to REER appreciation in the long run.

Study does not support the Balassa and Samuelson (1964) hypothesis that increase in productivity will appreciate the REER. Instead of that increase in productivity depreciate the REER in Pakistan as (Siddiqui et al. 1996: Hussain, 2009) found as similar results. Results of interest differentials are also significant, as in current decade the interest differentials decreases therefor REER appreciate in the long run. Foreign exchange reserve has negative effect and depreciates the REER, Aizenman and Crichton (2008) also support this relation that foreign exchange accumulation will leads to REER depreciation. Finally the variable of democratic effectiveness utilized in second model also supports the hypothesis that the stronger democratic effectiveness lead to REER depreciation in the long run.

Finally the above discussion is based on long run impact of fundamentals variables on real equilibrium exchange rate. However, in the short run results of both model indicates that only trade openness, relative price of tradable to non-tradable and foreign exchange reserves significantly contributed to exchange rate misalignments. As in case

of Pakistan it is observed that since a continues period of democratic government from 2008, the reserves accumulation is most preferred tool to deal with exchange rate fluctuation in short run to stabilized the exchange rate.

5.2.2 Misalignment of REER

The study defines the term 'Misalignment' as the degree at which the actual exchange rate differs from its equilibrium value or the estimated equilibrium level of exchange rate which is defined as BEER. It is simply calculated as follows:

$$\boldsymbol{REER\ Misalignment = \frac{REER - BEER}{BEER} * 100} \quad \text{..... (5.5)}$$

According to this formula the calculated misalignments is interpreted as percentage deviation of BEER from actual REER and positive value of misalignment represents the overvaluation of REER whereas negative value represents the undervaluation of REER. Table 5.9 indicate major period of overvaluation and undervaluation of REER whereas appendix (2) of study provides misalignments of REER from 1975-2017. The estimation results of study indicates the REER of Pakistan is 16% to 32% overvalued during the period 2010 to 2017 according to first model, however in between REER also remains undervalued in 2013 and 2013 about 32% and 16% respectively.

Table 5.9 Major Period of Overvaluation & Undervaluation of REER

First Model		Second Model	
Years	**Period of Overvaluation & undervaluation**	**Years**	**Period of Overvaluation & undervaluation**
1975-1980	REER remains undervalued about 31% to 59%, whereas 1976, 1979 and 1980 are period of overvaluation.	1975-1980	REER remains undervalued about 41% to 68%.
1986-1990	REER remains undervalued about 3% to 76%.	1986-1990	REER remains undervalued about 1% to 85%.
1991-1996	REER remains overvalued about 14% to 81%, whereas 1992 and 1994 account for 7% and 62% undervaluation respectively.	1991-1996	REER remains overvalued about 3% to 59%, whereas 1994 account for 69% undervaluation.
1997-2002	REER remains undervalued about 1% to 41%.	1997-2002	REER remains undervalued about 17% to 45%
2007-2009	REER remains undervalued about 21% to 22%,	2007-2009	REER remains undervalued about 13% to 53%,
2010- 2017	REER remains overvalued about 16% to 37%, whereas 2013 and 2014 account for 32% and 16% undervaluation respectively.	2010-2017	REER remains overvalued about 20% to 48%., whereas 2013 and 2014 account for 41% and 31% undervaluation respectively.

Whereas on the bases of second model the extent of overvaluation is greater as compare to first model due to incorporation of democracy impact on REER misalignments. Results of second model indicates that for the same period the extent of misalignments is 20% to 48% where similarly 2013 and 2014 is period of undervaluation and it is accounted as 41% and 31% respectively.

Figure 5.1 Actual REER and BEER for First and Second Model

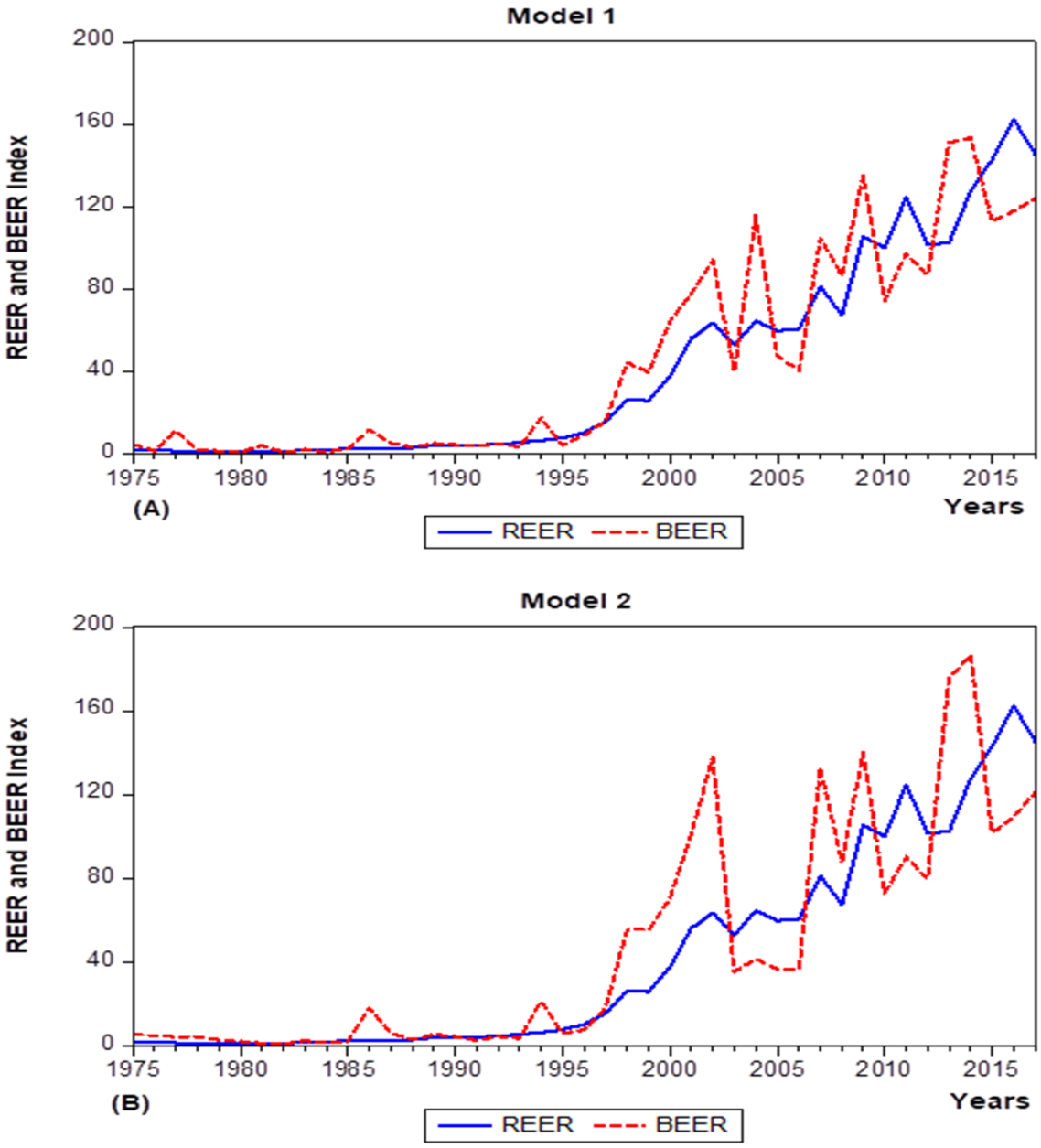
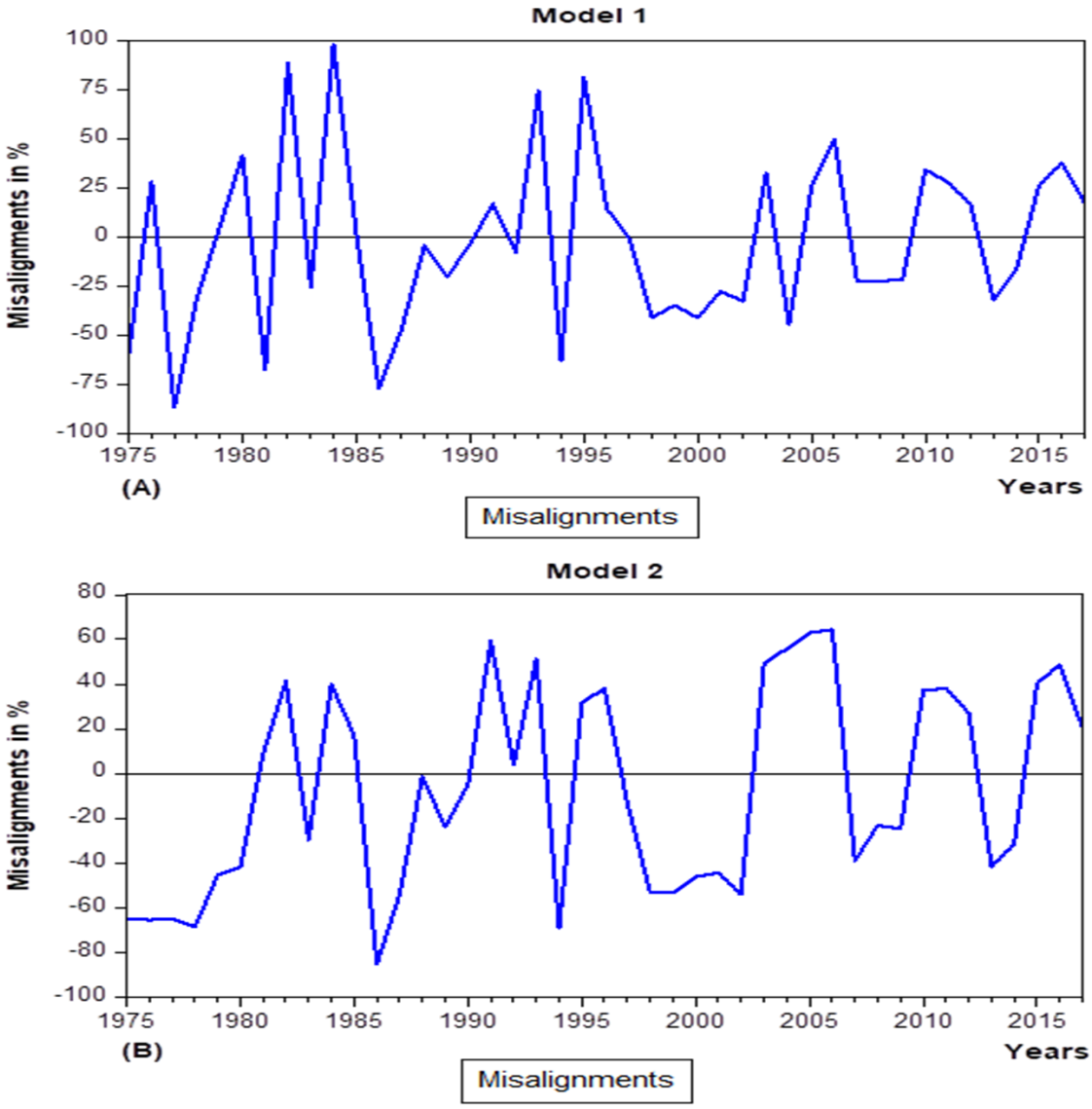


Figure 5.1 represents the trend of REER and BEER from 1975 to 2017. The figure 5.1 (A) show REER and BEER trend for first model whereas panel (B) show REER and BEER trend for second model. In both panel (A) and (B) a consequent overvaluation of REER is found after 2015 against the three major trading partners of Pakistan UK, USA and Japan. However extent of overvaluation is clearly greater in panel (B) due to

addition of democratic indicator. The next panel of two figures represents representing the misalignments of both models.

Figure 5.2 Misalignments of REER (1975-2017) for First and Second Model



The panel A and B of figure 5.2 provides the percentage deviation of REER from its equilibrium level where both panels present a clear picture of extent of misalignments. Similarly panel (A) represents the first model and panel (B) represents the second model of study. As mention above the extent of misalignment in second model is

greater than first model, this panel also depicts the similar kind of information. The extent of misalignment extended to 35% to 45% in both models respectively during 2015 and 2017 but in 2017 it is shrink and moves back towards its equilibrium level.

5.4 Diagnostic Test

Diagnostic test for VECM perform which shows the satisfactory results. All the necessary test for residual and parameter stability is perform which includes autocorrelation, normality and heteroskedasticity test. Table 5.10 depicts the diagnostic results as below;

Table 5.10: Residual Test

LM Autocorrelation Test		
Lag	LM- Stat	P-value
1	63.63	0.48
2	56.29	0.74
Joint LM Heteroskedasticity Test		
Chi-sq	Df	P-value
670.53	648	0.26
Joint Normality Test		
Jarque-Bera	Df	P-value
11.46161	16	0.3227

The first test show in table 5.10 is autocorrelation test, which indicate that there is no serial correlation problem exist at both lag in the models as study do not reject the null of no serial correlation because p-value at both lag 1 and 2 is greater than 0.05. Second test is joint LM heteroskedasticity test and it is also does not reject the null because p-value is greater than 0.05 and state that there is no heteroskedasticity issue in the

model. Finally the third test in in table 5.10 is joint normality test where decision is made on the basis of Jarque-Bera stats. The p-value of Jarque-Bera statistic is also greater than 0.05, thus we do not reject the null of normal distribution and conclude that all the series are normally distributed. So, the entire diagnostic test confirms the residual and parameters for this study is statistical significant and stable.

CHAPTER 6

CONCLUSION AND POLICY IMPLICATION

6.1 Conclusion

This study utilized the vector error correction (VECM) model to analyze the long run relationship of real effective exchange rate (REER) for Pakistan. The main objective of this study is to estimate the equilibrium exchange rate and assess the misalignments of RERR for Pakistan against its three major trading partner countries USA, UK and Japan which account for 16.13%, 7.44% and 3.8% share respectively in total trade of Pakistan. China becomes the 3rd largest trading partner of Pakistan according to recent trade statistic (2018) by Pakistan bureau of statistics but due to data limitation study does not includes China in the analysis. Moreover the objective of study also includes the identification of elapse of overvaluation and undervaluation and extent of misalignments which is not available in earlier studies conducted in Pakistan on equilibrium exchange rate for the period of 1973 to 2017. This study also incorporates the indicator of democratic effectiveness in second model which enable to made inference on the impact of democracy on REER.

The results of VECM long run model show that all the macroeconomic fundamentals of REER have significant impact in long run for both models excluding government consumption in second model which is statistically insignificant due to incorporation of democracy indicator in analysis. Whereas error correction term (ECT) represents how quickly REER revert to its equilibrium position. Moreover study found that the largest contributor in exchange rate misalignments is term of trade, relative price of tradable to

non-tradable and foreign exchange reserves. Currently Pakistan faces the overvaluation of exchange rate where extent of misalignments is around 7% to 24% percent.

One of important variable contributed in the exchange rate movement is foreign exchange reserves. The historical pattern of foreign exchange reserves and REER has direct relationship as whenever Pakistan faces the period of overvaluation the foreign exchange reserves touch its pick level. An important finding of study is after the flexible exchange regime in May 1999 REER remains overvalued during the period of democratic government. However the mid 90's also witness the period of undervaluation so, it can be inference on the bases of these result that democratic government in Pakistan use different tool to influence on REER and stabilizing it over the time to gain public confidence on its economic policies and performance.

Moreover when the role of democratic effectiveness added in second model study found that role of government consumption in exchange rate movement becomes insignificant. Thus insignificant of economic variable due to addition of DEMCY in analysis itself explains the impact of external forces other than economic fundamentals on equilibrium exchange rate. This kind of results provides some indication that SBP is not completely independent in exchange rate policy making and therefor democratic ruling government attempts to influence the exchange rate policy by maintaining its level for longer duration especially during the end of their tenure through different tools in which foreign exchange reserves is one of them.

This study also provides the extent of misalignments which indicates a serious deviation of REER from its equilibrium level. Especially in second model the extent of misalignments is about 48 % recorded during 2016 in second model of study whereas

about 37% overvaluation recorded in first model. But in 2017 both models show that REER moves towards it equilibrium level which is good indication for economy.

Concluding the above all discussion as real exchange rate is an important variable which play important role in the shape of economy specially the trade sector. Therefore a better policy on exchange rate which incorporates all the macroeconomic fundamentals can improves the economic health and prosperity of economy which in turn improves the living standards of resident of the country. Moreover, certain measure should be taken in regard to stabilized the exchange rate in Pakistan. First one is strengthening the local industry through vertical expansion so that trade deficit should be avoided or minimized.

Secondly, there should be policy continuation irrespective of government change to boost up investor confidence. Third including is to avoid heavily reliance on foreign exchange reserves accumulation policy through different temporary tools, government should boost up the confidence of international investor by providing them long run opportunities with market compatibility, which increases the foreign exchange reserves through foreign investment instead of debt accumulation. So, finally there should be need of appropriate policies and consensus of all the authorities on one page to move the Pakistan economy in right direction.

REFERENCES

Afridi, U. (1995). Determining Real Exchange Rates. *Pakistan Development Review*, Vol. 34(3), pp. 263–276.

Aizenman, J., & Crichton, D. (2008). Real Exchange Rate and International Reserves in an Era of Growing Financial and Trade Integration. T*he Review of Economics and Statistics*, Vol. 90(4), pp. 812-815.

Ajevskis, V., Rimgailaite, R., Rutkaste, U., & Tkacevs, O. (2012). The Assessment of Equilibrium Real Exchange Rate of Latvia. *Latvia Bank*, Working Paper. 4/2012.

Akhtar, K., Mujahid, M., Zuberi, M. A., & Shazib, M. (2014). Purchasing Power Parity: Implication with respect to Pakistan and USA. *Research Journal of Finance and Accounting*, Vol. 5(17), pp. 193-201.

Asea, P. K., & Mendoza, E. G. (1964). The Balassa-Samuelson Model: A General Equilibrium Appraisal. Review of International Economics, Vol. 2(3), pp. 244-267.

Balvers, R. J., & Bergstrand, J. H. (2000). Government Expenditures and Equilibrium Real Exchange Rates. *Center for Public Policy Studies*, Working Papers. 101/2000.

Bhatti, R. H. (1996). A Correct Test of Purchasing Power Parity: The Case of Pak-Rupee Exchange Rates. *Pakistan Development Review*, Vol. 35(4), pp. 671-682.

Calvo, G. A., & Darzen, A. (1997). Uncertain Duration of Reform: Dynamic Implication. *NBER Working Paper,* Working Paper No. *5925*.

Cassel, G. (1918). Abnormal Deviation in International Trade. *The Economic Journal,* Vol. 28(112), pp. 413-415.

Cheng, F., & Orden, D. (2005). Exchange Rate Misalignment and Its Effects on Agricultural Producer Support Estimate: Empirical Evidence from India and China. *International Food Policy Research Institute,* MTID Discussion Paper No. 81.

Chishti, S., & Hasan, M. A. (1993). What Determines the Behaviour of Real Exchange Rate in Pakistan? *The Pakistan Development Review*, Vol. 32(4), pp. 1015–1028.

Chou, K., & Lin, P. (2011). The Empirical Studies of Multilateral Exchange Rate Models in Taiwan. *International Journal of Economics and Finance*, Vol. 3(6), pp.

Clark, P. B., & MacDonald, R. (1998). Exchange Rate and Economic Fundamentals: A Methodological Comparison of BEERs and FEERs. *International Monetary Fund Working Paper,* WP/98/67.

Edward, S., & Wijnbergen, S. V. (1987). Tariffs, the Real Exchange Rate and the Term of Trade: on Two Popular Prepositions in International Economic. *NBER Working Paper Series,* W/P No. 2365.

Edwards, S. (1986a). Term of Trade, Exchange Rate and Labor Markets Adjustment in Developing Countries. *UCLA Economics Working Paper,* W/P No. 425.

Edwards, S. (1986c). Real Exchange Rate Variability: An Empirical Analysis of Developing Countries Case. *NEBR Working Paper,* W/P No. 1930.

Edwards, S. (1988). Real and Nominal Determinants of Real Exchange Rates: The Empirical Evidence. *UCLA Working Paper,* W/P, No. 511.

Edwards, S. (1989). Real Exchange Rate, Devaluation, and Adjustment, (*Cambridge, MA: MIT Press).*

Egert, B. (2002). Equilibrium Real Exchange Rate in Central Europe's Transition Economies: Knocking on Heaven's Door. *William Davidson Working Paper No. 480.*

Elbadawi, I. (1994). Estimating Long-Run Equilibrium Real Exchange Rate in J. Williamson (ed.). Fundamental Equilibrium Exchange Rates *(Williamson, DC: International Economics Institute).*

Engel, F, R., & Granger, C. W. J. (1987). Co-Integration and Error Correction: Representation, Estimation, and Testing. *Econometrica,* Vol. 55(2), pp. 251-276.

Fida, B. A., Shah, Z. A., & Zakaria, M. (2012). Estimating Equilibrium Real Exchange Rate through NATREX Approach: A Case of Pakistan. *Journal of Basic and Applied Scientific Research,* Vol. 2(4), pp. 3642-3645.

Fleming, J. M. (1962). Domestic Financial Policies under Fixed and Floating Exchange Rates. *IMF Staff Paper, Palgrave Macmillan,* Vol. 9(3), pp. 369-380.

Frenkel, J. A. (1976). The Monetary Approach to Exchange Rate: Doctrinal Aspects and Empirical Evidence. *The Scandinavian Journal of Economics,* Vol. 78(2), pp. 200-224.

Frenkel, J. A., & Razin, A. (1986). Fiscal Policies in the World Economy. *Journal of Political Economy,* Vol. 94(3), pp. 564-594.

Ghura, D. & Grennes, T. J. (1993). The Real Exchange Rate and Macroeconomic Performance in Sub-Saharan Africa. *Journal of Development Economics,* Vol. 42(1), pp.155-174

Gregorio, J., & Wolf, H. (1994). Terms of Trade, Productivity and Real Exchange Rate. *NBER Working Paper,* W/P No.4807.

Hallwood, P., & MacDonald, R. (1986). *International Money: Theory, Evidence and Institutions.* Basil Blackwell Ltd, T.J. Press, Padstow.

Hinnosaar, M., Kaadu, H., & Uuskiila, L. (2005). Estimating the Equilibrium Exchange Rate of the Estonian Kroon. *Working Papers of EestiPank,* Vol. (2).

Hussain, S. (2009). Misalignment of Real Exchange Rate with Its Equilibrium Path: Case of Pakistan. *SBP Research Bulletin,* Vol. 5(2).

Hyder, Z., & Mahboob, A. (2006). Equilibrium Real Effective Exchange Rate and Exchange Rate Misalignment in Pakistan. *SBP Research Bulletin,* Vol. 2(1).

Javed, S. A., Ahmed, V., & Ali, W. (2016). Political Economy of Exchange Rate Misalignment: A Synthesis of Lessons for Pakistan. *SDPI, Monetary Policy Brief, No. 55*.

Jeong, S., & Mazier, J. (2003). Exchange Rate Regimes and Equilibrium Exchange Rates in East Asia. *Revue Economique*, Vol. 54(5), pp. 1161-1182.

Johansen, S. (1996). *Likelihood based Inference in Cointegrated Vector Autoregressive Models.* Oxford University Press, Oxford

Jongwanich, J. (2009). Equilibrium Real Exchange Rate, Misalignments, and Export Performance in Developing Asia. *Asian Development Bank, Economics Working Paper Series No. 151*.

Khan, M. A., & Qayyum, A. (2007). Exchange Rate Determination in Pakistan: Evidence Based On Purchasing Power Parity Theory. *Pakistan Economic and Social Review,* Vol.45, pp. 181-202.

Khan, N. F., & Ahmad, E. (2005). Test of Purchasing Power Parity Based On Cointegration Technique: The Asian Evidence. *Pakistan Economic and Social Review,* Vol. XLIII, (2) (Winter 2005), pp. 167-183.

Krugman, P.R. (1978). Purchasing Power Parity and Exchange Rates: Another Look at the Evidence. *Journal of International Economics,* Vol. 8, pp. 397-407.

MacDonald, R. (1999). Exchange Rate Behaviour: Are Fundamentals Important? *The Economic Journal, Royal Economic Society,* Vol. 109, pp. 673-691.

MacDonald, R. (2007). *Exchange Rate Economics: Theories and Evidence*, Madison Ave, New York, NY, Routledge: Taylor & Francis Group.

Mendoza, G. E. (1995). The Term of Trade, the Real Exchange Rate, and Economic Fluctuation. *International Economic Review,* Vol. 36(1), pp. 101-137.

Minhaj, S., & Fatima, K. (2016). Economic Integration of Pakistan: An Empirical Test of Purchasing Power Parity. *International journal of Business and Management Invention*, Vol. 5(7), pp. 01-08.

Mongardini, J. (1998). Estimating Egypt's Equilibrium Real Exchange Rate. *IMF Working Paper,* WP/98/5.

Mundell, R. A. (1962). The Appropriate Use of Monetary and Fiscal Policy for Internal and External Stability, *IMF Staff Paper, Palgrave Macmillan,* Vol. 9(1), pp. 70-79.

Mussa, M. L. (1986). Nominal Exchange Rate Regime and Behavior of Real Exchange Rate: Evidence and Implication. *Carnegie-Rochester Conference Series on Public Policy, Elsevier,* Vol. 25, pp. 117-214.

Obstfeld, M. (1986). Capital Mobility in the World Economy: Theory and Measurement. *Carnegie,* Vol. 24, pp. 55-103.

Peter, I. (1977). How Far can we Push the "Law of One Price? *The American Economic Review*, Vol. 67, No. 5, pp. 942-948.

Pinto, B. (1988). Black Markets for Foreign Exchange, Real Exchange Rate, and Inflation: Overnight Versus gradual Reform in Sub-Saharan Africa. *Policy Research Working Paper Series,* W/P, No. 84.

Polak, J. (1943). European Exchange Depreciation in Early Twenties. *Econometrica,* Vol. 11(2), pp.151-162.

Qayyum, A., Khan, A., & Zaman, K. (2004). Exchange Rate Misalignment in Pakistan: Evidence from Purchasing Power Parity Theory. *Pakistan Development Review,* Vol. 43(4), pp. 721-735.

Rahman, A., & Basher, S. A. (2001). Real Exchange Rate Behaviour and Exchange Rate Misalignments in Bangladesh. *The Bangladesh Development Studies,* Vol. 27(2), pp. 69-93.

Rogoff, K. (1996). The Purchasing Power Parity Puzzle. *Journal of Economic Literature,* Vol. 34(2), pp. 647-658.

Saayman, A. (2007). The Real Equilibrium South African Rand/US Dollar Exchange Rate: A Comparison of Alternative Measures. *International Advance in Economic Research,* Vol. 13(2), pp. 183-199.

Samuelson, P. A. (1964). Factor of Balassa-Samuelson Thirty Years Later. *Review of International Economics, Wiley Blackwell,* Vol. 2(3), pp. 201-226.

Serven, L., & Solimano, A. (1991). Adjustment Policies and Investment Performance in Developing Countries: Theory, Country Experiences, and Policy Implication. *PRE Working Paper,* W/P, No. 606.

Shatz, H., & Tarr, G. D. (2001). Exchange rate overvaluation and trade protection: lessons from experience. In Globalization under Threat: The Stability of Trade Policy and Multilateral Agreement, *Edited by: Drabek, Z. 43–74. Cheltenham, UK: Edgar Elgar.*

Siddiqui, R., Afridi, U., & Mahmood, Z. (1996). Exchange Rate Determination in Pakistan: A Simultaneous Equation Model. *The Pakistan Development Review*, Vol. 35(4) Part II (Winter 1996), pp. 683—692.

Wren-Lewis, S. (1992). On the Analytical Foundations of the Fundamental Equilibrium Exchange Rate. In: Macroeconomic Modeling of the long-run, (ed.) by *C. P. Hargreaves, Aldershot, England: Edward Elgar*, pp. 323-338.

Zakaria, M., & Ghauri, A. B. (2011). Trade Openness and Real Exchange Rate: Some Evidence from Pakistan. *The Romanian Economic Journal*, Vol. 39.

Appendix

Appendix 1: Coefficient of VECM Estimates (First model)

Vector Error Correction Estimates
Sample (adjusted): 1975 2017
Included observations: 43 after adjustments
Standard errors in ( ) & t-statistics in [ ]

Cointegrating Eq:	CointEq1
LNREER_2(-1)	1.000000
ID(-1)	-0.163977 (0.02164) [-7.57653]
LNTOT(-1)	3.793053 (0.55262) [6.86382]
LNTOP(-1)	-0.129957 (0.23062) [-0.56352]
LNRTNT(-1)	9.945490 (1.34431) [7.39821]
LNGC(-1)	-0.810188 (0.17324) [-4.67678]
LNFOREX(-1)	0.587703 (0.13018) [4.51463]
C	-63.98214

Error Correction:	D(LNREER_2)	D(ID)	D(LNTOT)	D(LNTOP)	D(LNRTNT)	D(LNGC)	D(LNFOREX)
CointEq1	-0.177352 (0.04919) [-3.60542]	0.760576 (0.57422) [1.32453]	-0.153149 (0.03255) [-4.70517]	0.049300 (0.02956) [1.66769]	0.003828 (0.01594) [0.24016]	0.026823 (0.10158) [0.26405]	0.022563 (0.16927) [0.13329]
D(LNREER_2(-1))	0.045295 (0.16123) [0.28093]	3.359740 (1.88210) [1.78510]	-0.058562 (0.10669) [-0.54893]	-0.042015 (0.09689) [-0.43362]	0.022385 (0.05224) [0.42852]	-0.419900 (0.33295) [-1.26114]	0.352942 (0.55482) [0.63614]
D(ID(-1))	0.000605 (0.01332) [0.04539]	0.296342 (0.15550) [1.90569]	-0.014473 (0.00881) [-1.64195]	-0.000344 (0.00801) [-0.04300]	-0.001398 (0.00432) [-0.32382]	-0.021634 (0.02751) [-0.78643]	0.007760 (0.04584) [0.16929]
D(LNTOT(-1))	0.168008 (0.21457) [0.78298]	-0.073558 (2.50482) [-0.02937]	0.191718 (0.14198) [1.35029]	0.103166 (0.12895) [0.80003]	-0.115153 (0.06952) [-1.65637]	-0.185100 (0.44311) [-0.41773]	-0.213223 (0.73838) [-0.28877]

D(LNTOP(-1))	0.678302	0.136640	0.241197	0.148213	-0.055304	0.028668	-0.197377
	(0.31786)	(3.71052)	(0.21033)	(0.19102)	(0.10299)	(0.65641)	(1.09381)
	[2.13397]	[0.03682]	[1.14677]	[0.77589]	[-0.53701]	[0.04367]	[-0.18045]
D(LNRTNT(-1))	1.258075	13.34762	0.691164	-0.048257	-0.224910	-0.205297	0.321594
	(0.60657)	(7.08079)	(0.40137)	(0.36453)	(0.19653)	(1.25262)	(2.08732)
	[2.07408]	[1.88505]	[1.72202]	[-0.13238]	[-1.14442]	[-0.16389]	[0.15407]
D(LNGC(-1))	0.026862	0.848988	-0.066096	0.003697	0.002513	-0.088579	0.057146
	(0.07749)	(0.90455)	(0.05127)	(0.04657)	(0.02511)	(0.16002)	(0.26665)
	[0.34666]	[0.93858]	[-1.28909]	[0.07938]	[0.10011]	[-0.55355]	[0.21431]
D(LNFOREX(-1))	0.107582	1.060012	0.036953	-0.003392	0.019694	0.133297	-0.237604
	(0.06476)	(0.75598)	(0.04285)	(0.03892)	(0.02098)	(0.13374)	(0.22285)
	[1.66123]	[1.40217]	[0.86234]	[-0.08716]	[0.93858]	[0.99672]	[-1.06619]
C	0.028678	-0.454795	-0.018176	0.075862	-0.006267	0.159528	0.087601
	(0.04402)	(0.51386)	(0.02913)	(0.02645)	(0.01426)	(0.09090)	(0.15148)
	[0.65148]	[-0.88506]	[-0.62401]	[2.86769]	[-0.43939]	[1.75492]	[0.57831]
R-squared	0.363136	0.343935	0.461941	0.181922	0.159759	0.170964	0.081069
Adj. R-squared	0.213286	0.189567	0.335339	-0.010567	-0.037944	-0.024104	-0.135150
Sum sq. resids	0.891876	121.5363	0.390505	0.322115	0.093625	3.803495	10.56135
S.E. equation	0.161962	1.890660	0.107170	0.097334	0.052475	0.334466	0.557340
F-statistic	2.423324	2.228020	3.648761	0.945106	0.808075	0.876435	0.374939
Log likelihood	22.31164	-83.35313	40.06819	44.20764	70.77335	-8.870842	-30.82837
Akaike AIC	-0.619146	4.295494	-1.445032	-1.637565	-2.873179	0.831202	1.852483
Schwarz SC	-0.250523	4.664118	-1.076409	-1.268942	-2.504556	1.199825	2.221106
Mean dependent	0.097914	0.062161	-0.015775	0.083419	-0.003567	0.121846	0.094851
S.D. dependent	0.182602	2.100172	0.131454	0.096824	0.051507	0.330507	0.523111

Determinant resid covariance (dof adj.)	2.15E-10
Determinant resid covariance	4.15E-11
Log likelihood	86.85385
Akaike information criterion	-0.783900
Schwarz criterion	2.083170

Appendix 1: VECM Estimates of Second Model

Vector Error Correction Estimates
Sample (adjusted): 1975 2017
Included observations: 43 after adjustments
Standard errors in ( ) & t-statistics in [ ]

Cointegrating Eq:	CointEq1
LNREER_2(-1)	1.000000
ID(-1)	-0.187950 (0.02747) [-6.84105]
LNTOT(-1)	4.652216 (0.81955) [5.67653]
LNTOP(-1)	-0.877900 (0.39436) [-2.22614]
LNRTNT(-1)	12.57674 (1.99907) [6.29130]
LNGC(-1)	-0.427155 (0.24998) [-1.70872]
LNFOREX(-1)	1.049363 (0.17578) [5.96988]
DEMCR(-1)	0.077680 (0.03135) [2.47796]
C	-80.34342

Error Correction:	D(LNREER_2)	D(ID)	D(LNTOT)	D(LNTOP)	D(LNRTNT)	D(LNGC)	D(LNFOREX)	D(DEMCR)
CointEq1	-0.120173 (0.03819) [-3.14644]	0.877990 (0.41600) [2.11054]	-0.118844 (0.02362) [-5.03176]	0.034904 (0.02234) [1.56238]	-3.72E-05 (0.01192) [-0.00312]	-0.061983 (0.07162) [-0.86547]	-0.055610 (0.12601) [-0.44131]	-0.526543 (0.52210) [-1.00850]
D(LNREER_2(-1))	0.033289 (0.17268) [0.19278]	3.694401 (1.88084) [1.96423]	-0.066778 (0.10679) [-0.62535]	-0.038010 (0.10101) [-0.37631]	0.013753 (0.05389) [0.25520]	-0.338340 (0.32380) [-1.04490]	0.398934 (0.56973) [0.70022]	-2.329068 (2.36054) [-0.98667]
D(ID(-1))	0.011039 (0.01360) [0.81193]	0.252803 (0.14808) [1.70717]	-0.006189 (0.00841) [-0.73608]	-0.003215 (0.00795) [-0.40431]	-0.001300 (0.00424) [-0.30633]	-0.030387 (0.02549) [-1.19195]	0.001352 (0.04486) [0.03014]	0.080029 (0.18585) [0.43061]
D(LNTOT(-1))	0.126956 (0.23013)	0.294656 (2.50654)	0.168999 (0.14231)	0.114623 (0.13461)	-0.125835 (0.07182)	-0.009530 (0.43152)	-0.097001 (0.75926)	-1.144806 (3.14583)

	[0.55168]	[0.11755]	[1.18754]	[0.85153]	[-1.75205]	[-0.02209]	[-0.12776]	[-0.36391]
D(LNTOP(-1))	0.462196	0.439655	0.111934	0.204574	-0.061551	0.520631	0.177476	2.952130
	(0.32196)	(3.50680)	(0.19910)	(0.18833)	(0.10048)	(0.60372)	(1.06225)	(4.40120)
	[1.43557]	[0.12537]	[0.56220]	[1.08628]	[-0.61255]	[0.86237]	[0.16708]	[0.67076]
D(LNRTNT(-1))	1.080347	13.69581	0.630485	-0.003293	-0.255195	0.686065	0.967257	-7.919400
	(0.65243)	(7.10628)	(0.40346)	(0.38163)	(0.20362)	(1.22340)	(2.15257)	(8.91871)
	[1.65588]	[1.92728]	[1.56268]	[-0.00863]	[-1.25329]	[0.56079]	[0.44935]	[-0.88795]
D(LNGC(-1))	0.039241	0.784321	-0.056610	0.000268	0.003158	-0.105120	0.045752	0.001314
	(0.08113)	(0.88368)	(0.05017)	(0.04746)	(0.02532)	(0.15213)	(0.26767)	(1.10905)
	[0.48367]	[0.88757]	[-1.12834]	[0.00566]	[0.12470]	[-0.69098]	[0.17092]	[0.00118]
D(LNFOREX(-1))	0.105701	0.670256	0.050118	-0.004450	0.023476	0.203700	-0.172083	0.701978
	(0.06966)	(0.75877)	(0.04308)	(0.04075)	(0.02174)	(0.13063)	(0.22984)	(0.95229)
	[1.51732]	[0.88335]	[1.16339]	[-0.10922]	[1.07979]	[1.55939]	[-0.74871]	[0.73715]
D(DEMCR(-1))	0.010808	-0.112136	0.006465	-0.003074	0.002995	-0.044374	-0.028687	0.135307
	(0.01396)	(0.15207)	(0.00863)	(0.00817)	(0.00436)	(0.02618)	(0.04606)	(0.19086)
	[0.77412]	[-0.73739]	[0.74882]	[-0.37641]	[0.68737]	[-1.69496]	[-0.62276]	[0.70895]
C	0.045814	-0.464370	-0.009260	0.071479	-0.005516	0.109823	0.049790	-0.181379
	(0.04570)	(0.49781)	(0.02826)	(0.02673)	(0.01426)	(0.08570)	(0.15079)	(0.62478)
	[1.00239]	[-0.93282]	[-0.32763]	[2.67372]	[-0.38670]	[1.28144]	[0.33019]	[-0.29031]
R-squared	0.322856	0.392711	0.500332	0.175989	0.171055	0.273229	0.101853	0.081731
Adj. R-squared	0.138180	0.227086	0.364059	-0.048742	-0.055021	0.075018	-0.143096	-0.168707
Sum sq. resids	0.948285	112.5006	0.362642	0.324451	0.092366	3.334319	10.32248	177.2046
S.E. equation	0.169517	1.846377	0.104829	0.099156	0.052905	0.317868	0.559287	2.317291
F-statistic	1.748232	2.371091	3.671542	0.783110	0.756626	1.378477	0.415812	0.326352
Log likelihood	20.99309	-81.69217	41.65973	44.05226	71.06434	-6.040329	-30.33652	-91.46062
Akaike AIC	-0.511306	4.264752	-1.472546	-1.583826	-2.840202	0.746062	1.876117	4.719098
Schwarz SC	-0.101725	4.674333	-1.062964	-1.174245	-2.430620	1.155643	2.285698	5.128680
Mean dependent	0.097914	0.062161	-0.015775	0.083419	-0.003567	0.121846	0.094851	-0.023256
S.D. dependent	0.182602	2.100172	0.131454	0.096824	0.051507	0.330507	0.523111	2.143521

Determinant resid covariance (dof adj.)	8.82E-10
Determinant resid covariance	1.06E-10
Log likelihood	5.659172
Akaike information criterion	3.829806
Schwarz criterion	7.434122

Appendix 2: REER Misalignments from 1975-2017

First Model				Second Model			
Years	REER	BEER	Misalignments %	Years	REER	BEER	Misalignments %
1975	1.873946	4.611081	-59.35993438	1975	1.873946	5.300367	-64.64496873
1976	1.743874	1.358257	28.39058181	1976	1.743874	5.038298	-65.38763887
1977	1.501997	11.35139	-86.76817	1977	1.501997	4.281777	-64.92118601
1978	1.407752	2.041217	-31.03369486	1978	1.407752	4.483398	-68.60078791
1979	1.522115	1.445913	5.270155832	1979	1.522115	2.787743	-45.3997305
1980	1.30782	0.922685	41.74061669	1980	1.30782	2.252426	-41.93726631
1981	1.33195	4.12611	-67.71899862	1981	1.33195	1.222809	8.925361171
1982	1.447346	0.768066	88.44032916	1982	1.447346	1.024688	41.24756507
1983	1.722651	2.308123	-25.36569052	1983	1.722651	2.440809	-29.42293242
1984	2.042087	1.031843	97.90680299	1984	2.042087	1.459297	39.93637189
1985	2.461139	2.395169	2.754309375	1985	2.461139	2.100289	17.18098659
1986	2.70532	11.73267	-76.94199227	1986	2.70532	18.2704	-85.19288359
1987	2.814234	5.288534	-46.7861152	1987	2.814234	6.152967	-54.26216177
1988	2.98588	3.115139	-4.149387	1988	2.98588	3.022996	-1.227801058
1989	4.208356	5.25988	-19.99140678	1989	4.208356	5.53456	-23.9622375
1990	4.27331	4.433674	-3.616961202	1990	4.27331	4.485821	-4.737389255
1991	4.318669	3.691665	16.98432272	1991	4.318669	2.708991	59.41981688
1992	4.72408	5.112274	-7.593373722	1992	4.72408	4.546698	3.901335506
1993	5.536713	3.172338	74.5309776	1993	5.536713	3.657067	51.3976285
1994	6.57627	17.62291	-62.68340288	1994	6.57627	21.351	-69.19924936
1995	7.835686	4.320584	81.35710963	1995	7.835686	5.945181	31.79893857
1996	10.44959	9.115255	14.63846916	1996	10.44959	7.568801	38.0613516
1997	15.77081	15.90172	-0.823265147	1997	15.77081	18.12816	-13.00380715
1998	26.16	44.28899	-40.93339657	1998	26.16	55.38913	-52.77051119
1999	25.943	39.6969	-34.64727629	1999	25.943	55.49649	-53.25289257
2000	37.904	64.38795	-41.13184577	2000	37.904	70.40901	-46.16598732
2001	56.27187	77.7781	-27.65075854	2001	56.27187	101.1956	-44.39297417
2002	63.44534	93.96162	-32.47738362	2002	63.44534	137.8289	-53.9680448
2003	52.94545	39.92562	32.61022265	2003	52.94545	35.42397	49.46221201
2004	64.64185	115.9	-44.22619342	2004	64.64185	41.49252	55.79157439
2005	59.78514	47.45822	25.97426136	2005	59.78514	36.70302	62.88889843
2006	60.54908	40.47248	49.60557239	2006	60.54908	36.83153	64.39468653
2007	81.21031	104.8153	-22.52055131	2007	81.21031	132.9605	-38.92149462
2008	67.42887	86.63734	-22.17112072	2008	67.42887	87.81606	-23.21579302
2009	105.4572	134.8878	-21.81862332	2009	105.4572	139.9314	-24.63652182
2010	100	74.45793	34.30403318	2010	100	72.91886	37.13874009
2011	124.6315	97.39221	27.9686583	2011	124.6315	90.24904	38.09732615
2012	101.4056	86.97177	16.59601982	2012	101.4056	79.72891	27.18800641
2013	102.6823	151.106	-32.04619111	2013	102.6823	175.5664	-41.51371135
2014	127.638	153.3375	-16.76010392	2014	127.638	186.6053	-31.60001494
2015	142.9141	113.0093	26.46230692	2015	142.9141	101.8538	40.31300697
2016	162.3644	117.8666	37.7526838	2016	162.3644	109.2047	48.67895641
2017	145.3722	123.8191	17.40689373	2017	145.3722	120.9496	20.19234422