DETERMINANTS OF REAL EFFECTIVE EXCHANGE RATE FLUCTUATIONS IN KENYA

BY

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DECLARATION

I declare that this thesis is my original work and that it has not been presented for an award for any degree in any university within and without Kenya.

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DEDICATION

Dedicated to my dear friend and wife Margaret, my sons; Fabregas and Lenny, my father Richard, my mother Edna, Gladys and my close friend Evans.

ABSTRACT

Economic growth in any country is important as it has a significant role in the standards of living of the people. Exchange rates play an important role in economic growth especially through foreign trade. Exchange rates in Kenya have been experiencing fluctuations since the transition of the fixed exchange rate regime of the 1960s to the crawling peg of the 1970s to 1980s and lately the floating exchange rate of the 1990s to date leading to the country losing its nominal anchor on the global market and thus its exports became less competitive. The exchange rate has oscillated between Kshs. 7.142 in 1960s to Kshs. 102.35 per unit US dollar in 2015. The magnitude of exchange rate fluctuations in most developing economies has attracted the interest of many scholars including economists and policy makers. These scholars have however differed on the determinants of real effective exchange rate. The purpose of this study therefore was to examine the determinants of real effective exchange rate fluctuations in Kenya. The specific objectives for the study were; to examine the relationship between money supply and real effective exchange rate fluctuations in Kenya, to evaluate the relationship between external debt on real effective exchange rate fluctuations in Kenya, to determine the relationship between trade balance and real effective exchange rate fluctuations in Kenya and to examine the relationship between inflation real effective exchange rate fluctuations in Kenya. The study was anchored on the balance of payments theory of exchange rate determination; which focuses on the balance of payments in the sense of demand and supply of foreign exchange in the market. The study used annual time series data for the period 1972-2015; during this period Kenya adopted the crawling exchange rate from the initial fixed exchange rate regime and that Kenya experienced the highest depreciation in its currency. The study used correlational study design to establish the relationship between the real effective exchange rate fluctuations and money supply, external debt, trade balance and inflation. Hypotheses were tested at 5% level of significance. The study employed cointegration and ECM to test both the long run and short run dynamics between the dependent and independent variables respectively. Coefficient of determination(R^2) was to determine the goodness of fit, it established a 75.84% of the variations in real exchange rate fluctuations are explained by the independent variables and therefore the model was a good fit. From the ECM results, the vector of real effective exchange rate fluctuations in Kenya is error correcting at -11.4179 thus real effective exchange rate fluctuations in Kenya adjust to short run shocks caused by money supply, external debt, trade balance and inflation though not significantly. The study concluded that there exists a positive significant relationship between money supply, trade balance, inflation rate and real effective exchange rate fluctuations in Kenya. However, external debt has a negative but significant relationship with real effective exchange rate fluctuations in Kenya. A deficit trade balance leads to depreciation of the shilling by 0.2951. An increase in money supply also leads to depreciation in the Kenyan shilling by 7.1363 same to an increasing inflation rate (0.1678). An increasing debt burden depreciates the Kenyan shilling by 2.4061. These results are in conformity with the balance of payments theory of exchange rate determination. The study recommends that policy makers should formulate sound credit control policies to control money supply, export promoting policies should be to make the local products globally competitive, inflation rate should be maintained within the set limits and the government should reduce debt burden as much as possible.

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ABBREVIATIONS AND SYMBOLS

AR	Autoregressive
BG	Breusch-Godfrey
BOP	Balance of Payments
CBR	Central Bank rate
CBK	Central Bank of Kenya
ECM	Error Correction Model
GDP	Gross Domestic Product
IMF	International Monetary Fund
JB	Jarque Bera
KIPPRA	Kenya Institute for Public Policy Research and Analysis
Ksh	Kenya shilling
KTB	Kenya Tourism Board
MPC	Monetary Policy Committee
OLS	Ordinary Least Square
PKR	Pakistani
PKR/US	Pakistani rupee to US dollar
PPP	Purchasing Power Parity
RER	Real effective exchange Rate
US	United States
VIF	Variance Inflation Factor

OPERATIONAL DEFINITION OF TERMS

Biased	Unreliable findings with nonzero mean and non-constant variance.
External debt	Total external debt is debt owed to nonresidents repayable in currency, goods, or services. Total external debt is the sum of public, publicly guaranteed, and private nonguaranteed long-term debt, use of IMF credit, and short-term debt. Short-term debt includes all debt having an original maturity of one year or less and interest in arrears on long-term debt.
Exchange rate	Exchange rate is a price at which one currency may be converted into another.
Inflation rate	Inflation as measured by the consumer price index reflects the annual percentage change in the cost to the average consumer of acquiring a basket of goods and services that may be fixed or changed at specified intervals, such as yearly.
Money supply	Money supply measured as annual growth in broad money (M_3) is the sum of currency outside banks; demand deposits other than those of the central government; the time, savings, and foreign currency deposits of resident sectors other than the central government; bank and traveler's checks; and other securities such as certificates of deposit and commercial paper.
Nominal exchange rate	Nominal exchange rate refers to home currency price of a unit of foreign exchange.

Official exchange rate	Official exchange rate refers to the exchange rate determined by national authorities or to the rate determined in the legally sanctioned exchange market.
Real effective exchange rate	Real effective exchange rates are nominal exchange rate that has been adjusted for the different rates of inflation between currencies of two countries, for example between Kenya shilling and a foreign currency.
Real effective exchange rate fluctuations	Real effective exchange rate fluctuations refer to the misalignment or deviation of the exchange rate from the equilibrium real effective exchange rate
Trade balance	Trade balance is the difference between the exports and the imports of a country in a year. Trade balance will be computed as; $T = Exports(X) - \text{Im}\ ports(M)$
Volatility	Volatility represents the magnitude to which a variable changes over time. The larger the magnitude of change, or the quicker it changes over time, the more volatile it is. Fixed exchange rate by definition are not supposed to change, they are not volatile. However, floating exchange rates are free to change over time hence they are generally expected to be volatile.

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CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

According to the World Bank (2013) real effective exchange rates are nominal exchange rate that has been adjusted for the different rates of inflation between Kenya shillings and a foreign currency. In practice, changes of the real effective exchange rate rather than its absolute level are important. An increase in the real effective exchange rate is termed appreciation while a decrease is depreciation.

An exchange rate fluctuation is a measure that is not directly observable thus; there is no clear, right or wrong, measure of fluctuations. Most empirical studies have utilized the standard deviation of the moving average of the logarithm of the exchange rate fluctuations (defined as the standard deviation of the moving average of the logarithm of real effective exchange rate). The main criticism for such a measure is that it fails to capture the potential effects of high and low peak values of the exchange rate. However, it gives a near accurate measure of the exchange rate fluctuations since in the average the lows and the highs are inclusive; thus the reason why it is widely used (Serenisa & Tsounisb, 2012). This study adopted the standard deviation of the moving average of the logarithm of the real effective exchange rate as a measure of fluctuations.

In the 1990s, the Kenyan Government liberalized the financial, foreign exchange and domestic goods markets. The liberalization of the foreign exchange market in Kenya was gradual, from a fixed exchange rate regime up to 1972 to crawling peg during the period 1983 to 1993 before a floating exchange rate regime was adopted in 1993. Following the liberalization of the foreign exchange market, Kenya attained monetary independence to control inflationary pressures but

lost the nominal anchor to tie domestic prices down and thus globalization effects were transmitted directly into the country ((Ndung'u, 2001).

At the initial stages following liberalization in mid-1992, there was virtually no intervention by Central Bank of Kenya (CBK) in the foreign exchange market. The stated exchange rate policy of the CBK had been and continues to be to pursue a market determined exchange rate, intervening only to smooth out erratic movement, service external obligations and achieve targeted level of foreign exchange reserves. However, there were instances where depreciation pressures emanating from speculative tendencies occasioned by fragile donor relations and large food importation to mitigate adverse effects of drought could have led CBK to intervene in the foreign exchange market to reduce pressures on the economy. The exchange rate has been volatile attributed to various factors including the debt crisis in the euro zone, pressures from Kenya's balance of payment. This forced the cost of living to rise above the income and expectation of ordinary Kenyans (Kamaan, 2014).

Kenya, just like other developing countries has experienced a combination of exogenous shocks such as worsening terms of trade mainly on account of fluctuations in international commodity prices, oil price shocks and fluctuations in capital flows, which have created macroeconomic management policy challenges. External shocks require appropriate fiscal and monetary policies and the adoption of a flexible exchange rate regime to prevent emergence of unsustainable current account deficits, growing foreign debt burdens and steady losses of international competitiveness. Though external shocks have major effects on the real effective exchange rate, domestic shocks also play a role (Kiptui & Kipyegon, 2008).

Otuori (2013) observed that exchange rates in Kenya had been fluctuating over years with a rising trend; the exchange rate for the US dollar was 63.3 in 2007, 78.0 in 2008, 75.4 in 2009,

80.6 in 2010 and 80.6 in 2011. This showed a weakening shilling from 2007 to 2011 which may have been caused by a number of factors such as interest rates, inflation rates, terms of trade, and public debt. However, few empirical studies have been done to evaluate the relationship between money supply, external debt, trade balance, inflation and real effective exchange rate in Kenya.

Few studies in Kenya have attempted to estimate the *RER* equilibrium path, and use it to provide any evidence on the nature and extent of exchange rate fluctuations, and the implications of such fluctuations on Kenya's economic growth. Musyoki *et al*. (2012) examined and provided a deep understanding of equilibrium real effective exchange rate by not only investigating factors that determine real effective exchange rate behavior, but also measuring real effective exchange rate deviations from the equilibrium path. The conclusion drawn from these results was that the adoption of the floating exchange rate regime had not achieved the intended purpose for which it was established, namely to reduce real effective exchange rate fluctuations. Although declining, and generally exhibiting an appreciating trend, real effective exchange rate fluctuations continued to hamper the country's economic growth, however, this study left out the effect of money supply, external debt, trade balance and inflation on real effective exchange rate in Kenya. It was against this background that this study sought to examine the determinants of real effective exchange rate fluctuations in Kenya.

The Kenyan economy has stabilized and could again be in a position for a takeoff (World Bank, 2013). The gross domestic product (GDP) growth in 2012 was 4.6 percent, and was projected to grow to 5.7 and 6 percent in 2013 and 2014, respectively. Despite the optimism, risks may not be assumed. The economy is still vulnerable to exogenous shocks as the large current account deficit threatens macroeconomic stability, eroding Kenya's competitiveness and stifling the

export sector, which is supposed to be at the center point for poverty reduction (WorldBank, 2013). The CBK has on several occasions intervened in the money market to control and smooth the exchange rate fluctuations. This has been majorly because the exchange rate market has a great impact on economic growth of the country. The CBK has majorly been targeting commercial banks through credit control measures by adjusting the central bank rate (CBR), (Central Bank of Kenya, 2015). However, they have not determined the exact factors that affect the RER fluctuations; thus, this study sought to determine the effect of money supply, external debt, trade balance and inflation on exchange rate in Kenya.

Most scholars have studied the effect of exchange rate on money supply and ignored the fact that an increase or a decrease in money supply in the economy also affects the direction of the exchange rate. It is also evident from the emperical studies analysed (Mussa,1984; Hopper,1997; Ndungu,2000; Karanja,2010; Saeed,2012) that the few scholars that have studied the effect of money supply on exchange rate were not aggreing on the level of significance of money supply and exchange rate fluctuations and their relationship; some were showing negative (Musa, 1984, Hopper,1987, Ndung'u, 2000) while others positive (Saeed *et al*.,2012) results; some were showing significant (Hopper,1997, Ndung'u,2000, Saeed *et al*., 2012) while others insignificant (Mussa,1984) relationships. Due to lack of consensus by various scholars on contribution of money supply on real effective exchange rate fluctuations and the limited sample sizes used by the scholars of less than 25 years,this study aimed to determine the effect of money supply on real effective exchange rate fluctuations in kenya both in the short run and long run periods using a relatively larger sample size of 44 years. A relatively larger sample size would reduce the dergree of biasedness experienced by smaller sample sizes.

The annual fiscal deficit arising from the increased expenditures that are not matched by increased revenues has led to an increase in the stock of debt in Kenya. Total stock of debt increased from 1.49 trillion (49.3% of GDP) in 2011 of which 0.914 trillion was external to 1.63 trillion (45.8% of GDP) in 2012 of which 0.978 trillion was external. Consequently, debt per capita had continued to increase from Ksh 22,382 in 2007 to 31,837 in 2010 and Ksh 38,523 in 2012. According to the most recent debt sustainability analysis, the biggest risks that Kenya faces to external debt sustainability come from exchange rate shocks and less favorable terms on new public sector loans (Kippra, 2013).

A study by Otuori (2013) concluded that in kenya external debt had a positive but significant effect on exchange rate. The results conformed to those by Saeed, *et al*. (2012) in Pakistan, Saheed *et al*.(2015) in Nigeria, Bunescu (2014) in Romania and Masaku (2012) in kenya. The scholars concluded that a rising external debt depreciates the local currency. Although these researchers seem to be in consenses that there is a positive and significant relationship between external debt and exchange rate, the data used by Otuori (2013) and Saeed *et al*. (2012) is too short for trend analyis and may experience time biaiseness and hence may give misleading results. The current study sought to use a larger sample of 44 years for analysis. The method of OLS only shows the association of variables but may not give the short run or long run behaviour of the relationships hence making it difficult to use the results for prediction. This study therefore used the ECM and cointegration analysis to evaluate the relationship between external debt on exchange rate fluctuations in kenya.

Kiptui and Kipyegon (2008), found out that trade balance had a positive but significant impact on exhange rate in kenya. According to Mirchandani (2013) trade balance had no impact on exchange rate in India. The two scholars differ on the relationship between the trade balance and

exchange rate and also on the degree of significance. In addition Kiptui and Kipyegon used small data covering the period 1993 to 2006 which is not enough for a time series analysis since it will suffer from time biaisseness. Further, there is scanty studies especially in kenya that shows the impact of trade balance on exchange rate despite the fact that the country in the recent past has seen a detororiating current account. This study therefore sought to employ larger sample from the period 1972 to 2015 to determine the relationship between trade balance and real effective exchange rate volatilty in kenya using ECM and cointegration analysis.

Appreciation in the real effective exchange rate is an important contributor to the export stagnation. From 2003 to date, Kenya had higher inflation than its major trading partners, which in turn led to real appreciation, that is, loss in competitiveness (World Bank, 2013). According to the Central Bank of Kenya (2015) the overriding goal of monetary policy is maintaining price stability. Monetary policy is formulated in line with the inflation profile, given that this is the foremost threat to monetary stability in any country. Inflation can seriously undermine the value of the Kenya Shilling (exchange rate), causing exports to lose competitiveness and consequently decreasing earnings of foreign exchange.

McPherson and Rakovski (2000) carried out a study on 'exchange rates and economic growth in kenya' and concluded that inflation rate had a positive and significant effect on exchange rate in kenya. Nduri (2013) carried a similar study in kenya and concluded that inflation had a positive and significant effect on exchange rate using data from 2007 to 2011. This was too short a period for time series and could not give unbiased results due to time length constraint. According to the World Bank (2013), inflation had a negative and significant effect on exchange rate. High inflation causes appreciation of the local currency leading to loss of competetiveness on the global market. Due to lack of consensus on the nature of relationship between inflation and real

effective exchange rate fluctuations, this study sought to examine the relationship between inflation and real effective exchange rate fluctuations in kenya both in the short run and long run using a relatively larger sample size.

Exchange rates are important determinants of economic growth of any nation. They are important in the sound formulation of monetary and fiscal policies of an economy which is very important in trade and ensuring competitiveness in the global market and also in the stabilization of prices. Fluctuations of the exchange rate may distabilize trade between economies due to unstability in prices (CBK, 2014). Examining the determinants of exchange rate fluctuations is therefore key to stabilizing prices in the exchange rate market which has attracted the attention of various scholars.. the various schorlars have however, differed on the exact determinants of real effective exchange rate fluctuations both globally and in kenya. Also, the sample sizes used by most of the scholars are less than 30 observations. According to time series analysis sample sizes of less than 30 observations are likely to give biased results which may not be reliable and hence not sufficient for predictions (Gujaratti, 2001). It is against this background that this study sought to examine the determinants of real effective exchange rate fluctuations in kenya using a relatively larger sample size for the period 1972 to 2015.

1.2 Statement of the Problem

Exchange rate statistics play a pivotal role in the economic growth of any nation as they contribute immensely on a number of macroeconomic outcomes and objectives. They are important in international trade as payments are done in foreign currency; a rising exchange rate makes it harder to trade overseas due to a rise in relative prices. A weak currency can make it harder for economies to finance deficit budgets; this may cause loss of confidence by foreign investors and eventually lead to capital flight and loss of jobs. Exchange rates in Kenya have

been experiencing fluctuations since the transition of the fixed exchange rate regime of the 1960s to the crawling peg of the 1970s and 1980s and lately the floating exchange rate of the 1990s to date. The exchange rate has oscillated between Kshs. 7.142 from 1960s to an average of Kshs. 98.18 per unit US dollar 2015 exerting pressure on the economy. This has attracted various scholars' interest in this field of study. However, the scholars have differed on the exact determinants of real effective exchange rate fluctuations in Kenya and the rest of the world. The scholars have also not agreed on the level of significance with some showing significant and others insignificant results between the independent and dependent variables. In addition, the studies that have been undertaken give contradicting results on the relationship between money supply, external debt, trade balance, inflation rate and exchange rate fluctuations in Kenya; some show negative while others show positive relationships. Also, many studies have used small sample sizes in their analysis making their results likely to be biased and not sufficient for prediction like in the case of money supply and trade balance. This study sought to examine determinants of real effective exchange rate fluctuations in Kenya.

1.3 Objectives of the Study

1.3.1 General Objective

To examine the determinants of real effective exchange rate fluctuations in Kenya.

1.3.2 Specific Objectives

i. To examine the relationship between money supply and real effective exchange rate fluctuations in Kenya.
ii. To evaluate the relationship between external debt and real effective exchange rate fluctuations in Kenya.

iii. To determine the relationship between trade balance and real effective exchange rate fluctuations in Kenya.

iv. To examine the relationship between inflation and real effective exchange rate fluctuations in Kenya.

1.4 Hypotheses

i. H_0: There is no relationship between money supply and real effective exchange rate fluctuations in Kenya.

ii. H_0: There is no relationship between external debt and real effective exchange rate fluctuations in Kenya.

iii. H_0: There is no relationship between trade balance and real effective exchange rate fluctuations in Kenya.

iv. H_0: There is no relationship between inflation and real effective exchange rate fluctuations in Kenya.

1.5 Justification of the Study

The CBK has on several occasions intervened in the money market to control and smooth the exchange rate fluctuations. This was majorly because the exchange rate market has a great impact on economic growth of the country. During the 1970s oil price shocks, the CBK just like its counterparts adopted the crawling exchange rate in 1973 from the initial fixed exchange rate of the 1960s to cushion the country against the adverse fluctuations of the currency. In the year 1993 the regulator introduced the flexible exchange rate of which the currency was left to trade freely and respond to the market forces of demand and supply for the reason of stabilizing the

Kenyan shilling against adverse fluctuations against world major currencies. Despite the interventions the exchange rate still experienced fluctuations against world major currencies affecting the economy negatively with the year 2015 having an all-time high with an average of kshs 98.17845 for 1USD. Knowing the determinants of exchange rate fluctuations was key to policy makers and academicians in ensuring a stable exchange rate policy since their effect could be used to make sound exchange rate policies. This study therefore made important policy recommendations necessary for formulating and implementing sound exchange rate policies that would assist stabilize the Kenyan economy. The study was also important in its contribution to the existing literature on exchange rates both globally and in Kenya.

1.6 Scope of the Study

The study employed annual time series data for Kenya for the period 1972 to 2015 from the world development indicators (World Bank). The data was chosen from a single source for conformity and reliability purposes. The data was from 1972; the eve year that Kenya adopted the crawling exchange rate from the initial fixed exchange rate regime to cushion the country against the adverse effects of the 1970s oil price shocks. This was also the time that the Bretton Woods System collapsed because its pegged exchange rates could not be sustained in a new global financial environment in which international financial flows were continually growing and sometimes circumventing governments' official investment barriers (Makin, 2004). The year 2015 was the year that Kenyan shilling experienced the highest depreciation against all major currencies of the world with a unit of the US dollar exchanged for Kenya's shilling being 108 forcing the CBK to intervene the financial markets by increasing the CBR from 8.5 to 11.5 to discourage domestic credit flows within the economy. Though there are many determinants of exchange rate fluctuations, this study focused on four determinants of exchange rate fluctuations

(money supply, external debt, trade balance and inflation) which have the greatest influence as per the balance of payments theory of exchange rate determination.

1.7 Theoretical Framework

The study was guided by the balance of payments theory which was first developed by David Hume (1752) and further improved by other scholars over time such as Miller (1986) and Ronald MacDonald (2007). The balance of payments theory is the modern and most satisfactory theory of the determination of the exchange rate. It is also called the demand and supply theory of exchange rate. According to this theory, the rate of exchange in the foreign exchange market is determined by the balance of payments in the sense of demand and supply of foreign exchange in the market. If the demand for a country's currency falls at a given rate of exchange, we can speak of a deficit in its balance of payments. Similarly, if the demand for a country's currency rises at a given rate of exchange, we can speak of surplus in its balance of payments. A deficit balance of payments leads to a fall or depreciation in the external value of the country's currency. A surplus balance of payments leads to an increase or appreciation in the external value of the country's currency. It deals with the shifts in the relative demand for and supply of money, the allocation and level of expenditure; the distribution and level of factor payments (price levels/inflation); the composition and size of trade flows (trade balance); the levels of international reserves and external debt.

Miller (1986) has showm that in a four good (Tradables T, Nontradables N, Bonds A, Money M) model, that the sum of the period analysis, effective demand and supply budget constraint for the household, business and government sector of an economy lead to the aggregate budget constraint:

$$E_i = E_T + E_N + E_A + E_M \equiv 0 \quad (1.1)$$

Where,

E_i represent the ex-ante domestic supply minus demand for that good; domestic excess supply of good *i* (T, N, A and M) for a closed economy. But for an open economy we take account of foreign transactions denoted by X_i -excess supply of each good.

By definition of N, it follows that $X_N = E_N$. By assumption here, home residents had only home money and no home money is held abroad. Thus $X_M = E_M$. The E_T term represents the output minus total domestic demand of T. Hence it follows that:

$$X_T = E_T - B_T \quad (1.11)$$

Where,

X_T Is excess total market supply of home tradable.

B_T Is ex ante balance of trade

A similar definition applies to market excess of bonds, that is:

$$X_A = E_A - K_F \quad (1.12)$$

Where,

K_F Ex ante net international flow

With equation 1.1 and these definitions Miller (1986) obtains the identity:

$$X_T + X_N + X_A + X_M = -BP \quad (1.2)$$

Where,

$BP = B_T + K_F$ =The ex-ante balance of payments

Identity 1.2 has some intuitive appeal if we define ex ante balance of payments as excess supply of foreign exchange X_{FX}. Then 1.2 can be written as:

$$X_T + X_N + X_A + X_M + X_{FX} = 0 \quad (1.3)$$

The sum of excess supplies in all markets is always zero.

From equation 1.3 the first four items equal to a negative balance of payment (–BP). Therefore, equation 1.3 can also be written as:

$-BP + X_{FX} = 0$ And thus

$X_{FX} = BP$ We can therefore say

$$X_{FX} = f(BP) \quad (1.4)$$

From equation 1.2 equation 1.4 becomes,

$$X_{FX} = f(X_T, X_N, X_A, X_M) \quad (1.5)$$

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter discussed the theories of exchange rate determination as well as empirical studies carried out by other scholars globally and locally; specifically, Kenya on the determinants of real effective exchange rate fluctuations.

2.2 Theoretical Literature Review

This section introduces the balance of payments (BOP) theory of exchange rate determination which was the guiding theory to the study.

2.2.1 The Balance of Payments Theory

The balance of payments theory is the modern and most satisfactory theory of the determination of the exchange rate. It is also called the demand and supply theory of exchange rate. According to this theory, the rate of exchange in the foreign exchange market is determined by the balance of payments in the sense of demand and supply of foreign exchange in the market. A deficit in balance of payments occurs when the demand for a country's currency falls at a given rate of exchange. Similarly, a surplus balance of payments occurs when the demand for a country's currency rises at a given rate of exchange. A deficit balance of payments leads to a fall or depreciation in the external value of the country's currency while a surplus balance of payments on the other hand leads to an increase or appreciation in the external value of the country's currency, (Gali and Monacelli, 2005).

A deficit balance of payments of a country implies that demand for foreign exchange is exceeding its supply. The monetary theory of the balance of payments, which relates movements in international reserves (if exchange rates are fixed) or the exchange rate (if it is floating) to shifts in the relative demand for and supply of money, yields a similar functional relationship. An overvalued real effective exchange rate represents a persistent misalignment of prices between a particular country and the rest of the world. Such misalignment has an impact on the pattern and level of production, the allocation and level of expenditure; the distribution and level of factor payments; the composition and size of trade flows; the levels of international reserves and external debt; and (in more extreme cases) the emergence of parallel foreign exchange markets, currency substitution and capital flight. Persistent real overvaluation also seriously erodes business and consumer confidence, thereby lowering the rate of savings and investment. The outcome is a decline in growth, (McPherson & Rakovski, 2000).

Under floating exchange rate system, suppose the Kenyan shilling is appreciating against the dollar, and the central bank of Kenya (CBK) decides to intervene in the foreign-exchange market to increase the value of the dollar and stop the shilling appreciation. The CBK would increase domestic credit in order to purchase US dollar-denominated bonds. The increased demand for dollar bonds will mean an increase in the demand for dollars in the foreign-exchange market. This results in the higher foreign-exchange value of the dollar. Now, suppose the CBK has a target level of the Kenyan money supply that requires the increase in domestic credit to be offset. The CBK will sell shilling-denominated bonds in Kenya to reduce the domestic money supply. The domestic Kenya money supply was originally increased by the increase in domestic credit used to buy dollar bonds. The money supply ultimately returns to its initial level as the CBK uses

a domestic open-market operation (the formal term for central-bank purchases and sales of domestic bonds) to reduce domestic credit. In this case of managed floating exchange rates, the CBK would achieve its goal of slowing the appreciation of the shilling with no effect on the Kenyan money supply, (Macdonald, 2007).

The balance of payments theory asserts that the consistent adverse balance of payment will make the currency to depreciate in near future and the consistent surplus in balance of payment will make the currency appreciate in near future. Forecasting future exchange rates is virtually necessity for a multinational enterprise, *inter-alia,* to develop an international financial policy. It is particularly useful for a foreign country if it intends to borrow from or invest. Forward rates are likely to be an unbiased predictor of the future spot rate. In other words, the rate of premium or discount should be an unbiased predictor of the rate of appreciation or depreciation of a currency (Edward, 1994).

Current spot exchange rates are affected by changes in expectations concerning future trade flows, as well as by current international trade flows. As is often the case in economic phenomena, the short-run effect of some new event determining the balance of trade can differ from the long-run result. Suppose the long-run equilibrium under floating exchange rates is balanced trade, where exports equal imports, if we are initially in equilibrium and then experience a disturbance like the oil cartel formation, in the short run we expect large balance-of-trade deficits; but in the long run, as all prices and quantities adjust to the situation, we return to the long-run equilibrium of balanced trade. The new long-run equilibrium exchange rate will be higher than the old rate, because foreigners will have larger stocks of domestic currency, while

domestic residents will hold less foreign currency due to the period of the trade deficit. The exchange rate need not move to the new equilibrium immediately. In the short run, during which trade deficits are experienced, the exchange rate will tend to be below the new equilibrium rate. Thus, as the outflow of money from the domestic economy proceeds with the deficits, there is steady depreciation of the domestic currency to maintain the short-run equilibrium, where quantities of monies demanded and supplied are equal. Some unexpected event occurs at time that causes a balance-of-trade deficit. With the deficit and the consequent outflow of money from home to abroad, the domestic currency will depreciate. Eventually, as prices and quantities adjust to the changes in the structure of trade, a new long-run equilibrium is reached where trade balance is restored. This move to the new long-run exchange rate does not have to come instantaneously, because the deficit will persist for some time (Mirchandani, 2013).

2.3 Empirical Literature

Under this section this study compared various studies carried out by different scholars both globally and in Kenya.

2.3.1 Money Supply and Real effective exchange Rate Fluctuations

Hopper (1997) reviewed exchange-rate economics, focusing on what is predictable and what wasn't. The monetary model focused on the demand and supply of money. If the money supply in the United States rose, but nothing else changed, the average level of prices in the United States tend to rise. Since the price level in the foreign country remains fixed, more dollars were needed to get one unit of foreign currency. Hence, the dollar price of the foreign currency rose; the dollar depreciated.

According to Saeed *et al*. (2012), there was a strong positive relation between the ratio of the money stock of pakistan relative to the US dollar. The data range used was from 1990 to 2010 annual data representing 21 years. This researcher generally used a small sample size for time series analysis as it is prone to give unreliable results for prediction. A relatively larger sample was used in the current study to address this shortfall.

Papadopoulos and Zis (2000) studied the determination of exchange rate in Greece by estimating Drachma/ECU rate employing co-integration technique, Impulse response and Variance decomposition analysis using monthly data from 1980 to 1991. Exchange rate variation appears to be dominated mainly by money supply. However, this study did not give the long run effect of the money supply variable on exchange rate variation. To fill this gap, the current study sought to analyze the long run relationship of money supply and exchange rate fluctuations in Kenya for prediction purposes.

Wilson (2009) examined the effective exchange rate of US Dollar based on the weighted average trading partner of USA. The study concluded that money supply was positively related to the effective real effective exchange rate and increase in money causes decline in the value of currency. Karanja (2010) did a study on determinants of exchange rate and exchange rate fluctuations on selected countries using monthly data for the period 1993 to 2008 with an OLS method of analysis. It was concluded that in Kenya and Singapore there was a negative but significant relationship between money supply and exchange rate fluctuations. This was contrary to the UK where a positive and insignificant relationship was found. The method of OLS gives an association between variables. However, the method did not link the short run dynamics to the long run relations hence one may not be able to use it for prediction and policy

recommendations. Hence, the current study sought to employ both cointegration and the ECM which gives better analysis both in the short run and long run.

Ndungu (2000) analyzed the relationships among money supply, real effective exchange rate movements, domestic rate of inflation, and the government share of domestic credit. The study was based on annual 25 years' time series data from 1970 to 1995. The analysis suggested that money supply drove real effective exchange rate movements, and real effective exchange rate movements have an impact on money supply. Excess money supply has feedback effects with real effective exchange rate. Money supply growth depreciates the exchange rate. Despite analyzing the data both in the short run and long run, Ndung'u used a relatively smaller sample size of 25 years which is likely to suffer from time biasedness and hence may give biased results. To address this pitfall, the current study sought to use a relatively larger sample size to examine the effect of money supply on real effective exchange rate fluctuations in Kenya using cointegration and ECM.

Using 15 years data, Mussa (1984), established that in the US money supply had a negative but insignificant impact on exchange rate fluctuations. Hopper (1997), carried out a similar study in the US using 25 years data from 1980 to 1995 and found out that there was a negative but significant relationship between money supply and exchange rate. A rise in money supply depreciated the local currency. A study by Ndungu (2000), observed that in kenya money supply had a negative but significant impact on echange rate; cornforming to the results by Hopper (1997) but contradicting Mussa (1984). The most recent study by Saeed *et al*. (2012), showed that there was a positive but significant relationship between money supply and exchange rate fluctuations in Pakistan; a rise in money supply appreciated the Pakistani rupee.

Studies relating the effect of money supply on the exchange rate fluctuations are very scanty both globally and in kenya. Most scholars have studied the effect of exchange rate on money supply and ignored the fact that an increase or a decrease in money supply in the economy also affects the direction of the exchange rate. It is also evident from the various emperical studies analysed that the few scholars that have studied the effect of money supply on exchange rate are not agreing on the relationship; some are showing negative while others positive results; some are showing significant while others insignificant relationships. In addition most of these studies sample sizes range from 15 to 25 years. This represents a small sample for time series analysis which may have given baised results. This study therefore sought to use longer period in its analysis to examine the relationship between money supply and exchange rate fluctuations in kenya.

2.3.2 External Debt and Real effective exchange rate Fluctuations

Most of Kenya's public external debt remained on concessional terms, although its commercial component increased to about 10 percent at the end of 2012; mainly as a result of a syndicated loan of about US dollar 600 million. Overall, the maturity structure of Kenya's external debt is long term, with over 77 percent with a maturity of over 10 years, 20.7 percent with 5-10 years maturity, and less than 3 percent with less than 4 year maturity. The external debt was mainly denominated in the Euro (33 percent), the US Dollar (31 percent) and the Japanese Yen (16 percent) (WorldBank, 2013).

According to IMF (2015), rapidly depreciating exchange rates had increased pressures on countries that borrowed heavily in foreign currencies and had sparked significant capital outflows for several emerging markets. These developments could add stress to emerging market sovereigns that have increased their combined exposure to foreign currency borrowings and

foreign investor holdings of local currency debt. Across emerging markets more generally, the large portion of debt denominated in foreign currencies meant that micro- and macro prudential measures had important roles to play in limiting the risks from shocks. Regulators needed to conduct bank stress tests related to foreign currency and commodity price risks and more closely and regularly monitor corporate leverage and foreign currency exposures, including derivatives positions.

Saeed *et al.* (2012) carried out analysis of determinants of exchange rate in Pakistan and concluded that, relative stock of money and debt were positively and significantly related to exchange rate. Increase in the relative debt was an important source affecting exchange rate. Borrowing of the government from domestic and foreign was one of the major causes of depreciation in the Pakistan Rupee against US Dollar. Government borrowed to finance budget deficits, balance of payment deficits and development projects. All those policy measures aiming at decreasing these deficits would decrease the need for borrowing and would help in maintaining stability in the value of currency.

Devereux and Lane (2001) in their study hypothesized that for developing economies, external debt has an important effect on real effective exchange rate fluctuations. They used monthly data over 1995 to 2000. The study found that for developing economies, real effective exchange rate fluctuations (relative to creditor countries) was strongly negatively affected by the stock of external debt. For industrial countries however, external debt was generally not significant in explaining real effective exchange rate fluctuations.

Siregar and Pontines (2005) sought to evaluate whether the rapid accumulation of external debts had contributed to the fluctuations of the East Asian countries' currencies starting late 1997. The study used a basic overshooting model of Dornbusch. The empirical results showed that the accumulation of external debts in these economies had indeed been partly responsible for the increasing fluctuations of exchange rate of the local currency. The Dornbusch model just like the OLS gives a simple relationship between variables but in itself does not link the short run dynamics of the relationship to the long run. Due to the issues of the methodology used by this scholar, the current study sought to employ the cointegration and ECM techniques to establish the short and long run relationship of external debt to the real effective exchange rate fluctuations in Kenya.

Saheed *et al.* (2015) carried out a study on the 'Impact of Public External Debt on Exchange Rate in Nigeria' using secondary data for the period 1981 to 2013 using the Ordinary Least Square. They observed that with continuous increase in public expenditures, and low capital formation in many developing countries, many governments had resorted into borrowing either or both within and outside their boundaries. Most borrowings come with interest attached, which results in debt servicing. Serving external debt may involve demand for foreign currency which tends to affect the exchange rate of the country. Findings revealed that external debt, proved to be statistically significant in explaining exchange rate fluctuation in Nigeria within the period of observation. The method of OLS only gives the relationship between variables but does not give the long run effect. This study therefore sought to use the ECM and cointegration analysis to evaluate the short and long run relationship between external debt and exchange rate fluctuations in Kenya.

Bunescu (2014) carried out a study on 'The impact of external debt on exchange rate variation in Romania' and observed that exchange rate correlation analysis in Romania with external debt components revealed the existence of a strong link between variables. Public external debt had a great direct impact on variation of exchange rate, the positive correlation between the two indicators indicated that an increase in direct indebtedness of the government and local authorities on foreign financial markets was followed by a depreciation of the domestic currency against the euro. This study too used the OLS method of analysis which does not give the link between the short run dynamics and the long run relations. The current study used cointegration and the ECM to analyze the short run and long run relationship between the external debt and the exchange rate fluctuations in Kenya.

Masaku (2012) used a correlation design study to assess empirically the effect of Kenya's external debt on exchange rate fluctuations using secondary data from 1971 to 2010. The results showed that there was a general upward trend for both the exchange rates and external debt from 1971 – 2010. The correlation matrix revealed that external debt and exchange rate were positively and strongly correlated at 1% level. It was noted that exchange rate was positively and significantly influenced by external debt.

Saeed *et al*. (2012) undertook an analysis of determinants of exchange rate for US Dollar in terms of Pakistani Rupee within the framework of monetary approach using monthly data from January 1982 to April 2010. Stock of money, foreign exchange reserves and external debt of Pakistan relative to United States were taken as determinants of PKR/US Dollar exchange rate during the managed floating regime in Pakistan. Empirical results confirmed that stock of money, debt and foreign exchange reserve balance all in relative terms were significant determinants of exchange rate between Pakistani Rupee and US Dollar. There was a strong

positive relation between the ratio of the financial assets (money stock, foreign exhange reserves and debt) of pakistan relative to the US dollar. The researcher used a small sample size of 28 years which is not sufficient for prediction. Due to this shortfall, the current study used a relatively larger sample size of 44 years to evaluate the reltionship between external debt and exchange rate fluctuations in kenya.

A study by Otuori (2013) concluded that in kenya external debt had a positive but significant effect on exchange rate. The results conformed to those by Saeed, *et al*. (2012) in Pakistan, Saheed *et al*.(2015) in Nigeria, Bunescu (2014) in Romania and Masaku (2012) in kenya. The scholars concluded that a rising external debt depreciates the local currency. Although these researchers seem to be in consenses that there is a positive and significant relationship between external debt and exchange rate, the data used by Otuori (2013) and Saeed *et al*. (2012) is too short for trend analyis and may experience time biaiseness and hence may give misleading results. The current study sought to use a larger sample of 44 years for analysis. The method of OLS only shows the association of variables but may not give the short run or long run behaviour of the relationships hence making it difficult to use the results for prediction. This study therefore used the ECM and cointegration analysis to evaluate the relationship between external debt on exchange rate fluctuations in kenya.

2.3.3Trade Balance and Real effective exchange rate Fluctuations

Tseng, Chen and Lin (2005) examined the relationship between trade balance and exchange rate fluctuations in Taiwan with an OLS method of analysis using quarterly data from 2000 to 2004. They concluded that increased trade balance tends to reduce exchange rate fluctuations showing a significant negative relationship. However, the method of analysis used here (OLS) does not show the effect of trade balance in the long run, thus the reason that the current study seeks to

find using both cointegration and ECM. The sample size of 20 was also not sufficient for trend analysis and most likely to give biased results. To fill this gap, the current study used a relatively larger sample size to do a trend analysis.

Baharumshah (2001) employed an unrestricted VAR model for the bilateral trade balances of Thailand and Malaysia with the United States and Japan for the period 1980 to 1996. The results showed a significant and positive long-run relationship between trade balance and the exchange rate fluctuations. The data set of 17 years is not sufficient for trend analysis. This may have given unreliable prediction as it suffered from time biasedness. According to the time series analysis for one to get unbiased results, a data set of at least 30 observations is needed for analysis (Gujarati, 2004). The current study employed a relatively larger sample to determine the long run relationship between trade balance and exchange rate fluctuations in Kenya.

Karanja (2010) found out that in Kenya there was a negative and significant relationship between trade balance and exchange rate fluctuations. Though the results showed negative association in the UK and Singapore, the magnitude was insignificant. However, he overlooked the long run relationship of the two variables which is necessary for prediction and policy recommendations. This study aimed to determine both the short run and long run relationship of trade balance on real effective exchange rate fluctuations in Kenya.

Kiptui and Kipyegon (2008) study on external shocks and real effective exchange rate movements in Kenya for the period 1993-2006, adopted an error correction model (ECM) used to capture the long-run and short-run dynamics of the impact of external shocks on the real effective exchange rate fluctuations including trade balance, net foreign exchange flows, trade openness, real GDP growth, interest rates differential and government spending. The results showed that external shocks to a large extent influence real effective exchange rate fluctuations

as demonstrated by the significance of the trade balance in the long-run and short-run estimations. 13 years was too short a period for time series analysis and may not give reliable data for trend analysis. The current study sought to employ data from 1972 to 2015 to determine the relationship between trade balance and real effective exchange rate fluctuations in Kenya using the ECM and cointegration model.

Mirchandani (2013) carried out an analysis of macroeconomic determinants of exchange rate in india from 1991 to 2010 using pearson's corelation analysis and found out that there was no relationship between the trade balance and real effective exchange rate fluctuations. The value of any currency is expected to fall when the trade balance is in deficit, and more likely to rise when the trade balances is in surplus. Though this relationship is not extremely systematic, yet the data represent a moderate impact of the exchange rate on the balance of current account.

Kiptui and Kipyegon (2008), found out that trade balance had a positive but significant impact on exhange rate in kenya. According to Mirchandani (2013) trade balance had no impact on exchange rate in India. The two scholars differ on the relationship between the trade balance and exchange rate and also on the degree of significance. In addition Kiptui and Kipyegon used small data covering the period 1993 to 2006 which is not enough for a time series analysis since it will suffer from time biaisseness. Further, there is scanty studies especially in kenya that shows the impact of trade balance on exchange rate despite the fact that the country in the recent past has seen a detororiating current account. This study therefore sought to employ larger sample from the period 1972 to 2015 to determine the relationship between trade balance and real effective exchange rate volatilty in kenya using ECM and cointegration analysis.

2.2.4 Inflation and Real effective exchange rate Fluctuations

Mirchandani (2013) carried out a research in order to investigate various macroeconomic variables leading to acute variations in the exchange rate of a currency in India. The study found out that inflation had a significant but negative relationship with exchange rate.

Nduri (2013) studied the effects of interest rate and inflation rate on real effective exchange rate fluctuations in Kenya using annual time series data for the period 2007 to 2012. The regression results indicated that the relationship between inflation against exchanges rates is positive and significant. Nduri, (2013), not only used very small sample size but also used the OLS method which does not give predictions. The current study used data for 44 years using the ECM and cointegration to examine the short and long run relationship between inflation and real effective exchange rate fluctuations in Kenya.

According to Ndungu (2000), inflation is negatively associated with the exchange rate movements in Kenya.

McPherson and Rakovski (2000), attempted to determine the relation between growth and exchange rate while allowing for other key influences on both variables in Kenya. The system was estimated using Three-Stage Least Squares (3SLS). The results indicated that there was a positive significant relationship between exchange rate and inflation in Kenya. Inflation explained 18% of the variations in exchange rate.

Otuori (2013) observed that inflation had a negative and significant relation on exchange rate in kenya. A study by Ndung'u (2001) found out that inflation had no effect on exchange rate in kenya. This was a contradiction of his earlier work on ‘money supply and exchange rate policy in kenya’ (Ndungu, 2000) which concluded that inflation had a negative and insignificant effect on exchange rate in kenya. McPherson and Rakovski (2000) concluded that inflation rate had a

positive and significant effect on exchange rate in kenya. According to Nduri (2013) inflation had a positive and significant effect on exchange rate in kenya. However, the period of study was too short for time series and could not give unbiased results due to time length constraint. Mirchandani (2013) found out that inflation had a negative and significant effect on exchange rate in india. According to the World Bank (2013) Kenya' inflation had a negative and significant effect on exchange rate. High inflation causes appreciation of the local currency leading to loss of competetiveness on the global market. Based on the disconsensus of various scholars and the length of the period, this study examined the relationship between inflation and real effective exchange rate fluctuations in kenya for a relatively longer period using the ECM and cointergration analysis.

2.4 Summary and Gap in Literature

Exchange rates are important determinants of economic growth of any nation. They are important in the sound formulation of monetary and fiscal policies of an economy which is very important in trade and ensuring competitiveness in the global market and also in the stabilization of prices. Fluctuations of the exchange rate may distabilize trade between economies due to instability in prices. Examining the determinants of exchange rate fluctuations is key to stabilizing prices in the exchange rate market. Various scholars have differed on the exact determinants of real effective exchange rate fluctuations both globally and in kenya. Also, the sample sizes used by most of the scholars are less than 30 observations. According to time series analysis sample sizes of less than 30 observations are likely to give biased results which may not be reliable and hence not sufficient for predictions. It is against this background that this study sought to examine the determinants of real effective exchange rate fluctuations in kenya using a relatively larger sample size for the preiod 1972 to 2015.

CHAPTER THREE

METHODOLOGY

3.1 Introduction

In this chapter, the study discusses research design, study area, data collection, analysis and presentation. Under data analysis the study will focus on correlation analysis, stationarity tests, cointegration, ECM and diagnostic tests.

3.2 Research Design

This study used correlational research design. According to Gujarati (2004) Correlational designs are helpful in identifying the relation between variables. In this type of research, the researcher measures two or more variables and assesses the statistical relationship between them with little or no effort to control the extraneous variables.

3.2.1 Model Specification and Definition

In line with the BOP theories which establishes that movements in exchange rates are caused by movements in money supply, the extent of external debt, trade balance and inflation (relative movement of prices), this study adopted a linear regression model relating the exchange rate fluctuations (dependent variable) as a function of money supply, external debt, trade balance and inflation rate (independent variables) by modifying model 1.5 such that:

$X_{FX} = f(X_T, X_N, X_A, X_M)$ became

$$E = f(M, ED, TB, I) \qquad (3.1)$$

Where,

E Real effective exchange Rate Fluctuations,

M Money Supply, in this study M3 is used to mean money supply.

ED External Debt,

TB Trade Balance,

I Inflation Rate and

Based on the classical linear regression model and the BOP theory, this study employed annual time series data and assumed a linear model which took the following form:

$$E_t = \beta_0 + \beta_1 M_t + \beta_2 ED_t + \beta_3 TB_t + \beta_4 I_t + \varepsilon_t \quad (3.2)$$

Where,

ε Stochastic Term/ error term; $\varepsilon \approx N(0, \delta^2)$ i.e., the error term is normally distributed with a zero mean and constant variance.

β_0 Constant

$\beta_{1,2,3,4}$ Coefficients to be estimated. They measure the responsiveness of the dependent variable to changes in the independent variables.

3.3 Study Area

At 580,367 km^2 (224,081 sq mi), Kenya is the world's forty-seventh largest country (after Madagascar). It lies between latitudes 5°N and 5°S, and longitudes 34° and 42°E. From the coast on the Indian Ocean, the low plains rise to central highlands. The highlands are bisected by the Great Rift Valley, with a fertile plateau lying to the east. It is bordered by Tanzania to the south, Uganda to the west, South Sudan to the north-west, Ethiopia to the north and Somalia to the

north-east. Kenya covers 581,309 km^2 (224,445 sq mi), and had a population of approximately 45 million people in July 2014 (KTB, 2014).

3.4 Target Population

The target population was all the macroeconmic determinants affecting real effective exchange rate fluctuations

3.5 Sample Size

The study focused on only four determinants of real effective exchange rate (money supply, external debt, trade balance and inflation rate) which have the greatest influence as per the balance of payments theory. The study focused annual time series data for the period 1972-2015. This was the period that kenya shifted from the initial fixed exchange rate regim to the crawling peg to cushion the country against the adverse effects of the 1970s oil price shocks that were threatening the growth of the country. During this period the country also experienced the highest depreciation of the shilling in the year 2015.

3.6 Data Collection

This study used time series secondary data for the period 1972 to 2015. Time series data is data that has been collected over a period of time. A time series is a set of observations on the values that a variable takes at different times. Secondary data refers to data that has already been collected and analyzed, Kothari,(2004). For the purpose of uniformity, the data used was obtained from one single source of the world development indicators (World Bank, 2015).

3.7 Data Analysis and Presentation

The model for this research is an equation that specifies a linear relationship amongst the variables. The study employed inferential data analysis techniques which included correlation analysis, unit root tests, co-integration test and the error correction model. Diagnostic tests which include heteroscedasticity, autocorrelation, normality test and multicollinearity were carried out and the results presented in form of tables.

3.6.1 Descriptive statistics

The study used descriptive statistics to analyse the distribution of variables which included mean, median, mode, minimum and maximum, skewness and kurtosis, mean and standard deviation, Jarque-Bera (JB).

3.7.2 Correlation Analysis

According to Gujarati, (2004), correlation analysis measures the degree or strength of linear association between two variables. The correlation coefficient is used to measure this strength. It tries to measure or predict the average value of one variable on the basis of the fixed values of other variables. Most of the correlation theory is based on the assumption of randomness of variables while most of the regression theory is conditional upon the assumption that the dependent variable is stochastic but the explanatory variables are fixed or nonstochastic.

3.7.3 Stationarity Tests

Most empirical work based on time series data assumes that the underlying time series is stationary. A time series is stationary if its mean and its variance do not vary systematically over time (Gujarati, 2004). Stationarity can be checked by finding out if the time series contains a unit

root. This was done using the Augmented Dickey Fuller test and confirmed by the Phillips-pheron (pp) unit root tests.

$$\Delta X_t = \delta X_{t-1} + \varepsilon_t \quad (3.4)$$

Where equation 3.4 is the first difference operator and X represents any of the variables.

The following hypotheses was tested:

$H_0 : \delta = 0$ that is, unit root exists (time series is non stationary)

$H_1 : < 0$ time series is stationary

This was done using ADF test as shown below:

$$\Delta X_t = \delta X_{t-1} + \sum_{i=1}^{m} \alpha_i \Delta X_{t-i} + \varepsilon_t \quad (3.5)$$

$$\Delta X_t = \beta_1 + \delta \Delta X_{t-1} + \sum_{i=1}^{m} \alpha_i \Delta X_{t-i} + \varepsilon_t \quad (3.6)$$

$$\Delta X = \beta_1 + \beta_{2t} \delta \Delta X_{t-1} + \sum_{i=1}^{m} \alpha_i \Delta X_{t-i} + \varepsilon_t \quad (3.7)$$

Where,

m is lag length

3.7.4 Cointegration and Vector Error Correction Mechanism

3.7.4.1 Cointegration

According to Gujarati, (2004), cointegration means despite being individually nonstationary, a linear combination of two or more time series can be stationary. Though they individually exhibit random walks, there seem to be a stable long run relationship between them; they will not wander away from each other.Cointegration of two or more time series suggest that there is a

long run, or equilibrium relationship between them. This study used Johansen method to establish the long run relationship between variables.

3.7.4.2 Vector Error Correction Model (VECM)

In the short run there could be a possibility of disequilibrium relationship. Therefore, the error term can be treated as a disequilibrium error which is used to tie the short run behavior of a variable to its long run behavior (Gujarati, 2004).

$$\Delta E_t = \beta_{10} + \sum_{i=1}^{p} \beta_{11} \Delta M_{t-i} + \sum_{i=1}^{p} \beta_{12} \Delta E_{t-i} + \sum_{i=1}^{p} \beta_{13} \Delta ED_{t-i} + \sum_{i=1}^{p} \beta_{14} \Delta TB_{t-i} + \sum_{i=1}^{p} \beta_{15} \Delta I_{t-i} + \lambda_i \mu_{t-1} + \varepsilon_{1t} \quad (3.8)$$

$$\Delta M_t = \beta_{20} + \sum_{i=1}^{p} \beta_{21} \Delta M_{t-i} + \sum_{i=1}^{p} \beta_{22} \Delta E_{t-i} + \sum_{i=1}^{p} \beta_{23} \Delta ED_{t-i} + \sum_{i=1}^{p} \beta_{24} \Delta TB_{t-i} + \sum_{i=1}^{p} \beta_{25} \Delta I_{t-i} + \lambda_i \mu_{t-1} + \varepsilon_{2t} \quad (3.9)$$

$$\Delta ED_t = \beta_{30} + \sum_{i=1}^{p} \beta_{31} \Delta M_{t-i} + \sum_{i=1}^{p} \beta_{32} \Delta E_{t-i} + \sum_{i=1}^{p} \beta_{33} \Delta ED_{t-i} + \sum_{i=1}^{p} \beta_{34} \Delta TB_{t-i} + \sum_{i=1}^{p} \beta_{35} \Delta I_{t-i} + \lambda_i \mu_{t-1} + \varepsilon_{3t} \quad (3.10)$$

$$\Delta TB_t = \beta_{40} + \sum_{i=1}^{p} \beta_{41} \Delta M_{t-i} + \sum_{i=1}^{p} \beta_{42} \Delta E_{t-i} + \sum_{i=1}^{p} \beta_{43} \Delta ED_{t-i} + \sum_{i=1}^{p} \beta_{44} \Delta TB_{t-i} + \sum_{i=1}^{p} \beta_{45} \Delta I_{t-i} + \lambda_i \mu_{t-1} + \varepsilon_{4t} \quad (3.11)$$

$$\Delta I_t = \beta_{50} + \sum_{i=1}^{p} \beta_{51} \Delta M_{t-i} + \sum_{i=1}^{p} \beta_{52} \Delta E_{t-i} + \sum_{i=1}^{p} \beta_{53} \Delta ED_{t-i} + \sum_{i=1}^{p} \beta_{54} \Delta TB_{t-i} + \sum_{i=1}^{p} \beta_{55} \Delta I_{t-i} + \lambda_i \mu_{t-1} + \varepsilon_{5t} \quad (3.12)$$

3.7.5 Diagnostic Tests

The following diagnostic tests were conducted: heteroscedasticity, autocorrelation and normality and multicollinearity.

3.7.5.1 Heteroscedasticity

According to (Gujarati, 2004), the assumption of homoscedasticity or equal variance is that the Y populations corresponding to various X variables have the same variance. Given the value of X the variance of ε_i is the same for all observations. Heteroscedasticity implies that the variances of ε_i are unequal for various observations. This study used the white's general heteroscedasticity test for testing varying variances of the error term because it does not rely on the assumption of normality and is easy to implement.

3.7.5.2 Autocorrelation

Gujarati, (2004), defines autocorrelation as the correlation between members of series of observations ordered in time. The classical linear regression model assumes that the disturbance term relating to any observation is not influenced by the disturbance term related to any other observation. To test for autocorrelation, the study used the Breusch-Godfrey (BG) test since unlike the Durbin Wartson test the BG test also known as the LM test is that it allows for nonstochastic regressors such as lagged values of the regressand, higher-order autoregressive schemes such as AR (1), AR (2) and higher order moving averages of white noise error term ε_t.

3.7.5.3 Normality

Gujarati (2004) asserts that the classical normal linear regression model assumes that each ε_i is distributed normally with a zero mean and a constant variance. For two normally distributed

variables zero covariance or correlation means independence of the two variables. This study used the LM test method to test for normality of the residuals.

3.7.5.4 Multicollinearity

According to Gujarati, (2004), multicollinearity means presence of a linear relationship among the explanatory variables. The assumption of no multicollinearity in regresion analysis requires that we include only those variables that are not exact linear functions of one or more varibales in the regression model. The study used the variance-inflating factor (VIF)to measure the problem of multicollinearity. VIF measures the speed at which variances and covariances increase. It shows how the variance of an estimator is infalted by the presence of multicollinearity.

3.7.6 Granger Causality Test

Cointegration gives signal that there is possibility of causality but does not show direction of causality. This study adopted the Granger Causality test because according to Gujaratti (2004), the test is a useful descriptive tool for time series data showing the possibility of a dependent variable causing variations in the independent variable and vice versa.

The following pair of regressions was estimated to establish pair wise Granger causality;

$$\Delta E_t = \beta_{10} + \sum_{i=1}^{p} \beta_{11} \Delta M_{t-i} + \sum_{i=1}^{p} \beta_{12} \Delta E_{t-i} + \sum_{i=1}^{p} \beta_{13} \Delta ED_{t-i} + \sum_{i=1}^{p} \beta_{14} \Delta TB_{t-i} + \sum_{i=1}^{p} \beta_{15} \Delta I_{t-i} + \varepsilon_{1t} \quad (3.13)$$

$$\Delta M_t = \beta_{20} + \sum_{i=1}^{p} \beta_{21} \Delta M_{t-i} + \sum_{i=1}^{p} \beta_{22} \Delta E_{t-i} + \sum_{i=1}^{p} \beta_{23} \Delta ED_{t-i} + \sum_{i=1}^{p} \beta_{24} \Delta TB_{t-i} + \sum_{i=1}^{p} \beta_{25} \Delta I_{t-i} + \varepsilon_{2t} \quad (3.14)$$

$$\Delta ED_t = \beta_{30} + \sum_{i=1}^{p} \beta_{31} \Delta M_{t-i} + \sum_{i=1}^{p} \beta_{32} \Delta E_{t-i} + \sum_{i=1}^{p} \beta_{33} \Delta ED_{t-i} + \sum_{i=1}^{p} \beta_{34} \Delta TB_{t-i} + \sum_{i=1}^{p} \beta_{35} \Delta I_{t-i} + \varepsilon_{3t} \quad (3.15)$$

$$\Delta TB_t = \beta_{40} + \sum_{i=1}^{p} \beta_{41} \Delta M_{t-i} + \sum_{i=1}^{p} \beta_{42} \Delta E_{t-i} + \sum_{i=1}^{p} \beta_{43} \Delta ED_{t-i} + \sum_{i=1}^{p} \beta_{44} \Delta TB_{t-i} + \sum_{i=1}^{p} \beta_{45} \Delta I_{t-i} + \varepsilon_{4t} \quad (3.16)$$

$$\Delta I_t = \beta_{50} + \sum_{i=1}^{p} \beta_{51} \Delta M_{t-i} + \sum_{i=1}^{p} \beta_{52} \Delta E_{t-i} + \sum_{i=1}^{p} \beta_{53} \Delta ED_{t-i} + \sum_{i=1}^{p} \beta_{54} \Delta TB_{t-i} + \sum_{i=1}^{p} \beta_{55} \Delta I_{t-i} + \varepsilon_{5t} \quad (3.17)$$

Where it was assumed that the error terms $\mu\varepsilon_{1t}, \mu\varepsilon_{2t}, \mu\varepsilon_{3t}, \mu\varepsilon_{4t}$ *and* $\mu\varepsilon_{5t}$ are uncorrelated. The study involved testing the following hypothesis;

H_0 : No causality,

H_1 : Causality exists

3.7.7 Variance Decomposition And Impulse Response

Impulse response function usually traces out how the changes in one variable impact on current and future values of the endogenous variables in the system. It can be used to produce the time path of the dependent variables in the VAR, to shocks from all the explanatory variables. If the system of equations is stable, any shock should tend to zero meaning short-run values of the variable in question converge to the long-run equilibrium values. On the other hand, an unstable system would produce an explosive time path meaning short-run values of the variable will diverge from its equilibrium values. On the other hand, variance decomposition measures the

proportion of forecast error variance in one variable explained by innovations in itself and the other variables (Asmah, 2013).

3.8 Data Presentation

Presentation was done to tables and figures.

CHAPTER FOUR

RESULTS AND DISCUSION

4.1 Introduction

This chapter presents and discusses the trends of real effective exchange rates, money supply, external debt, trade balance and inflation in Kenya for the period 1972-2015 and discussion of findings. The various diagnostic tests have also been presented and discussed in line with the study objectives.

4.2 Trend Analysis

4.2.1 Trend of Real effective exchange Rate in Kenya

Figure 4.1: Real effective exchange rate fluctuations

Figure 4.1 above shows Kenya's real effective exchange rate trend for the period 1972-2015. Clearly as shown the Kenya shilling has been fluctuating against the US dollar from the year 1972 when Kenya adopted the crawling exchange rate regime to cushion the country against the 1970's oil price shocks. According to Ndung'u (2001), the Kenya government liberalized the financial, foreign exchange and goods market. This liberalization was steady from the adoption of the crawling peg exchange rate regime from the 1960s fixed exchange rate regime to the flexible regime of 1993 to date. The exchange rate has been fluctuating significantly from the 1970's to date.

In 1972 the Kshs against the US dollar was 7.1429. A growth margin of about 2 points was experienced until 1982 when the shilling weakened against the dollar to a low of 10.9230. There was no course of alarm as this was within the CBK range. However, there was an alarming weakening shilling from 1982 to an all-time low of 58.0013 in the year 1993 forcing the country to adopt the flexible exchange rate where market forces were given room to prevail. There was a downward trend as the shilling appreciated to 56.0506 in 1994 and 51.4298 in 1995. However, this did not continue for long as the shilling started experiencing an upward trend from 1995 to a low of 79.139 in 2004 before strengthening to 67.3176 in 2007. This was followed by the 2008 global financial crisis which saw the Kenya shilling depreciate against all other major world currencies. This was also the same period Kenya was experiencing it worst political crisis after the 2007 disputed presidential elections (OECD, 2012). The value of the Kenya shilling weakened from 67.3176 in 2007 to 69.1753 in 2008 and to an all-time low of 98.1785 in 2015 with the month of July 2015 recording the worst ever figure of 108. These upward and

downward trends in the value of the Kenya shilling indicate fluctuations which implies the instability of the Kenya shilling globally.

4.2.2 Trend of Money Supply in Kenya

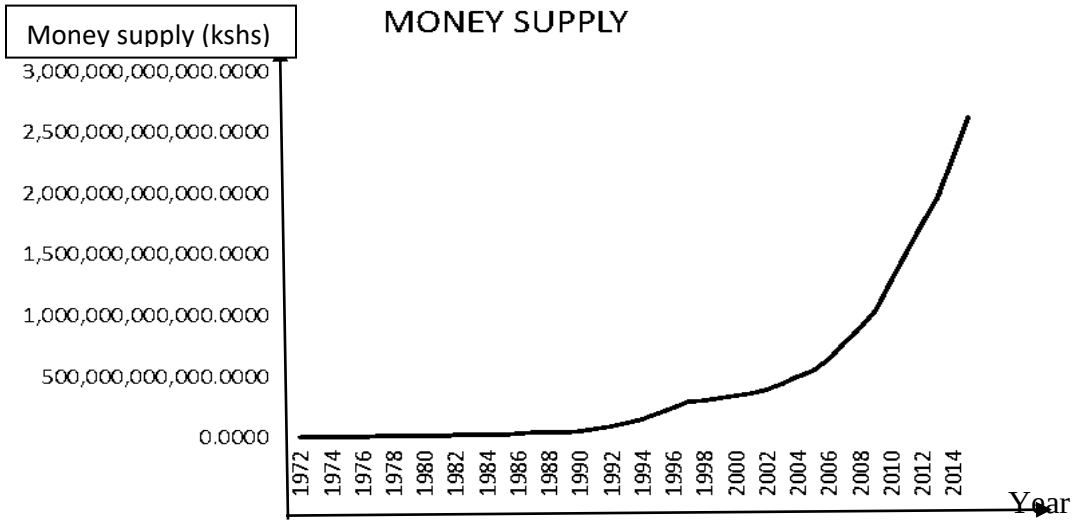

Figure 4.2: Money supply trend in Kenya (self-computation from excel sheet)

Figure 4.2 above shows Kenya's money supply trend for the period 1972 –2015. Clearly as depicted there is a steady increase in money supply from 4.295B in 1972 to 12.2B in 1977, 16.13B in 1980. In 1986 money supply growth was more than 100% from 16.12B in 1980 to 35.7B. This double increase is also shown in 1991 (69.4B) and 1992 (96.6B). Since then, the growth in money supply has been growing immensely to highs of 775B in 2007, 896B in 2008, 1.044T in 2009, and 1.277T in 2010 and 2.65T in 2015. This clearly shows an ever increasing upward trend in money supply in Kenya. This was mainly attributed to the increased demand for money to finance various development projects in the country (Ndung'u, 2013).

4.2.3 Trend of External Debt in Kenya

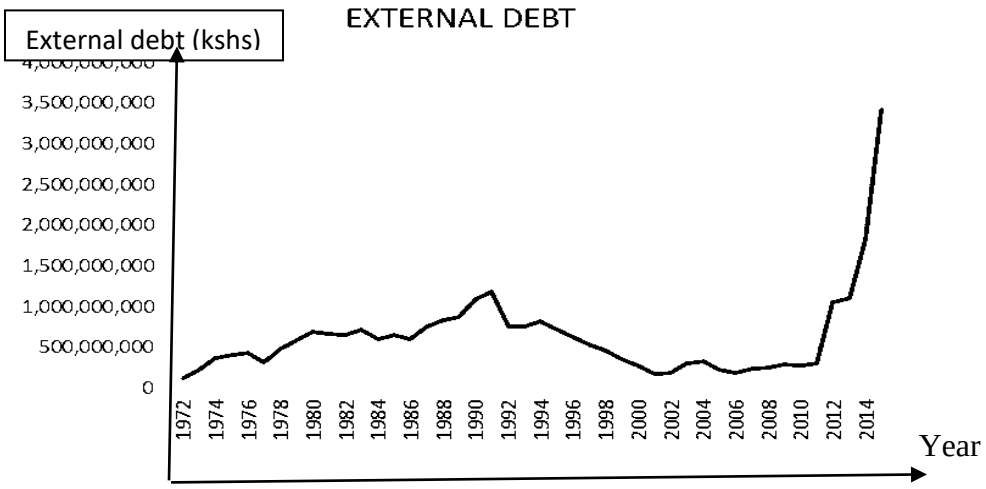

Figure 4.3: External Debt Trend in Kenya

Figure 4.3 shows Kenya's external debt growth for the period 1972-2015. Kenya's external debt has been growing tremendously from 123B in 1973 to 689B in 1980 and declined to 604B in 1986. This is followed by a double increase to 1.184T in 1991 and then a downward trend to 752B in 1992, 356B in 1999, 276B in 2010 and then a sharp increase to 3.4T in the year 2015. External debt of Kenya was on a downward trend in the early to mid-1980s. In the 1980s and the years preceding, Kenya was among the major aid recipients in Africa, largely to put up infrastructure so as to integrate the large rural economy into the then emerging import substitution Kenyan economy (Mutuku and Putunoi, 2013). Mwega (2009) asserts that the multivariate aid (mainly in form of loans) increased moderately in the 1980s and early 1990s, primarily due to the disbursement of the World Bank adjustment lending under SAPs. The share of external debt increased sharply from the early 1990s to mid-1990s before declining sharply in the late 1990s. The 1990s witnessed a steady decline in development assistance to Kenya occasioned by a perception of poor governance and mismanagement of public resources and

development assistance. Other factors include the end of the cold war and the collapse of the Soviet Union. These led to a debt crisis in the country in the early 1990s which turned Kenya into a highly indebted nation. The debt problem was exacerbated by macroeconomic mismanagement in the 1990s such as the Goldenberg scandal which fleeced Kenyans billions of shillings leading to a reduction of donor inflows (Mutuku and Putunoi, 2013). An upward trend picked up from 2000 to 2007 and Mwega (2009) attributed this to increased government borrowing to finance development projects on infrastructure.

4.2.4 Trend of Trade Balance in Kenya

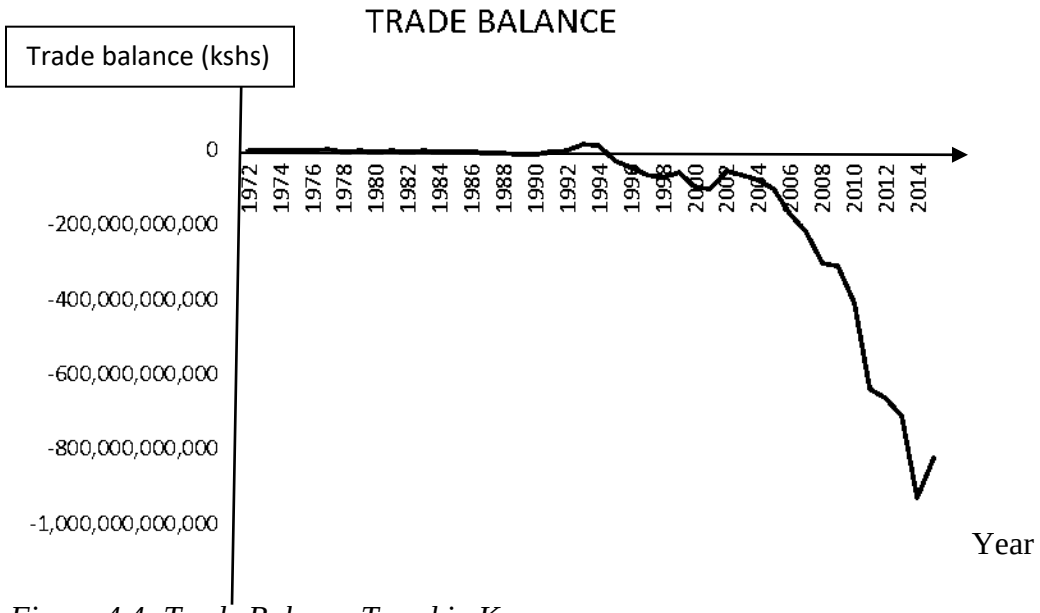

Figure 4.4: Trade Balance Trend in Kenya

Kenya's trade balance continues to exhibit a negative balance since 1972 save for 1976 (202m), 1977 (1.252B, 1993 (16.5B) and 1994 (11.28B). this was because Imports outweighed exports for the period 1972-2015. According to Roberto and Fagernäs (2004) Kenya's economy experienced a declining trend in its trade until the late 1980s. Kenya lost world market share for its coffee exports, but was able to increase its presence in the exports market for tea and

horticultural products, in the 1990's there was rapid real export growth, notably through the expansion of exports of garments. However, this growth was not enough to offset the ever rising imports hence the country still experienced a negative trade balance. According to the (Ministry of Trade, 2008), the trade sector has shown growth trend from 2003 to 2007. This is partly due to increase in trade particularly within the East African Community (EAC) and the Common Markets of Eastern and Southern Africa (COMESA) regions. According to (Economic Survey, 2010), domestic exports grew marginally by 0.3% while re-exports declined by 4.1%. Total imports grew by 2.3% in 2009 compared to a 27.4% growth recorded in 2008. This resulted in the volume of trade growing by 1.6% in 2009 compared to a growth of 26.8% in 2008.

4.2.5 Trend of Inflation in Kenya

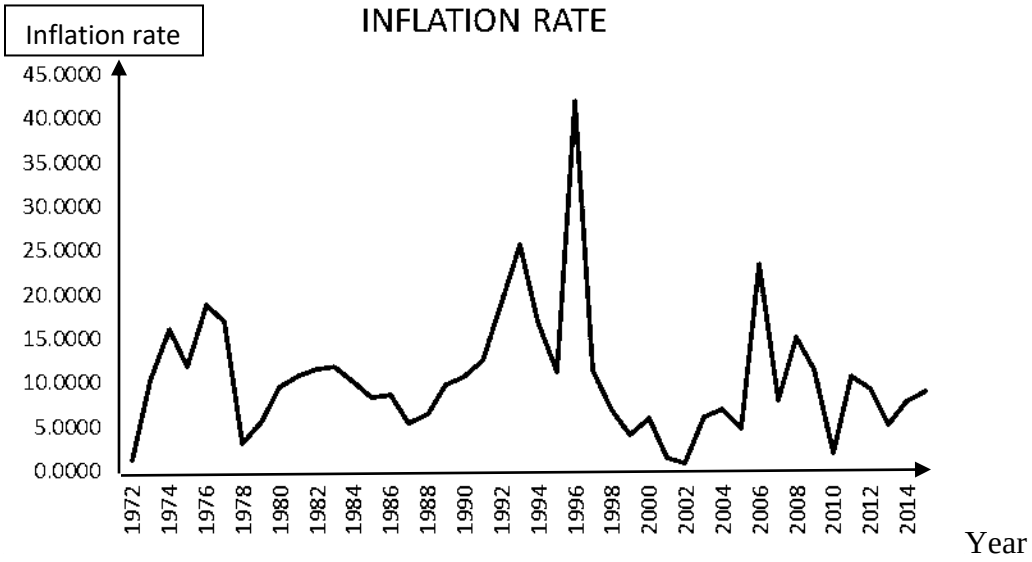

Figure 4.5: Inflation Rate trend in Kenya

Figure 4.5 depicts Kenya's inflation rate trend for the period 1972-2015. From 1972 to 1977 there was a steady increase in the inflation rate from 1.2% to 16.9% respectively followed by a reduction to 3% in 1978 before rising again to 10.192 in 1984. The highest rate of inflation was

experience in 1996 at 42%. The central bank of Kenya set the rate at $5\% \pm 2.5\%$. The country has been on course to achieve this target including the year 2013 (5.4%) but slipped in the year 2015 (9.2). this was highly due to the shortage of food production that led to a general increase in the consumer price index. The country experienced a major drought with rains taking long to water the crops and farmers experiencing retarded growth in their yield.

4.3 Descriptive Analysis of Variables

According to Johansen (2011) descriptive statistics gives initial indication of variables that can be used in regression analysis giving several summarized statistics on a variable, e.g. mean, medium, standard deviation and also often the lowest and highest observation.

Table 4.1: Descriptive Statistics of Variables

	E	ED	I	M	TB
Mean	43.19300	6.08E+08	10.28620	4.27E+11	-1.31E+11
Median	41.82333	5.12E+08	9.659865	1.10E+11	-9.41E+09
Maximum	98.17845	3.43E+09	41.98877	2.63E+12	1.65E+10
Minimum	7.020384	82032000	-9.219158	3.51E+09	-9.33E+11
Std. Dev.	32.04603	5.48E+08	7.781255	6.53E+11	2.41E+11
Skewness	0.133749	3.248298	1.363084	1.930188	-2.094327
Kurtosis	1.329773	16.72258	8.004219	5.895752	6.207892
Jarque-Bera	5.483991	441.8203	62.24220	44.63510	6.207892
Probability	0.064442	0.000000	0.000000	0.000000	0.000000
Observations	46	46	46	46	46

Source: Own Computation from eviews 7.1

The statistics in Table 4.1 indicate that the means and medians are not much different from each other which imply that real effective exchange rate, external debt, inflation, money supply and trade balance are normally distributed. Jarque-Bera test further confirms that the variables are normally distributed at 5% level of significance since the

$JB - statistic > \chi^2\ (2df) = 5.99147)$ for each of the variables. The maximum and minimum for the variables are; 98.17845 (2015) and 7.020384 (1973) for real effective exchange rate respectively, Ksh. 2.6 trillion (2015) and Ksh.4.3 billion (1972) respectively for money supply, 343B (2015) and 820m (1972) for external debt, 16B (1993) and minus 932B in 2014 for trade balance, 41.98% (1996) and 0.932% in 2002 for inflation rate.

According to Masaku (2012), the standard deviation represents the amount of deviation from the mean, (the smaller the standard deviation the more accurate future predictions may be, because there is less variability). In table 4.1, the results indicate that exchange rate, money supply, external debt, trade balance and inflation do not deviate much from the mean (the variables have smaller standard deviation) thus the more accurate are the future predictions. Musau and Musau (2011) assert that skewness measures the direction and degree of asymmetry; a value of zero indicates a symmetrical distribution, a positive value indicates skewness (longtailedness) to the right while a negative value indicates skewness to the left, value between -3 and +3 indicate typical values of samples from a normal distribution. While Kurtosis measures the heaviness of the tails of a distribution, negative kurtosis indicates too many cases in the tails of distribution; positive kurtosis indicates too few cases (Musau & Musau, 2011).

From Table 4.1, results indicate that all the variables have normal curves since the value of skewness lies between -3 and +3. The negative values of skewness for variables of trade balance indicate a tail to the left while a positive value for exchange rate, money supply, external debt

and inflation indicates a tail to the right with all the distributions having too few cases in the tails (lighter tails) since the kurtosis for all the variables are positive.

4.4 Correlation Analysis

The study involved identifying the existence of correlation between; exchange rate, money supply, external date, trade balance and inflation using correlation coefficients obtained from the correlation matrix. Analysis of data with regard to correlation was based on the null hypothesis of no correlation in line with the objectives of study.

Table 4.2: Correlation matrix

Sample: 1970 2015
Included observations: 46

Correlation Probability	E	ED	I	M	TB
E	1.000000				

ED	0.207171	1.000000			
	(0.1671)	-----			
I	-0.020192	0.079229	1.000000		
	(0.8940)	(0.6007)	-----		
M	0.761600	0.559581	-0.098187	1.000000	
	(0.0000)	(0.0001)	(0.5162)	-----	
TB	-0.683059	-0.544308	0.104989	-0.984250	1.000000
	(0.0000)	(0.0001)	(0.4874)	(0.0000)	-----

N=45 ( ) P-values

Based on the first objective, there is a strong positive correlation between money supply and real effective exchange rate fluctuations in Kenya $r = 0.7616$. From the results in Table 4.2, the study therefore rejects the null hypothesis of no correlation between money supply and real effective exchange rate fluctuations in Kenya at 5 % level of significance with the correlation

between money supply and real effective exchange rate fluctuations being significant (p value=0.0000) since $r \neq 0$. These were in conformity with Saeed *et al*. (2012), in Pakistan, Papadopoulus and Zis (2000), in Greece, Wilson (2009), in USA, Karanja (2010) in the UK and Ndung'u (2000) in Kenya. These results however, contradict those found by Musa (1984), Hopper (1997), in USA, and Karanja (2010) in Kenya and Singapore who found a negative but significant association between money supply and exchange rate. Given that various researchers had varied results on the correlation between money supply and real effective exchange rate fluctuations, our analysis establishes a strong significant positive correlation between money supply and real effective exchange rate fluctuations in Kenya.

The results summarized in Table 4.2 show that; based on the second objective, there is a weak positive correlation between external debt and real effective exchange rate fluctuations in Kenya ($r = 0.207171$). From these results the study therefore rejects the null hypothesis of no correlation between external debt and real effective exchange rate fluctuations at 5 % level of significance with the correlation between external debt and real effective exchange rate fluctuations being insignificant (p value=0.1671). Although these results in contrast to those of Devereux and lane (2001), in selected developing economies and Siregar and Pontines (2005) in East Asia countries who found a negative significant correlation between trade balance and exchange rate, they are in conformity with those of Saeed *et al*., (2012) in Pakistan, Saheed *et al*., (2015), in Nigeria, Dunescu (2014), in Romania and Otuori (2013) in Kenya. Although various researchers had varied views on the correlation between external debt and real effective exchange rate fluctuations, the analysis of results provides evidence of a weak insignificant positive correlation between external debt and real effective exchange rate fluctuations in Kenya.

Given the third objective, there is a strong negative correlation between trade balance and real effective exchange rate fluctuations in Kenya ($r = 0.683059$). From the results in Table 4.2, the study therefore rejects the null hypothesis of no correlation between trade balance and real effective exchange rate fluctuations in Kenya at 5 % level of significance with the correlation between trade balance and real effective exchange rate fluctuations being significant (p value=0.0000) since $r \neq 0$. These results conform to those of Tseng, Chen and Lin (2005) in Taiwan, Karanja (2010) in Kenya and Mirchandani (2013), in India. However, they are in contradiction to those by Baharamshah (2001), in Thailand and Malaysia, Kiptui and Kipyegon (2008), in Kenya who found that there was a positive significant correlation between trade balance and exchange rate fluctuations. Although the various researchers had divergent views on the correlation between trade balance and exchange rate fluctuations, the finding indicates that there is a strong significant negative correlation between trade balance and real effective exchange rate fluctuations in Kenya.

Based on the fourth objective, there is a weak negative correlation between inflation rate and real effective exchange rate fluctuations in Kenya ($r = -0.020192$). From the results in Table 4.2, the study therefore rejects the null hypothesis of no correlation between inflation rate and real effective exchange rate fluctuations in Kenya at 5 % level of significance with the correlation between inflation rate and real effective exchange rate fluctuations in Kenya being insignificant (p value=0.8940) since $r \neq 0$. These results conform to those by Mirchandani (2013), in India, Ndung'u (2000), in Kenya and Otuori (2013) in Kenya. However, they are a contradiction to those by Nduri (2013), in Kenya and McPherson and Rakovski (2000), in Kenya who concluded that there was a positive significant correlation between inflation and real effective exchange rate. Given that various researchers had varied results on the correlation between inflation rate

and real effective exchange rate fluctuations, this analysis establishes a weak significant negative correlation between inflation rate and real effective exchange rate fluctuations in Kenya.

4.5 Stationarity Test

To identify the time series property of stationarity for each of the variables, Augmented Dickey Fuller (ADF) test was performed on levels and first differences. The ADF test takes the form of equations (3.5), (3.6) and (3.7). This test examined the null hypothesis that the considered variable has a unit root (series non stationary) against the alternative hypothesis that the variable is stationary.

Table 4.3: Unit root test

		ADF (P-value)			**Inference**	**PP (P-value)**			**Inference**
		Level	First Difference	Second Difference		Level	First Difference	Second Diff	
Exchange Rate	Intercept	0.9759	0.0000		I (1)	0.9759	0.0000		I (1)
	Trend & Intercept	0.4917	0.0001		I (1)	0.4632	0.0001		I (1)
	None	0.9941	0.0000		I (1)	0.9925	0.0000		I (1)
External Debt	Intercept	0.9993	0.9999	0.0000	I (2)	0.9516	0.8725	0.0000	I (2)
	Trend & Intercept	1.0000	0.8666	0.0000	I (2)	0.9985	0.9477	0.0000	I (2)
	None	0.9797	0.3618	0.0000	I (2)	0.9398	0.6130	0.0000	I (2)
Inflation	Intercept	0.0001	-	-	I (0)	0.0001	-	-	I (0)
	Trend & Intercept	0.0007	-	-	I (0)	0.0005	-	-	I (0)
	None	0.1133	0.0000		I (1)	0.0094	-	-	I (0)
Trade Balance	Intercept	1.0000	0.9995	0.0000	I (2)	1.0000	1.0000	0.0000	I (2)
	Trend & Intercept	1.0000	0.9926	0.0000	I (2)	1.0000	0.9993	0.0000	I (2)
	None	0.9999	0.9970	0.0000	I (2)	1.0000	1.0000	0.0000	I (2)
Money	Intercept	1.000	0.9995	0.0000	I (2)	1.000	1.0000	0.000	I (2)

Supply	pt	0				0		0	
	Trend & Intercept	1.0000	0.9926	0.0000	I (2)	1.0000	0.9993	0.0000	I (2)
	None	0.9999	0.9970	0.0000	I (2)	1.0000	1.0000	0.0000	I (2)

Note. The null hypothesis is that the series contains a unit root (series non stationary). The rejection of the null hypothesis is based on the Mackinnon (1996) one-sided p-values given in parentheses. ** implies rejection of null hypothesis of non-stationarity at 5% significance level.

The results of ADF tests presented in Table 4.3 reveals that the real effective exchange rate is integrated of order 1, I (1) and non-stationary in levels (intercept, trend and intercept, none) and only become stationary after first differencing. These results are confirmed by Philip Pheron test on the right hand side of the table. For money supply, the ADF tests revealed that money supply is integrated of order 2, I (2) and is non-stationary at level (intercept, trend and intercept, none) and only becomes stationary after second differencing. The results are confirmed by Philip Pheron test. The ADF tests also revealed that external debt and trade balance are integrated of order 2, I (2) and are non-stationary at level. External debt and trade balance become stationary after the second differencing and this is confirmed by the Philip Pheron test. ADF test revealed that inflation is stationary at level for intercept and trend and intercept but is integrated of order1, for none and is non-stationary at level. However, it becomes stationary after first differencing. This result is confirmed by Philip Pheron test.

4.6 Cointegration and Vector Error Correction Mechanism

4.6.1 Cointegration Test Results

Having determined that the variables of real effective exchange rate is integrated of order 1, I (1), money supply, external debt and trade balance integrated of order 2, I (2) and inflation is

integrated of order 0, I (0), this study established cointegration between money supply, external debt, trade balance and inflation and real effective exchange rate fluctuations in Kenya. To achieve this, the researcher performed the Johansen cointegration test to establish whether the variables in question are cointegrated using two likelihood ratio tests namely; the trace test and maximum eigenvalue test. Analysis of data was based on the null hypothesis of no cointegration in line with the objectives of this study.

Table 4.5: Cointegration

Sample (adjusted): 1976 2015

Included observations: 40 after adjustments

Trend assumption: Linear deterministic trend

Series: E ED I M TB

Lags interval (in first differences): 1 to 3

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.654291	118.7329	69.81889	0.0000
At most 1 *	0.487329	76.24656	47.85613	0.0000
At most 2 *	0.414457	49.52170	29.79707	0.0001
At most 3 *	0.345864	28.11307	15.49471	0.0004
At most 4 *	0.242996	11.13547	3.841466	0.0008

Trace test indicates 5 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.654291	42.48630	33.87687	0.0037
At most 1	0.487329	26.72486	27.58434	0.0641
At most 2 *	0.414457	21.40863	21.13162	0.0457
At most 3 *	0.345864	16.97760	14.26460	0.0182
At most 4 *	0.242996	11.13547	3.841466	0.0008

Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegrating Coefficients (normalized by b'*S11*b=I):

E	ED	I	M	TB
-244.9057	-589.2879	41.10431	1747.727	72.28505
-2133.486	-3.871141	36.96460	-1815.633	-81.76683
-2244.482	200.3314	-34.13721	690.1867	-34.73045
1361.204	875.7218	7.691770	980.4189	120.1803
-232.6426	-480.5131	-4.656609	-2433.511	49.36078

Unrestricted Adjustment Coefficients (alpha):

D(E)	0.000466	8.48E-05	0.000713	0.000415
D(ED)	0.002146	-0.000588	-0.000725	-0.002249
D(I)	-0.038128	-0.023231	0.021885	-0.005332
D(M)	-0.000433	0.000272	-0.000279	0.000244
D(TB)	-0.016566	0.007619	-0.004205	-0.009407

1 Cointegrating Equation(s):	Log likelihood	748.0720

Normalized cointegrating coefficients (standard error in parentheses)

E	ED	I	M	TB
1.000000	2.406183	-0.167837	-7.136329	-0.295155
	(0.70495)	(0.04059)	(2.18483)	(0.08081)
	[3.41327]	[-4.13467]	[-3.26631]	[-3.65238]

Note: values in () represent standard errors while values in [ ] represent the t-statistic.

The results in Table 4.5 indicate that both the trace test and maximum eigenvalue test in the Johansen procedure each detected 5 and 1 cointegrating vectors respectively, thus the study rejects the null hypothesis of no cointegration at 5% level of significance.

From the Johansen procedure results in Tables 4.5, model (3.2), under model specification and definition becomes the cointegrating equation hence expressed as;

$$E_t - 7.136329M_t + 2.406183ED_t - 0.295155TB_t - 0.167837I_t = 0 \quad (4.1)$$

Making exchange rate the subject, equation 4.1 becomes:

$$E_t = 7.136329M_t - 2.406183ED_t + 0.295155TB_t + 0.167837I_t \quad (4.2)$$

Basing on the first objective, rejection of the null hypothesis of no cointegration at 5% significance level among the variables implies that the variables of money supply and real effective exchange rate fluctuations in Kenya have a significant positive (equation 4.2) long run relationship that conforms to a priori expectation. This result is in conformity with Ndung'u (2000) in Kenya. Saeed *et al*. (2012), in Pakistan, Papadopoulus and Zis (2000), in Greece and Wilson (2009), in USA found a positive significant relationship between money supply and exchange rate. However, they did not do the long run relationship between the two variable. The results contradict those of Karanja (2010), in Kenya and Singapore who found that money supply had a negative but significant (table 4.5) relationship with real effective exchange rate (he too did not establish the long run relationship. Despite the varied results by various researchers, this finding of a significant positive long relationship between money supply and real effective exchange rate fluctuations in Kenya implies that money supply affects real effective exchange rate in the long run. Thus, a unit increase in the level of money supply depreciates the Kenyan shilling by 7.1363 units.

Based on the second objective, rejection of the null hypothesis of no cointegration at 5% significance level among the variables implies that the variables of external debt and real effective exchange rate fluctuations in Kenya have a significant negative long run relationship. Significant external debt and real effective exchange rate fluctuations cointegration finding in Kenya is consistent with the results of Devereux and Lane (2001), in selected developing countries and Siregar and Pontines (2005), in East Asia countries. The results are however, inconsistent with Saeed *et al*. (2012), in Pakistan, Saheed *et al*. (2015), Nigeria, Dunescu (2014), in Romania and Otuori (2013), in Kenya who concluded that there was a positive significant relationship between external debt and real effective exchange rate. Given the varied results by the various researchers, the significant negative long relationship finding between external debt and real effective exchange rate fluctuations in Kenya implies a rising external debt depreciates the Kenyan shilling in the long run. Thus, a unit increase in the level of external debt depreciates the Kenyan shilling by 2.4061 units.

Based on the third objective, rejection of the null hypothesis of no cointegration at 5% significance level among the variables implies that the variables of trade balance and real effective exchange rate fluctuations in Kenya have a significant positive long run relationship. These results are consistent to those of Baharumshah (2001), in Thailand and Malaysia, Karanja (2010), in Kenya and Kiptui and Kipyegon (2008), in Kenya. However, there is a sharp contrast with those of Tseng *et al*. (2005), Taiwan, and Mirchandani (2013), in India who established a negative but significant relationship between trade balance and real effective exchange rate. Although the various researchers lacked consensus on the trade balance and real effective exchange rate relationship, the positive significant relationship finding in Kenya implies that in the long run trade balance affects real effective exchange rate fluctuations. The value of Kenyan

shilling is expected to fall when the trade balance is in deficit and more likely to rise when the trade balance is in surplus. Thus, a unit increase in the level of surplus trade balance appreciates the Kenyan shilling by 0.2951 units.

Based on the fourth objective, rejection of the null hypothesis of no cointegration at 5% significance level among the variables implies that the variables of inflation rate and real effective exchange rate fluctuations in Kenya have a significant positive long run relationship. The results are in conformity to those by Nduri (201), in Kenya and McPherson and Rakovski (2000), in Kenya. They are however, contradicting the findings of Mirchandani (2013), in India, Ndung'u (2000), in Kenya and Otuori (2013), in Kenya who established a negative significant relationship between inflation and real effective exchange rate. Although the various researchers lacked consensus on the inflation rate and real effective exchange rate relationship, the positive significant relationship finding in Kenya implies that in the long run inflation rate affects real effective exchange rate fluctuations. A rising inflation rate depreciates the Kenyan shilling. Thus, a unit increase in the inflation rate depreciates the Kenyan shilling by 0.1678 units.

4.6.2 Vector Error Correction Model (VECM)

Following Granger representation theorem which states that if two (or more) variables Y and X(s) are cointegrated, then the relationship between (or among) them can be expressed as error correction mechanism. Existence of cointegration among the variables of the model which we established necessitated the need for the VECM of the form (3.8), (3.9), (3.10), (3.11), and (3.12) to capture the short run dynamics of the model. The equilibrium error term μ_{t-1} corrects the disequilibrium and guides the variables $E_t, M_t, ED_t, TB_t and\ I_t$ to restore bac k to equilibrium.

Table 4.6: Vector Error Correction Model

Vector Error Correction Estimates

Sample (adjusted): 1976 2015

Included observations: 40 after adjustments

Standard errors in ( ) & t-statistics in [ ]

Cointegrating Eq:	CointEq1				
C	-0.000281				
Error Correction:	D(E)	D(ED)	D(I)	D(M)	D(TB)
CointEq1	-0.114179	-0.525539	9.337758	0.105929	4.057052
	(0.07984)	(0.23936)	(3.58984)	(0.04522)	(1.41738)
	[-1.43015]	[-2.19563]	[2.60116]	[2.34274]	[2.86236]
D(E(-1))	-0.780600	0.247539	-22.19720	0.052966	0.479237
	(0.30720)	(0.92099)	(13.8130)	(0.17398)	(5.45378)
	[-2.54105]	[0.26877]	[-1.60698]	[0.30443]	[0.08787]
D(E(-2))	-0.347571	-0.381768	-45.87175	0.093869	-6.437411
	(0.33918)	(1.01688)	(15.2510)	(0.19209)	(6.02157)
	[-1.02474]	[-0.37543]	[-3.00778]	[0.48866]	[-1.06906]
D(E(-3))	-0.139060	-0.429122	-27.45932	0.127219	-4.062652
	(0.34115)	(1.02278)	(15.3395)	(0.19321)	(6.05653)
	[-0.40763]	[-0.41956]	[-1.79010]	[0.65845]	[-0.67079]
D(ED(-1))	0.266285	-0.221641	-19.34073	-0.240141	-8.195213
	(0.17615)	(0.52812)	(7.92068)	(0.09977)	(3.12733)
	[1.51166]	[-0.41968]	[-2.44180]	[-2.40706]	[-2.62051]
D(ED(-2))	0.225160	-0.390494	-14.22008	-0.200200	-6.694664
	(0.14509)	(0.43500)	(6.52400)	(0.08217)	(2.57588)
	[1.55184]	[-0.89770]	[-2.17966]	[-2.43632]	[-2.59898]
D(ED(-3))	0.245806	-0.409171	-5.110837	-0.182521	-6.163021
	(0.15641)	(0.46891)	(7.03270)	(0.08858)	(2.77673)
	[1.57160]	[-0.87259]	[-0.72672]	[-2.06051]	[-2.21953]
D(I(-1))	-0.014978	-0.066201	-0.302388	0.013487	0.475967
	(0.01025)	(0.03074)	(0.46108)	(0.00581)	(0.18205)
	[-1.46069]	[-2.15335]	[-0.65582]	[2.32224]	[2.61449]

D(I(-2))	-0.009082	-0.044494	-0.491777	0.006741	0.248306
	(0.00651)	(0.01950)	(0.29251)	(0.00368)	(0.11549)
	[-1.39604]	[-2.28137]	[-1.68125]	[1.82970]	[2.15001]
D(I(-3))	-0.001733	-0.018310	-0.170147	0.001078	0.072908
	(0.00287)	(0.00860)	(0.12904)	(0.00163)	(0.05095)
	[-0.60402]	[-2.12809]	[-1.31858]	[0.66338]	[1.43102]
D(M(-1))	-0.329779	-3.272691	61.48069	-0.357421	14.88357
	(0.57673)	(1.72907)	(25.9324)	(0.32663)	(10.2389)
	[-0.57181]	[-1.89275]	[2.37081]	[-1.09426]	[1.45363]
D(M(-2))	-0.666429	-1.701655	25.88395	-0.051776	13.12502
	(0.56336)	(1.68899)	(25.3313)	(0.31906)	(10.0016)
	[-1.18295]	[-1.00750]	[1.02182]	[-0.16228]	[1.31230]
D(M(-3))	-0.448452	-0.531509	1.675352	-0.278412	2.954828
	(0.34804)	(1.04344)	(15.6494)	(0.19711)	(6.17885)
	[-1.28852]	[-0.50938]	[0.10706]	[-1.41246]	[0.47822]
D(TB(-1))	-0.013974	-0.126343	1.648044	0.037685	-0.084810
	(0.02623)	(0.07863)	(1.17923)	(0.01485)	(0.46560)
	[-0.53283]	[-1.60687]	[1.39756]	[2.53716]	[-0.18215]
D(TB(-2))	0.009127	-0.096107	0.380100	0.027371	-0.317287
	(0.02263)	(0.06785)	(1.01753)	(0.01282)	(0.40175)
	[0.40332]	[-1.41657]	[0.37355]	[2.13566]	[-0.78976]
D(TB(-3))	0.007715	-0.072280	-0.534997	0.015230	-0.151426
	(0.01334)	(0.03998)	(0.59965)	(0.00755)	(0.23676)
	[0.57852]	[-1.80782]	[-0.89219]	[2.01651]	[-0.63958]
C	-2.31E-05	0.000182	-0.002946	-3.35E-05	0.000531
	(0.00033)	(0.00099)	(0.01481)	(0.00019)	(0.00585)
	[-0.07020]	[0.18423]	[-0.19894]	[-0.17983]	[0.09075]
R-squared	0.758426	0.798429	0.937155	0.754808	0.862582
F-statistic	4.513068	5.693994	21.43620	4.425242	9.023319
Log likelihood	201.6782	157.7595	49.44316	224.4197	86.61506
Akaike AIC	-9.233908	-7.037974	-1.622158	-10.37099	-3.480753

Note. Values in ( ) are std errors while values in [ ] are t-statistics, * implies statistical significance at 5% level of significance.

The results summarized in table 4.6 by examining the F- statistics and the R^2 indicate that the variables in VECM significantly explained short – run changes in Et (real effective exchange rate) at 5% level of significant accounting for 0.7584 of the changes. All the other variables in VECM also significantly explained short-run changes at 5% level of significance account for 0.7548 for M_t (money supply), 0.7984 for ED_t (external debt), 0.8625 for TB_t (trade balance) and 0.9371 for I_t (inflation rate). From the results in table 4.6 models (3.8), (3.9), (3.10), (3.11), and (3.12) are represented as models (4.3), (4.4), (4.5), (4.6) and (4.7) respectively with 3 lags and t-statistics in parentheses. The lag length determination was by AIC as shown in table 4.7.

$$\begin{aligned}\Delta E_t = {} & \underset{[-0.0702]}{0.0000231} - \underset{[-0.5718]}{0.3298}\Delta M_{t-1} - \underset{[-1.1830]}{0.6664}\Delta M_{t-2} - \underset{[-1.2885]}{0.0017}\Delta M_{t-3} - \underset{[-2.5410]}{0.7806}\Delta E_{t-1} - \underset{[-1.0247]}{0.3475}\Delta E_{t-2} \\ & - \underset{[-0.4076]}{0.1390}\Delta E_{t-3} + \underset{[1.5116]}{0.2662}\Delta ED_{t-1} + \underset{[1.5518]}{0.2252}\Delta ED_{t-2} + \underset{[1.5716]}{0.2458}\Delta ED_{t-3} - \underset{[-0.5328]}{0.01340}\Delta TB_{t-1} + \underset{[0.4033]}{0.0091}\Delta TB_{t-2} \\ & + \underset{[0.5785]}{0.0077}\Delta TB_{t-3} - \underset{[-1.4607]}{0.0150}\Delta I_{t-1} - \underset{[-1.3960]}{0.0091}\Delta I_{t-2} - \underset{[-0.6040]}{0.0017}\Delta I_{t-3} - \underset{[-1.4302]}{0.1142}\Delta \mu_{t-1}\end{aligned}$$

4.3

The coefficients of the error correction term μ_{t-1} for the VECM1 (4.3) with economic real effective exchange rate fluctuations (ΔE_t) as the dependent variable has the correct sign which conform to economic a priori expectation i.e. negative and statistically significant at 5 % level of significance (validating the existence of long run relationship among money supply, external debt, trade balance, inflation and real effective exchange rate fluctuations in Kenya. This implies that the vector of real effective exchange rate fluctuations (E_t) is error correcting i.e. -11.4179%, of equilibrium error for real effective exchange rate fluctuations will be corrected in the next period (annually). This explains that real effective exchange rate fluctuations in Kenya adjust to

short run disequilibrium (shocks) caused by changes in money supply, external debt, trade balance and inflation though not significantly.

Results of Table 4.6 clearly indicate that while money supply, trade balance and inflation rate have a significant positive influence on Kenya's real effective exchange rate fluctuations in the long run, in the short run as depicted by VECM1 money supply and past values of real effective exchange rate fluctuations has an insignificant negative effect on economic real effective exchange rate fluctuations in Kenya at lag 1, 2 and 3 whereas trade balance has an insignificant negative effect evident at lag 1 and insignificant positive effect at lag 2 and 3 on real effective exchange rate fluctuations and inflation rate has an insignificant negative effect on real effective exchange rate fluctuations in Kenya at both lag 1, 2 and 3. The -0.3298, -0.664, -0.4484, -0.0140, -0.0150, -0.0091 and -0.0017 coefficients of

$M(-1), M(-2), M(-3), TB(-1), TB(-2), TB(-3), I(-1), I(-2)\ and\ I(-3)$ respectively imply that in the short run, a unit increase in money supply, trade balance and inflation rate causes depreciation to the Kenyan shilling in the short run by 0.3298, 0.664, 0.4484, 0.0140, 0.0150, 0.0091 and 0.0017 units respectively. The constant (-0.0000231) which represents the short run total factor productivity is negative and statistically insignificant.

4.6.3 Lag Length Determination

The study involved the Akaike Information criterion in the determination of the lag length for the autoregressive models (AR). In the Vector Error Correction Model (VECM) with ΔE_t as dependent variable the lag 3 has the lowest AIC value, thus the study settled for 3 as the lag length for the various autoregressive models as depicted in Table 4.9. The choice of AIC was based on the fact that it measures the information loss associated to each sub model relative to

the full model. A choice based on minimum AIC is equivalent to choosing the sub model with the minimum information loss.

Table 4.7: Vecm Akaike Information Criterion Values

LAG	1	2	3	4
AIC	-9.055334	-9.152911	-9.233908*	-9.049443

Note. Optimal lag structure has the lowest AIC value, * shows the lowest AIC value.

4.6.4 Residual Diagnostic Tests

Regression is based on certain assumptions some of which refer to the; normal distribution of the residuals, correlation between the error terms, constant variance of the residuals and correlation between explanatory variables. The study employed second order tests or econometric tests which include normality, serial correlation, multicollinearity and heteroscedasticity tests to ascertain that the assumptions of regression analysis with regard to residuals and the correlation between explanatory variables are satisfied.

4.6.4.1 Normality Test

Normality test is carried out to verify if the error term is normally distributed. The study employed Jacque –Bera (JB) test to test for normality. The results in Figure 4.6 below show that the null hypothesis that residuals are normal distributed is not rejected. The JB-statistic=0.026980 and from the chi-square distribution table at 5% level of significance, the critical $\chi^2(2df) = 5.99147$. This implies that $JB - statistic < \chi^2(2df)$, thus we do not reject the null hypothesis that residuals are normally distributed at 5 % level of significance.

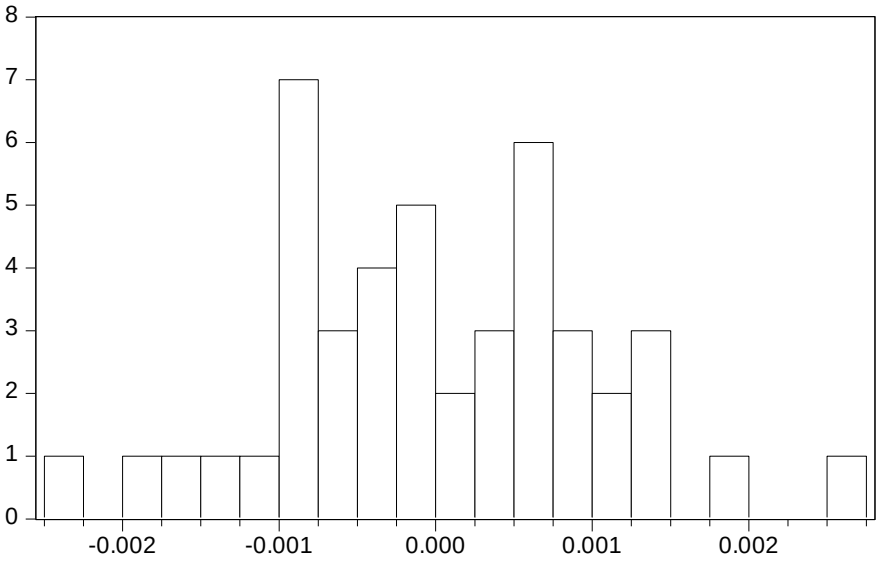

Figure 4.6: Normality test results.

4.6.4.2 Autocorrelation Test

Serial correlation refers to the case in which the error term in one period is correlated with the error term in any other time period. Classical regression assumes that such correlation does not exist. The Breusch- Godfrey serial correlation LM test was employed to test for serial correlation. Table 4.8 results indicate that the null hypothesis of no serial correlation is not rejected at 5% level of significance thus, the residuals are not correlated.

Table 4.8: Residual Serial Correlation LM Test

VEC Residual Serial Correlation LM Tests
Null Hypothesis: no serial correlation at lag order h

Sample: 1972 2015

Included observations: 40

Lags	LM-Stat	Prob
1	20.12285	0.7404

4.6.4.3 Multicollinearity

Multicollinearity refers to the case in which two or more explanatory variables in the regression model are highly correlated which makes it difficult to isolate their individual effects on the dependent variable. This study involved the use of Variance Inflation Factor (VIF) to test for multicollinearity. The results in Table 4.9 clearly indicate all the VIF are less than 10. This implies that none of the variables is highly collinear.

Table 4.9: Variance Inflation Factors

Sample: 1971 2015
Included observations: 45

Variable	Coefficient Variance	Uncentered VIF	Centered VIF
C	1.09E-07	4.327733	NA
ED	0.001253	1.126699	1.021634
I	2.82E-06	1.033354	1.033143
M	0.029422	4.142800	1.063465
TB	2.82E-05	1.058578	1.058160

Note: if VIF is greater than 10, the variables are highly collinear

4.6.4.4 Heteroscedasticity Test

Heteroscedasticity occurs when the variance of the error term is not constant. The study employed White's General Heteroscedasticity Test to test for heteroscedasticity. Results depicted in Table 4.10 show that there is no heteroscedasticity. This implies that we do not reject the null hypothesis of no heteroscedasticity (homoscedasticity) at 5 % level of significance thus a constant variance for the residuals.

Table 4.10: Residual Heteroscedasticity Test Result

VEC Residual Heteroskedasticity Tests:
No Cross Terms (only levels and squares)
Sample: 1972 2015
Included observations: 40

Joint test:

Chi-sq	df	Prob.
464.4052	480	0.6870

4.7 Granger Causality Test

Cointegration gives signal that there is possibility of causality but does not show direction of causality. This study examined causality linkage between exchange rate, money supply, external debt, trade balance and inflation in Kenya by estimating five VAR models (3.13), (3.14), (3.15), 3.16 and (3.17). Data analysis was based on the null hypothesis of no causality and in line with the objectives of the study.

The test involved 3 lags based on the Akaike Information Criterion to ensure consistency with the criterion used in the determination of lag length right from unit root test through cointegration and vector error correction tests.

Table 4.11: Pairwise Granger Causality Tests
Sample: 1972 2015
Lags: 3

Null Hypothesis:	Obs	F-Statistic	Prob.
M does not Granger Cause E	41	5.16035	0.0039*
E does not Granger Cause M		0.26436	0.8506
ED does not Granger Cause E	41	3.05235	0.0121*
E does not Granger Cause ED		0.26138	0.8527
TB does not Granger Cause E	41	2.85970	0.0488*
E does not Granger Cause TB		1.15853	0.3398
I does not Granger Cause E	41	3.17649	0.0096*
E does not Granger Cause I		4.94563	0.0059*

The results summarized in Table 4.11 based on the first objective, indicate that unidirectional causality exists between money supply and real effective exchange rate fluctuations ($M_t \rightarrow E_t$). This implies that the null hypothesis of no causality is rejected for the relationship between money supply and real effective exchange rate fluctuations in Kenya. The unidirectional causality running from money supply to real effective exchange rate fluctuations in Kenya conforms to a priori expectation and is significant at 5% level of significance. The finding of causality from money supply to real effective exchange rate fluctuations in Kenya implies that money supply affects real effective exchange rate fluctuations in Kenya.

Based on the second objective, results in Table 4.11 indicate that unidirectional causality exists between external debt and real effective exchange rate fluctuations ($ED_t \rightarrow E_t$).This implies that the null hypothesis of no causality is rejected for the relationship between external debt and real effective exchange rate fluctuations in Kenya. The unidirectional causality running from external

debt to real effective exchange rate fluctuations in Kenya is significant at 5% level of significance. The finding of causality from external debt to real effective exchange rate fluctuations implies that external debt affects real effective exchange rate fluctuations in Kenya.

Given the third objective, results in Table 4.11 indicate that unidirectional causality exists between trade balance and real effective exchange rate fluctuations ($TB_t \rightarrow E_t$). This implies that the null hypothesis of no causality is rejected for the relationship trade balance and real effective exchange rate fluctuations in Kenya. Unidirectional causality from trade balance to real effective exchange rate fluctuations finding in Kenya is significant at 5% level of significance and conforms to a priori criteria. The finding of causality from trade balance to real effective exchange rate fluctuations in Kenya implies that trade balance affects real effective exchange rate fluctuations in Kenya.

Given the fourth objective, results in Table 4.11 indicate that bi-directional causality exists between inflation and real effective exchange rate fluctuations ($I_t \leftrightarrow E_t$). This implies that the null hypothesis of no causality is rejected for the relationship between inflation and real effective exchange rate fluctuations in Kenya. Bi-directional causality between inflation and real effective exchange rate fluctuations finding in Kenya is significant at 5% level of significance. The finding of causality from inflation to real effective exchange rate fluctuations in Kenya and from real effective exchange rate fluctuations to inflation indicate that the two variables affect each other. Contrary to most studies that indicate a unidirectional causality, this study found a bi-directional causality which is in conformity to the balance of payments theory.

4.8 Impulse Response

Response of E to M

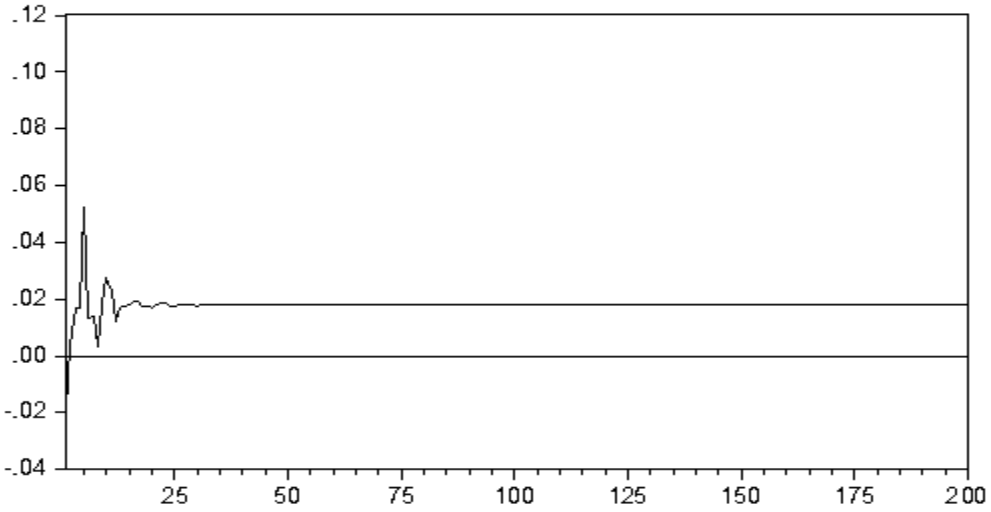

Figure 4.7: Response of Real Effective Exchange Rate Fluctuations to Money Supply

The first objective of this study was to examine the relationship between money supply and real effective exchange rate fluctuations in Kenya. The response to one standard deviation innovation to money supply as depicted in Figure 4.7 resulted in explosive positive effect on real effective exchange rate up to the 5th year and dampened by the 25th year after which the effect fizzled out.

Response of E to ED

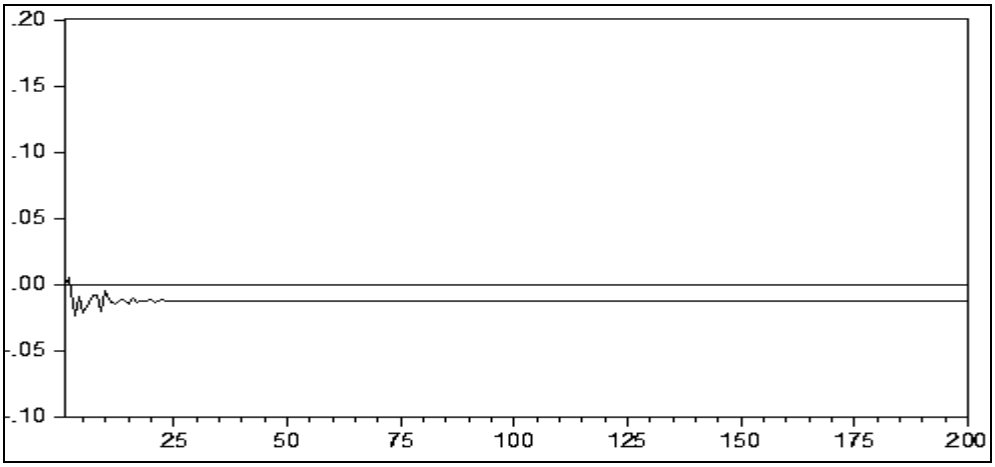

Figure 4.8: Response of Real Effective Exchange Rate Fluctuations to External Debt

The second objective of this study was to evaluate the relationship between external debt and real effective exchange rate fluctuations in Kenya. Figure 4.8 indicates that one standard deviation shock to external debt had explosive negative effects that lasted for 25 years after which we had dampened effect with a stable negative path that never fizzled out.

Response of E to TB

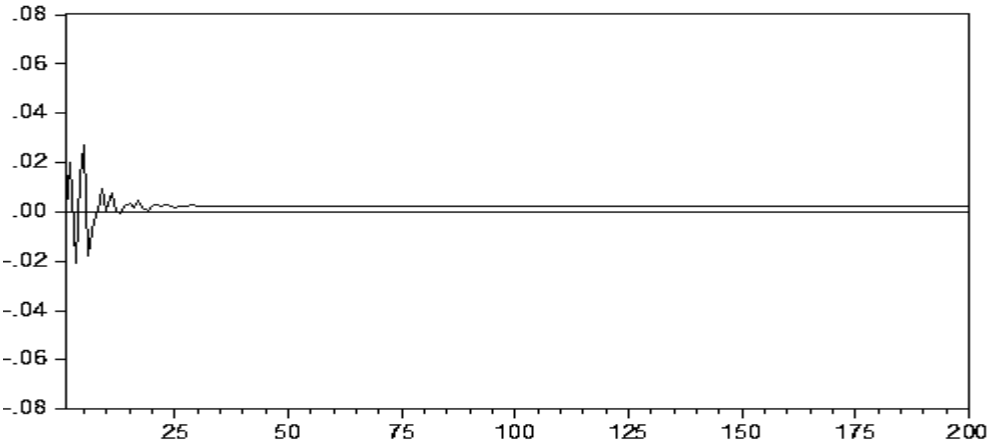

Figure 4.9: Response of Real Effective Exchange Rate Fluctuations to Trade Balance

The third objective of this study was to determine the relationship between trade balance and real effective exchange rate fluctuations in Kenya. Trade balance as shown in Figure 4.9 also had explosive positive effects up to the 30th year after which the effect dampened with a stable positive path that never fizzled out.

Response of E to I

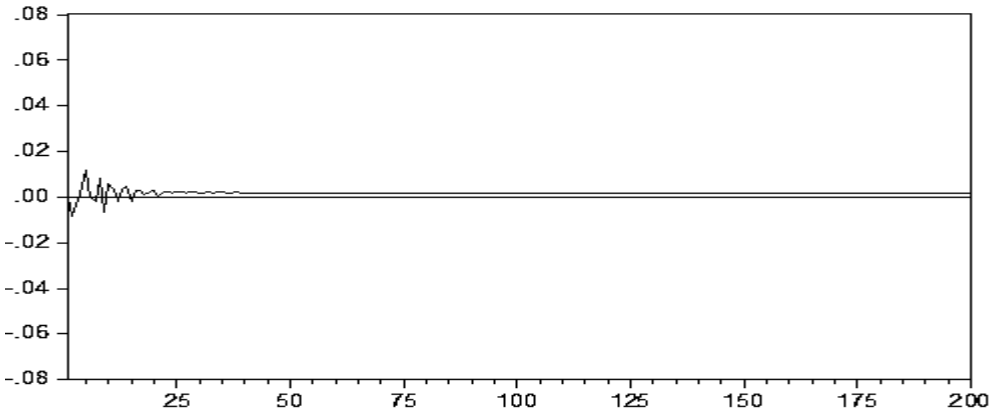

Figure 4.10: Response of Real Effective Exchange Rate Fluctuations to inflation

The fourth objective of this study was to examine the relationship between money inflation and real effective exchange rate fluctuations in Kenya. Figures 4.10 indicates that the response of real effective exchange rate fluctuations to one standard deviation innovation to inflation resulted in explosive positive effect that dampened with a stable path after the 25th year.

The findings implied that the null hypothesis of no relationship between money supply, external debt, trade balance and inflation and real effective exchange rate fluctuations in Kenya was rejected. That is, an increase in money supply, trade balance and inflation would lead to an increase (depreciation) in real exchange rate fluctuations in Kenya while an increase in external debt would decrease the real effective exchange rate fluctuations in Kenya. This result is in conformity with Ndung'u (2000) in Kenya. Saeed *et al*. (2012), in Pakistan, Papadopoulus and Zis (2000), in Greece and Wilson (2009), in USA found a positive significant relationship between money supply and exchange rate, Baharumshah (2001), in Thailand and Malaysia, Karanja (2010), in Kenya and Kiptui and Kipyegon (2008), in Kenya found a positive significant relationship between trade balance and exchange rate, Nduri (2001), in Kenya and McPherson and Rakovski (2000), in Kenya who found a positive relationship between inflation and

exchange rate. On the other hand, the external debt findings conformed to the results of devereux and Lane (2001), in selected developing countries and Siregar and Pontines (2005), in East Asia countries who found out that external debt had a significant long run relationship with exchange rate.

4.9 Variance Decomposition Analysis

The study employed variance decomposition to examine the proportion of the variance in real effective exchange rate fluctuations that was due to own and each of the independent variables variations over time in line with objectives of the study. It was noted that the larger proportion of variance in inflation was due to its own shock at 100% in the first year and reduced to 73.70% by the 12th year as depicted in Table 4.12.

Table 4.12: Variance Decomposition

Variance Decomposition of E: Period	S.E.	E	ED	I	M	TB
1	0.169290	100.0000	0.000000	0.000000	0.000000	0.000000
2	0.189343	92.44552	0.129666	0.082887	2.518982	4.822948
3	0.209291	82.80885	1.068482	1.321318	8.143393	6.657960
4	0.224889	77.58841	5.929840	1.290648	8.141921	7.049185
5	0.248718	72.31463	10.77413	1.773311	8.706947	6.430979
6	0.253947	71.95106	10.83403	2.122856	8.895050	6.197001
7	0.265809	72.88158	10.17362	2.013775	9.183654	5.747368
8	0.274049	72.55495	10.10240	1.986096	9.846023	5.510535
9	0.284734	73.28634	9.374215	2.332814	9.726121	5.280511
10	0.292969	73.46837	9.110452	2.225021	9.965506	5.230648
11	0.302638	73.61110	8.605601	2.271947	10.50584	5.005512
12	0.308830	73.70160	8.309053	2.402418	10.69432	4.892605

The first objective of this study was to examine the relationship between money supply and real effective exchange rate fluctuations in Kenya. Tables 4.12 test results indicated that in the first period the variation in real effective exchange rate in Kenya resulting from money supply, external debt, trade balance and inflation was 0. The influence of money supply on variation in real effective exchange rate in Kenya increased continuously with increase in forecasting time from the 2nd period at 2.52 up to the 12th period at 10.69. For the second objective, external debt exhibited an increase in forecasting time from the 2nd period at 0.13 up to the 6th period at 10.83 and then a reduction from the 7th period at 10.17 up to the 12th period at 8.31. The third objective showed that the influence of trade balance on variation of real effective exchange rate in Kenya increased from the 2nd period at 4.82 up to the 4th period at 7.05 before experiencing a downward shift from the 5th period at 6.43 up to the 12th period at 4.89. The influence of the inflation variables showed mixed responses at various periods with an increase in variation for the 2nd period at 0.08 up to 3rd period at 1.32, a reduction in the 4th period at 1.29 up to 5th period at 1.77, an increase in the 6th period at 2.12, a reduction in the 7th period at 2.01 up to 8th period at 1.99, an increase in the 9th period at 2.33, a reduction in the 10th period at 2.23 and an increase from the 11th period at 2.27 up to 2.40 in the 12th period.

The findings implied that the money supply, external debt, trade balance and inflation are determinants of real effective exchange rate fluctuations in Kenya. The study therefore rejected the null hypothesis of no relationship between these determinants and real effective exchange rate fluctuations in Kenya. This was in conformity to the balance of payments theory hence the model specification used.

4.10 Conclusion

In conclusion, there is a significant positive long run relationship between; money supply, trade balance and inflation rate on real effective exchange rate fluctuations in Kenya. However, the variable external debt depicts a negative but significant long run relationship with real effective exchange rate fluctuations in Kenya. Owing to these results it can also be concluded that the balance of payments theory of exchange rate determination is applicable in Kenya as it can clearly be seen that an increasing trade deficit depreciates the Kenya shilling. In addition, an increasing money supply depreciates the Kenya shilling and the CBK has to sell Kenya shilling denominated bonds to reduce money supply so as to appreciate the shilling.

CHAPTER FIVE

SUMMARY OF THE FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter presents a summary of the findings on the analysis of the determinants of real effective exchange rate fluctuations in Kenya. Under this chapter, the study also gives its contribution to the existing literature on exchange rate fluctuations. Policy recommendations have also been suggested as well as areas for further research.

5.2 Summary of Findings

The study specifically sought to; examine the relationship between money supply and real effective exchange rate fluctuations in Kenya; evaluate the relationship between external debt and real effective exchange rate fluctuations; determine the relationship between trade balance and real effective exchange rate fluctuations and examine the relationship between inflation rate and real effective exchange rate fluctuations in Kenya.

The first objective of this study was to examine the relationship between money supply and real effective exchange rate fluctuations in Kenya. Analysis of data on this objective was based on the null hypothesis of no relationship between money supply and real effective exchange rate fluctuations in Kenya. First, the correlation coefficients show that there is a strong positive significant correlation at 5% significance level between money supply and real effective exchange rate fluctuations in Kenya. Secondly, the cointegration results show that the variables of money supply and real effective exchange rate fluctuations in Kenya have a significant positive long run relationship that conforms to economic a priori. Thirdly, the Vector Error

Correction Model results indicate that in the short- run money supply has an insignificant negative relationship with real effective exchange rate fluctuations at 5% level of significance in Kenya.

The second objective of this study was to evaluate the relationship between external debt and real effective exchange rate fluctuations in Kenya. Analysis of data on this objective was based on the null hypothesis of no relationship between external debt and real effective exchange rate fluctuations in Kenya. First, the correlation coefficients show that there is a weak positive insignificant correlation at 5% significance level between external debt and real effective exchange rate fluctuations in Kenya. Secondly, the cointegration results indicates that the variables of external debt and real effective exchange rate fluctuations in Kenya have a significant negative long run relationship at 5% level of significance that conforms to economic a priori. Thirdly, the Vector Error Correction Model results indicate that in the short- run external debt has an insignificant positive relationship with real effective exchange rate fluctuations in Kenya at 5% level of significance.

The third objective of this study was to determine the relationship between trade balance and real effective exchange rate fluctuations in Kenya. Analysis of data on this objective was based on the null hypothesis of no relationship between trade balance and real effective exchange rate fluctuations in Kenya. First, the correlation coefficients show that there is a strong negative significant correlation at 5% significance level between trade balance and real effective exchange rate fluctuations in Kenya. Secondly, from the Johansen procedure the variables of trade balance and real effective exchange rate fluctuations in Kenya have a significant positive long run relationship at 5% level of significance that conforms to economic a priori. Thirdly, the Vector Error Correction Model results show that in the short- run trade balance has an insignificant

negative relationship with real effective exchange rate fluctuations in Kenya at 5% level of significance.

The fourth objective of this study was to examine the relationship between inflation rate and real effective exchange rate fluctuations in Kenya. Analysis of data on this objective was based on the null hypothesis of no relationship between inflation rate and real effective exchange rate fluctuations in Kenya. First, the correlation coefficients show that there is a weak negative significant correlation at 5% significance level between inflation rate and real effective exchange rate fluctuations in Kenya. Secondly, from the Johansen procedure the variables of inflation rate and real effective exchange rate fluctuations in Kenya have a significant positive long run relationship at 5% level of significance. Thirdly, the Vector Error Correction Model results show that in the short- run inflation rate has an insignificant negative relationship with real effective exchange rate fluctuations in Kenya at 5% level of significance.

In addition, the VECM results revealed that the vector of E_t (exchange rate fluctuations) is insignificantly error correcting at 5 % level of significance i.e. 11.4179% of equilibrium error is corrected in the next period (annually) respectively.

5.3 Conclusions

In general, the findings of this study clearly indicate that the time series variables of money supply and external debt on real effective exchange rate fluctuations have a positive correlation, integrated of order two, i.e. become stationary after the second difference level (intercept, intercept and trend and none), long run equilibrium relationship exists among the variables, real effective exchange rate fluctuations is error correcting at 11.4179%.

In conclusion, there is a significant positive long run relationship between; money supply, trade balance and inflation rate on real effective exchange rate fluctuations in Kenya. However, the variable external debt depicts a negative but significant long run relationship with real effective exchange rate fluctuations in Kenya. Owing to these results it can also be concluded that the balance of payments theory of exchange rate determination is applicable in Kenya as it can clearly be seen that an increasing trade deficit depreciates the Kenya shilling. In addition, an increasing money supply depreciates the Kenya shilling and the CBK has to sell Kenya shilling denominated bonds to reduce money supply so as to appreciate the shilling. Since external debt is paid in foreign currency, it implies that the country depletes its foreign exchange reserves as the debt increases thus depreciating the Kenya shilling during the time of purchase of the foreign denominated currency.

5.4 Contribution of the Study

5.4.1 Contribution of the Study to Academia

This study argues that there is a long run equilibrium relationship among the variables of money supply, external debt, trade balance, inflation rate and real effective exchange rate fluctuations in Kenya. The results of the study indicate that although in the short run an increase in money supply, trade balance (deficit) and inflation rate may cause an appreciation in the Kenyan shilling, in the long run an increase in these variables may cause depreciation in the Kenyan shilling. Increasing external debt is followed by a depreciation of the Kenyan shilling in the long run. From the results above, this study has been able to generally contribute to the existing literature on the various determinants of real effective exchange rate fluctuations in Kenya.

5.4.2 Policy Recommendation

From the empirical findings in 4.6 this study makes the following policy recommendations:

First, a proper monetary policy framework should be instituted by the government of Kenya through the Central Bank that would control the supply of money in Kenya despite the ever growing demand of money. Credit control measures like the central bank rate, overnight lending and the cash reserve ratios should be adequately enhanced and controlled by the CBK to avoid unnecessary injection of money into the economy.

Secondly, policy makers should implement debt control policies through various legislative bodies to tame the blossoming debt burden.

Thirdly, policy makers should institute export promoting policies that will help reduce the trade deficit. Local industries should be strengthened to give them capacity to add value to their products so as to comply with the international standards that would enable them to be competitive on the global market. Policies that would hasten trade licensing, review import authorization procedure, harmonize the operations of trade facilitation institutions with the empowerment of this institutions through financing to enhance their services of monitoring, surveillance, cross border clearance and controlling cross border trade to check illegal activities of smuggling, tax evasion and dumping of substandard products in the country should be formulated and implemented. This would enable the country to protect local industries by ensuring that no commodities are getting into the country through unorthodox means, reduce clearance delays at the borders and measure effectively the contribution of any cross border trade to the economy.

Fourthly, policy makers should formulate sound inflation control policies that will keep the inflation rate within the national target. This in turn would make Kenya's exports globally competitive and help stabilize the real effective exchange rate.

5.5 Areas for Further Research

The study only considered the relationship between money supply, external debt, trade balance, inflation rate and real effective exchange rate fluctuations in Kenya. However, these are not the only determinants of exchange rate fluctuations and recommends that research should be widened to the remaining macroeconomic variables determining real effective exchange rate fluctuations in Kenya. This study only covered the four objectives of money supply, external debt, trade balance and inflation since they bear the greatest effect on exchange rate fluctuations as per the balance of payments theory. In addition, studies should be conducted to test the applicability of the BOP theory in Kenya.

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APPENDICES

Appendix A1: Data Presentation

YEAR	EXCHANGE RATE	MONEY SUPPLY	EXTERNAL DEBT	TRADE BALANCE	INFLATION RATE	EXPORTS LCU	IMPORTS LCU
1972	7.1429	4,295,170,000	123,096,000	-322,000,000	1.2052	4,002,000,000	4,324,000,000
1973	7.0204	5,356,070,000	225,899,000	-223,998,000	10.2038	4,812,001,000	5,035,999,000
1974	7.1348	5,454,180,000	371,033,000	-1,531,998,000	16.0493	7,144,002,000	8,676,000,000
1975	7.3432	6,556,640,000	410,891,000	-1,122,001,000	11.8351	7,138,001,000	8,260,002,000
1976	8.3671	8,193,000,000	432,527,000	202,002,000	18.9062	9,434,001,000	9,231,999,000
1977	8.2766	12,199,340,000	321,970,000	1,252,000,000	16.8998	13,004,000,000	11,752,000,000
1978	7.7294	14,155,080,000	491,549,000	-3,998,000,000	3.0810	11,862,000,000	15,860,000,000
1979	7.4753	16,010,710,000	586,488,000	-2,730,000,000	5.6386	12,002,000,000	14,732,000,000
1980	7.4202	16,136,020,000	689,839,000	-3,441,004,000	9.5507	15,912,596,000	19,353,600,000
1981	9.0475	18,276,240,000	667,851,000	-2,084,000,000	10.8531	18,890,000,000	20,974,000,000
1982	10.9223	21,369,710,000	651,401,000	-3,442,707,800	11.5926	18,726,283,400	22,168,991,200
1983	13.3115	22,425,810,000	712,831,000	-1,801,044,600	11.8380	20,654,122,100	22,455,166,700
1984	14.4139	25,293,220,000	602,648,000	-4,733,527,700	10.1907	23,872,299,700	28,605,827,400
1985	16.4321	26,898,400,000	650,500,000	-4,886,911,500	8.3058	25,504,259,100	30,391,170,600
1986	16.2257	35,693,900,000	604,390,000	-4,750,883,400	8.7117	30,361,529,800	35,112,413,200
1987	16.4545	39,666,700,000	762,453,000	-6,678,880,000	5.4020	27,943,033,500	34,621,913,500
1988	17.7471	42,855,600,000	837,306,000	-7,759,030,300	6.4556	33,172,881,100	40,931,911,400
1989	20.5725	48,392,900,000	877,665,000	-12,082,193,200	9.7690	39,249,226,500	51,331,419,700
1990	22.9148	58,099,200,000	1,090,358,000	-11,070,412,400	10.6372	50,468,913,400	61,539,325,800
1991	27.5079	69,470,800,000	1,184,767,000	-3,395,817,700	12.5320	60,635,470,900	64,031,288,600
1992	32.2168	96,579,300,000	752,396,000	-1,084,656,600	18.8972	69,451,303,400	70,535,960,000
1993	58.0013	123,653,800,000	751,570,000	16,509,685,500	25.6985	129,786,903,400	113,277,217,900
1994	56.0506	152,314,120,000	817,057,000	11,276,260,200	17.0164	148,404,788,10	137,128,527,900

						0	
1995	51.4298	196,485,943,000	717,969,000	-30,531,331,700	11.2211	151,633,131,100	182,164,462,800
1996	57.1149	246,246,119,000	621,829,000	-47,546,900,600	41.9888	173,379,637,400	220,926,538,000
1997	58.7318	295,974,693,000	531,560,000	-66,896,616,600	11.4352	174,756,191,000	241,652,807,600
1998	60.3667	304,650,456,000	460,329,000	-72,818,294,000	6.9314	171,601,725,000	244,420,019,000
1999	70.3262	324,415,249,000	356,017,000	-59,193,394,200	4.1939	188,937,831,600	248,131,225,800
2000	76.1755	340,337,217,644	277,409,000	-98,079,647,000	6.0798	208,932,485,800	307,012,132,800
2001	78.5632	359,533,470,000	178,716,000	-102,875,854,600	1.5731	233,952,757,700	336,828,612,300
2002	78.7491	395,087,060,000	186,084,000	-55,669,180,000	0.9332	257,786,886,000	313,456,066,000
2003	75.9356	441,657,150,000	298,886,000	-67,438,761,600	6.1973	272,610,240,000	340,049,001,600
2004	79.1739	501,155,720,000	331,326,000	-79,728,218,000	7.1268	339,102,242,000	418,830,460,000
2005	75.5541	550,812,090,000	232,888,000	-105,624,492,000	4.8996	403,609,468,000	509,233,960,000
2006	72.1008	644,295,400,000	192,568,000	-172,548,000,000	23.5301	427,989,000,000	600,537,000,000
2007	67.3176	775,880,140,000	234,472,000	-216,357,000,000	8.1295	471,554,000,000	687,911,000,000
2008	69.1753	896,520,484,867	257,177,000	-	15.1512	563,010,000,00	866,700,000,000

				303,690,000,000		0	
				-			
2009	77.3520	1,044,063,756,335	287,113,000	309,232,000,000	11.6373	573,672,000,000	882,904,000,000
				-			
2010	79.2332	1,277,533,897,163	275,678,000	409,253,000,000	2.0938	654,689,000,000	1,063,942,000,000
				-			
2011	88.8108	1,522,207,881,390	307,170,000	640,736,000,000	10.7916	805,766,000,000	1,446,502,000,000
				-			
2012	84.5296	1,741,288,952,397	1,057,542,000	664,247,000,000	9.3828	844,425,000,000	1,508,672,000,000
				-			
2013	86.1229	1,964,909,332,869	1,104,672,000	710,968,000,000	5.3661	861,252,000,000	1,572,220,000,000
				-			
2014	87.9222	2,299,896,568,811	1,829,853,000	932,563,000,000	7.9937	913,585,000,000	1,846,148,000,000
				-			
2015	98.1785	2,625,659,346,892	3,427,462,000	825,895,000,000	9.1427	981,522,000,000	1,807,417,000,000

Source: World Bank (World Development Indicators), 2016

Appendix A2: Data Presentation

YEAR	%er	%ms	%ed	%tb	inf
1971	0.0000	7.5326	-6.6312	766.6688	-9.2192
1972	0.0000	13.9460	50.0585	-61.2982	1.2052
1973	-1.7147	24.6998	83.5145	-30.4354	10.2038
1974	1.6299	1.8318	64.2473	583.9338	16.0493
1975	2.9206	20.2131	10.7424	-26.7622	11.8351
1976	13.9442	24.9573	5.2656	-118.0037	18.9062
1977	-1.0826	48.8995	-25.5607	519.7958	16.8998
1978	-6.6112	16.0315	52.6692	-419.3291	3.0810
1979	-3.2871	13.1093	19.3142	-31.7159	5.6386
1980	-0.7374	0.7827	17.6220	26.0441	9.5507
1981	21.9309	13.2636	-3.1874	-39.4363	10.8531
1982	20.7220	16.9262	-2.4631	65.1971	11.5926
1983	21.8744	4.9420	9.4304	-47.6852	11.8380
1984	8.2812	12.7862	-15.4571	162.8212	10.1907
1985	14.0021	6.3463	7.9403	3.2404	8.3058
1986	-1.2559	32.6990	-7.0884	-2.7835	8.7117
1987	1.4098	11.1302	26.1525	40.5819	5.4020
1988	7.8557	8.0392	9.8174	16.1726	6.4556
1989	15.9202	12.9208	4.8201	55.7178	9.7690
1990	11.3856	20.0573	24.2340	-8.3741	10.6372
1991	20.0443	19.5727	8.6585	-69.3253	12.5320
1992	17.1186	39.0214	-36.4942	-68.0590	18.8972
1993	80.0342	28.0334	-0.1098	-1622.1117	25.6985
1994	-3.3633	23.1779	8.7134	-31.6991	17.0164
1995	-8.2439	29.0005	-12.1274	-370.7576	11.2211
1996	11.0540	25.3251	-13.3906	55.7315	41.9888
1997	2.8311	20.1947	-14.5167	40.6961	11.4352
1998	2.7836	2.9313	-13.4004	8.8520	6.9314

1999	16.4984	6.4877	-22.6603	-18.7108	4.1939
2000	8.3174	4.9079	-22.0798	65.6936	6.0798
2001	3.1344	5.6404	-35.5767	4.8901	1.5731
2002	0.2367	9.8888	4.1227	-45.8870	0.9332
2003	-3.5728	11.7873	60.6189	21.1420	6.1973
2004	4.2645	13.4717	10.8536	18.2231	7.1268
2005	-4.5719	9.9084	-29.7103	32.4807	4.8996
2006	-4.5706	16.9719	-17.3130	63.3598	23.5301
2007	-6.6340	20.4230	21.7606	25.3895	8.1295
2008	2.7596	15.5488	9.6835	40.3652	15.1512
2009	11.8202	16.4573	11.6402	1.8249	11.6373
2010	2.4319	22.3617	-3.9828	32.3450	2.0938
2011	12.0879	19.1521	11.4235	56.5623	10.7916
2012	-4.8206	14.3923	244.2856	3.6694	9.3828
2013	1.8849	12.8422	4.4566	7.0337	5.3661
2014	2.0892	17.0485	65.6467	31.1681	7.9937
2015	11.6652	14.1642	87.3081	-11.4382	9.1427

Appendix 3: Map of Kenya

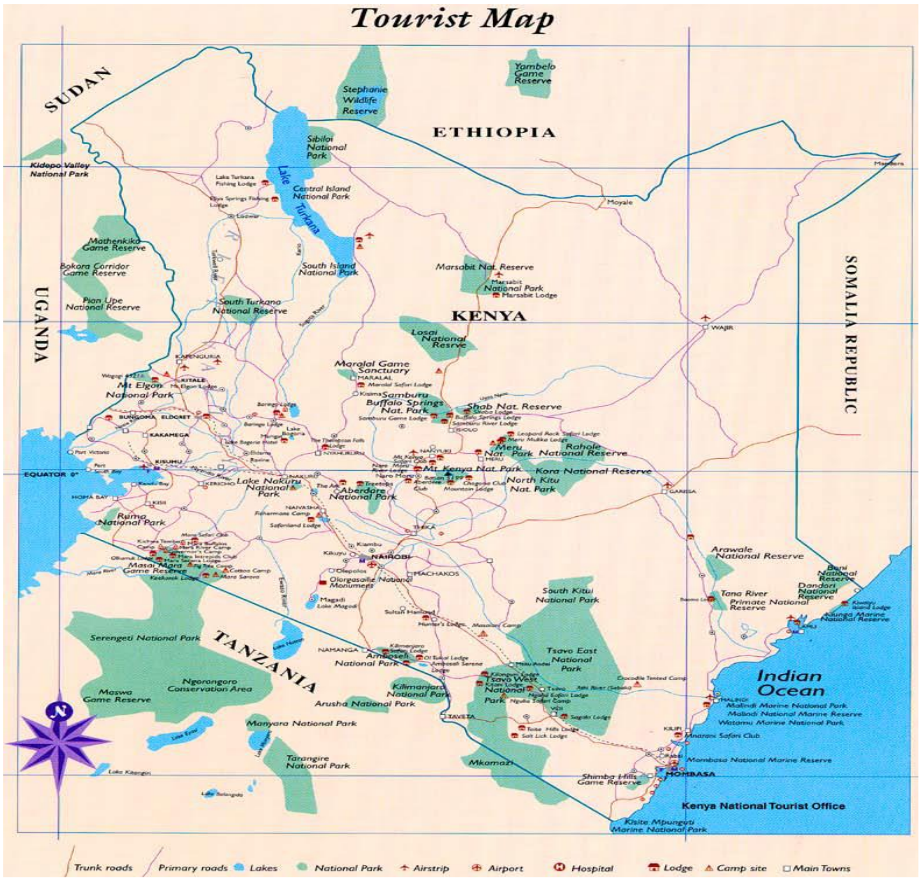

Figure 1.2: Map of Kenya, Source: (KTB, 2014)