Journal of Business Studies Quarterly
2012, Vol. 3, No. 4, pp. 24-42 ISSN 2152-1034

Journal of Business Studies Quarterly jbsq.org

REAL EXCHANGE RATE EQUILIBRIUM AND MISALIGNMENT IN KENYA

Danson Musyoki
Ganesh P. Pokhariyal
Moses Pundo
University of Nairobi, Kenya

Abstract
This paper examines Real Exchange Rates (RER) misalignment in Kenya by using Johansen Cointegration and error correction technique based on single equation and Vector Autoregressive (VAR) specification. It was found that actual RER was more often above its equilibrium value for the study period of June 1993 – December 2009 and the country's international competitiveness deteriorated over the study period.

Keywords: Real Exchange Rate, Misalignment, Equilibrium.

1.0 Introduction

Misalignment of the *RER*, whereby the actual *RER* deviates from equilibrium value, has important implications on a country's economic growth. *RER* overvaluation, for instance, would be damaging to a country's economic growth, as it would particularly hamper growth in all sectors (Edwards, 1989, Gylfason, 2002). Such misalignment is widely believed to influence economic behaviour. In particular, overvaluation is expected to hinder economic growth, while undervaluation is sometimes thought to provide an environment conducive to growth.

An exchange rate is defined as a price at which one currency may be converted into another. Exchange rate is referred to as the nominal exchange rate (*NER*) when inflation effects are embodied in the rate, and as the real exchange rate (*RER*) when inflation influences have not been factored in the rate (Copeland, 1989:4, Lothian, and Taylor, 1997).

During the era of the fixed exchange rate regime, that covered the period of 1966-92, Kenya, like many developing countries, had to frequently devalue its currency in an attempt to reduce the negative effects that *RER* misalignment had on its economy. The adoption of a floating exchange rate system in 1993 marked the climax of efforts to make the *RER* more aligned to the market determined equilibrium *RER*, and thus eliminate *RER* misalignment. There is, however, no available evidence that success has since been achieved in realizing the objective for which the foreign exchange market was liberalized.

In spite of the abundant literature on the effects of exchange rate volatility on macroeconomic variables such as economic growth, studies that specifically focus on Kenyan economy are scanty. Were et. al., (2001), analyzed factors that have influenced the exchange rate movements since the foreign exchange market was liberalized in 1993. A related study by Ndung'u (1999) assessed whether the exchange rates in Kenya were affected by monetary policy, and whether these effects were permanent or transitory. The study by Kiptoo (2007) focused on the real exchange rate, misalignment, and its impact on the Kenya's international trade, and investment. Sifunjo (2011) investigated chaos and nonlinear dynamical approaches to predicting exchange rates in Kenya.

Few studies in Kenya too have attempted to estimate the *RER* equilibrium path, and use it to provide any evidence on the nature and extent of exchange rate misalignment, and the implications of such misalignment on Kenya's economic growth. This study examines and provide a deep understanding of equilibrium *RER* by not only investigating factors that determine *RER* behaviour, but also measuring *RER* deviations from the equilibrium path.

Real Exchange Rate Misalignment

RER misalignment, refer to measures of deviations of actual *RER* from its long run or equilibrium level. Therefore, the equilibrium *RER* is the *RER* that would be prevailing when an economy is operating at full employment and maximum output, and its balance of payment position is at sustainable level. Thus, misalignment in the *RER* is the difference between the actual *RER*, and the equilibrium *RER*.

An exchange rate is labeled *undervalued* when it is more depreciated than the equilibrium *RER*, and *overvalued* when it is more appreciated than the equilibrium *RER* (Edwards, 1989). Determining the equilibrium *RER* is pivotal in computing the degree of misalignment. Policy makers and many researchers are interested in predicting, and monitoring misalignment in the foreign exchange market, because, in many cases, it is closely related to possible current account problems or impending currency crises.

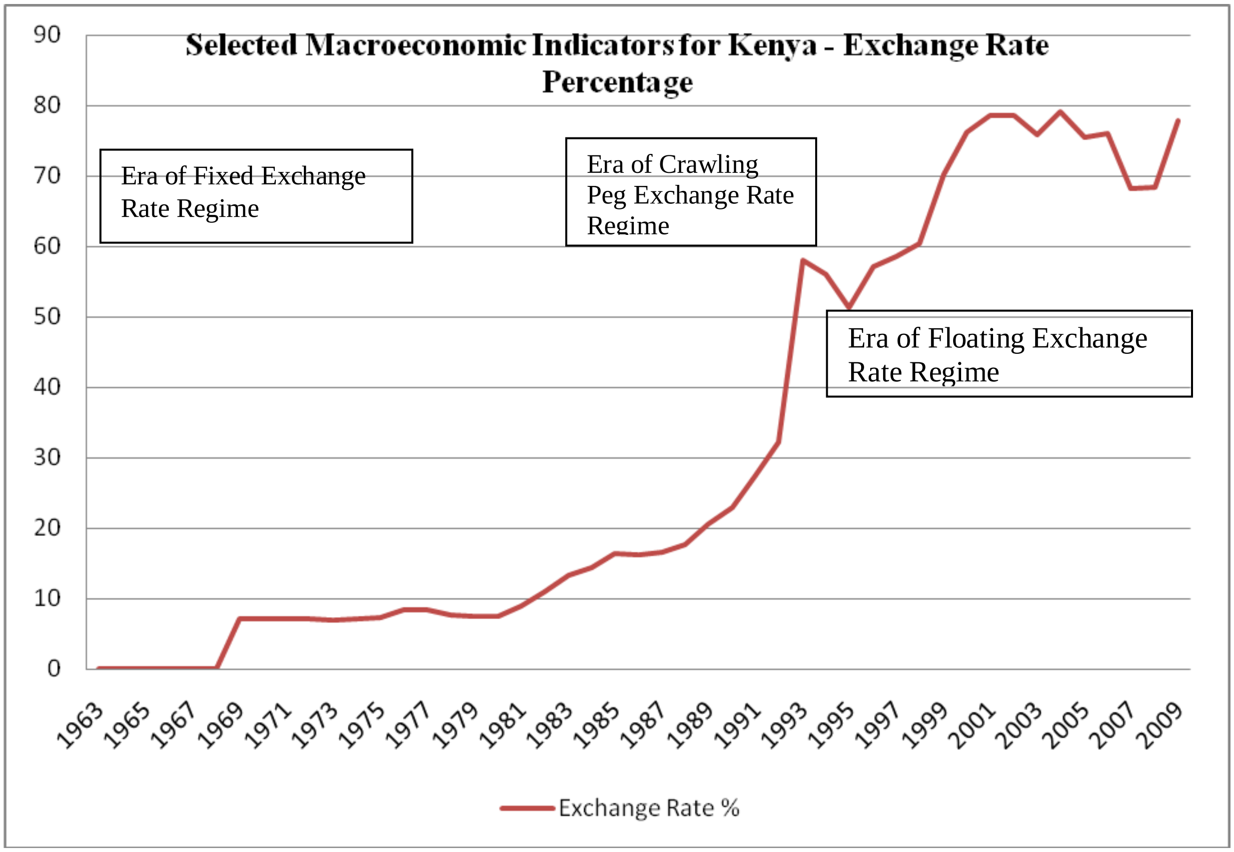
1.2 Exchange Rate Determination

There are at least five competing theories of the exchange rate concept, which may either be classified as traditional or modern. These theories are: the elasticity approach to exchange rate determination, the monetary approach to exchange rate determination, the portfolio balance approach to exchange rate determination, and the purchasing power theory of exchange rate determination. The modern theory explain the short run volatility of the exchange rate and their ability to shoot in the long run.

1.3 Overview of Kenya's Exchange Rate Policy and its economic impact

The exchange rate of Kenya shilling to the US Dollar from 1967 to 2009 has been described by the fixed exchange rate error, the crawling peg error and the floating error.

Figure 1.1 : Kenya Exchange Rate Regimes, 1967-2009 (Kenya Shilling per US dollar)



Source: Derivations from data from Kenya National Bureau of Statistics (KNBS)-2010

2.0 THE MODEL, ESTIMATION METHOD

The Real Exchange Rate - The *RER* is defined as the rate at which goods, and services produced at home can be exchanged for those produced in another country or group of countries abroad. The *RER* is obtained by adjusting the nominal exchange rate (*ner*) with inflation differential between the domestic economy, and foreign trading partner economies.

Since the Kenya shilling appreciated against some currencies and depreciated against others during the study period, the Nominal Effective Exchange Rate (*NEER*) is constructed. The *NEER* is derived by weighting the bilateral shilling exchange rate against its trading partner currencies using the value of Kenya's trade (imports plus exports) with its respective trading partners. Since some of the data on bilateral exchange rates are originally expressed in terms of (United States) US dollars, cross rates had to be obtained, so as to have all bilateral exchange rates expressed in terms of Kenya Shilling per foreign currency.

The calculation of the *NEER* is achieved through the arithmetic mean approach that involves summing up the trade weighted bilateral exchange rates as shown in equation 1 below:

$$NEER_t = \sum_{it}^{n} ER_{it} * w_{it} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots Eqn\ (1),$$

where, ER_{it} is Kenya's bilateral exchange rate index with country i at time t while w_{it} is the bilateral trade weight for Kenya's i^{th} trading partner at time t. TEach bilateral exchange rate index (ER_{it}) in equation 1 is computed as follows:

$$ER_{it} = \left[\frac{NER_c}{NER_{t=0}}\right] * 100 \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots \dots\dots Eqn\ (2),$$

where, the NER_c is the index of Kenya shilling exchange rate per unit of trading partner currency in the base period (2007) while $NER_{t=c}$ is the index or Kenya shilling exchange rate per unit of trading partner currency in the current period year.

Due to relative stability of the economy and low volatility in the domestic foreign exchange market during 2007, it was chosen as the base year. The Gross Domestic Product (GDP) growth rate during this year was 7.1%, the highest rate ever achieved during the 1993-2009-study period. The year 2007 also enjoyed macroeconomic stability, with inflation rates that were not only low but also stable, while the current account balance as well as fiscal deficits was considered to have been at sustainable levels.

Each monthly bilateral trade weight in equation 1 was computed as a ratio of total trade (exports plus imports) for each trading partner to the ratio of total trade (export plus imports) for all Kenya's trading partners. The formula to be used in deriving the trade weights is:

$$w_{it} = \left[\frac{\sum(x_{it} + m_{it})}{\sum(X_t + M_t)}\right] \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots Eqn\ (3),$$

where, x_{it} is total value of Kenya's exports to i^{th} trading partner at time t, m_t is the total value of imports from Kenya's i^{th} trading partner also at time t, X_t are Kenya's total exports to all trading partners at time t, and M_t are total imports to all trading partners at time t. In this study $i=1, 2 \ldots..,n$ where n is the total number of Kenya's trading partners which in this study was 140.

The *NEER* is obtained by combining equations 2, and 3 using the following arithmetic mean formula:

$$NEER_t = \sum_{it}^{n} ER_t * w_t \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots Eqn\ (4),$$

where, ER_t is the bilateral exchange rate (equation 2), and w_t, is the bilateral trade weight. n is the total number of countries, which in the case of this study is 140. Based on the above formula (equation 4), a decline in *NEER* represents an appreciation while an increase represent a depreciation of the *NEER*. This is because in the calculation of the *NEER* index, the base year (2007) exchange rate is taken as the denominator while the current exchange rate is taken as the numerator.

To obtain the *REER*, the *NEER* is adjusted by the relative price indices of Kenya, and the weighted average price indices of Kenya's trading partners. In an equation form, this is expressed as:

$$REER_t = NEER_t \left[\frac{P_{wt}}{P_{dt}}\right] \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots Eqn\ (5),$$

where, *REER* is the Real Effective Exchange Rate. *NEER* is the Nominal Effective Exchange Rate, P_{dt} is the price level in Kenya proxied by Consumer Price Index (CPI) at time t, and P_{wt} is the weighted average price level of Kenya's trading partner countries proxied by weighting CPI at time t. The price level of Kenya's trading partner countries is obtained by adding all the trade weighted price levels proxied by CPI of Kenya trading partners. This is shown in an equation form as follows:

$$P_{wt} = \sum_{it}^{n} P_{it} * w_t \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots Eqn\ (6),$$

where, P_{wt} is the arithmetic mean i.e. the average price level of Kenya's trading partner countries proxied by weighted CPI at time t, P_{it}, is the price level of Kenya's i^{th} trading partner countries proxied by CPT at time t. w_{it} is the trade weight of Kenya's i^{th} trading partner country at time t. These weights are the same as those used in the derivation of *REER*.

In line with the interpretation of the *NEER* movements, a decline in the *REER* represents an appreciation while an increase represents depreciation in the *REER*. An effort was made in this study to calculate the *NEER*, and the *REER* using the geometric mean approach as shown in the formula indicated below:

$$RER_t = 100 \text{ x } \Pi\left[\frac{ER_{it}}{P_{it}}\right] \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots Eqn\ (7),$$

This study used the technique of Johansen cointegration analysis to estimate the model developed by Edwards (1989) to get Kenya's *RER* equilibrium path over the study period.

The model for equilibrium *RER* was formulated on the basis of long- term variables shown in the following equation

$$rer_t^* = \beta_0 + \beta_1 tot_t + \beta_2 gex_t + \beta_3 nfki_t + \beta_4 open_t + \beta_5 tp_t + \varepsilon_t \dots\dots\dots\dots\dots\dots Eqn\ (8),$$

where, rer_t* denotes equilibrium *rer*, tot_t denotes terms of trade, gex_t denotes government expenditure expressed as percent of GDP, $nkft_t$ denotes net capital, and financial inflows, open denotes degree of openness of Kenya's economy, tp_t denotes the measure of productivity/technological progress, all expressed in natural logarithms, ε_t denotes the error term, while t denotes time.

By substitution for rer_t in equation 8, the macroeconomic policy variable proxied by excess money supply (*exm*), also defined as the rate of growth of domestic credit minus the rate of growth of Gross Domestic Product (GDP), and the change in nominal exchange rate devaluation (*nerd*), the following estimable equation for the actual *rer* is given as:

$$rer_t = \psi_0 + \psi_1 tot_t + \psi_2 gex_t + \psi_3 nfki_t + \psi_4 open_t + \psi_5 tp_t + \psi_6 exms_t + \varepsilon_t \dots Eqn\ (9),$$

where, the ψ are the coefficient of the model parameters. Thus, the model (equation 9) incorporates both short run and long run factors that affect the observed *rer*.

Since the focus of this study was to derive *rer* misalignment from equilibrium real exchange rate (*rer* *), equation (9) is adopted. Borrowing therefore from the work of Baffes et. al., (1997), this study assumed that a linear relationship exists between the equilibrium *RER*, and the fundamentals. Thus, the general model of the *RER* and its determinants as specified in equation (9) is expressed in vector forms as follows:

$rer_t^* = \alpha_0 + \beta_t F_t + \varepsilon_t$ ……………..……………………………………………..…….*Eqn (10),*

where, rer_t* is the equilibrium *rer*, α_0 is a constants vector, β_t is a vector of coefficients of explanatory variables, namely: *tot, gex, nkft, open, tp*. The hypotheses to be tested in equation 9 are: $\psi_1 = 0, \psi_2 = 0, \psi_3 = 0, \psi_4 = 0, \psi_5 = 0$. According to theory, the following results were expected: $\psi_1 \neq 0, \psi_2 \neq 0, \psi_3 < 0, \psi_4 > 0, \psi_5 \neq 0$.

The approach involves first estimating the parameters of a cointegrating regression by applying OLS on the levels of the variables, and then testing for stationarity of the residual and by using the Augmented Dickey Fuller (ADF) test. If the time series variables have unit roots, then the first difference of the variable is taken in order to obtain stationary series. Thus equation 10 becomes:

$\Delta Y_t = \alpha_0 + \beta_I \Delta X_t + u_t$……………………………….………………………………..…….*Eqn (11).*

The procedure of differencing, however, results in loss of valuable long run information, by introducing the error correction model (*ECM*), the theory of cointegration addresses this, problem. The *ECM* lagged one period (i.e. ECM_{t-1}) integrates short run dynamics in the long run equilibrium real exchange rate equation.

A key feature of the dynamics of cointegrated variables is that the paths followed by the variables are affected by the size of the deviation from the long-run equilibrium that ties them together. Equation 11 is therefore re-specified as a general error correction model *(ECM)* as follows:

$\Delta Y_t = \alpha_t + \sum_{t=0}^{n}(\beta_u \Delta X_{t-1}) + \lambda_t ECM_{t-1} + \varepsilon_1$……………………………….……………..…….*Eqn (12),*

where, *X* is a vector of fundamentals. In the case of the model used to estimate equilibrium *rer*, the Engle and Granger (1987) procedure involves estimating the parameters at levels using OLS in order to obtain a cointegrating equation between the *rer*, and its determinants. Once Johansen cointegration vector was found equilibrium *rer* series was constructed by applying the cointegrating vector to the fundamental series. At each point of time an equilibrium value to the *rer* was reached, the difference between the observed *rer*, and the calculated equilibrium *rer* was token as the extent of *rer* misalignment.

2.1 Data Source

The study used mainly secondary data collected from: The Statistical Bulletins and the Monthly Economic Reviews of the CBK: the Economic Surveys of the Kenya National Bureau of Statistics (KNBS), the Budget Outturns of the Ministry of Finance. The data was also extracted from the relevant publications or documents of the above institutions, and saved in Excel spreadsheet. The International data was collected from International Financial Statistics (IFS), and the Directorate of Trade Statistics (DTS). The Library Network that serves the World Bank Group, and the IMF was also used to get international data. United Nations data base on social indicators was extensively reliable source of information.

3.0 EMPIRICAL RESULTS

In order to determine the nature and extent of *RER* misalignment during the study period, the study first needed to establish the long-run relationship between the *RER* and its determinants. The section therefore deals with the results of the estimation of the equilibrium *RER* Model. It first starts with coverage of the unit root tests of variables used in the model. It is then followed by the results of the long run, and short run equilibrium *RER* models obtained through the technique of Johansen cointegration analysis. Before formal unit root tests were carried out, this study carried out a graphical inspection of the variable indicated in Figure 4.1, in the appendix 1.

Except excess money supply variable (*exms*), all the series exhibited an upward or downward trend, suggesting that each of the variables could be (a) trend stationary, (b) random walk with a draft or (c) Random walk with a drift, and linear time trend. In order to ascertain the actual situation with regard to the time series proprieties of these variables, formal unit root tests were undertaken using ADF, and PP tests. However, the two tests produced mixed, and unreliable results, confirming the weakness of the power, and tests of their findings. The study therefore, employed the DF-GLS, and NG-PR unit root tests, and which are known to be more powerful in results than the ADF, and Philip Peron (PP) test. To estimate the long-run relationship between the *RER* and its fundamentals, the Johansen cointegration technique was employed.

The numbers of Johansen cointegration vectors or rank were tested using the trace, and maximum eigenvalue statistics from the Johansen statistics. The first statistic was based on the sum of *r* eigenvalues, while the second statistic relied on the significance of the i^{th} eigenvalue.

The results of the unrestricted Johansen cointegration rank test (maximum eigenvalue test) results are reported in Table 4.1 (appendix 2). The result indicate that while the trace test found two cointegrating equations, the max-eigenvalue test rejected the null hypotheses of $r = 0$ at the *5* percent level of significance and that even with the inclusion of linear deterministic trend, the results did not alter as they all suggested that there is a unique cointegrating vector for *RER* that is one equilibrium relationship between the non-stationary variables *(Log RER, Log TOT, IRD, OPEN, GEX, and PG).*

This cointegrating vector in its unrestricted form is shown in Table 1.2 (appendix 3), for the unrestricted cointegrating coefficients (Beta), and the unrestricted adjustment coefficients (Alpha), and vector error correction estimates.

3.1 The Long Run Model of the (Equilibrium) Real Exchange Rate

Based on the normalized cointegrating coefficients and vector error correction estimates the long-run relationship between the *RER*, and its fundamentals are presented in the column entitled model 1 in Table 1.3 (in appendix 4). The column entitled model 2 has the excess money supply variable excluded from the estimation.

The long-run relationship for *RER* was consequently derived from model 1 in Table 4.3 (Appendix 4) as follows:

$$LnRER = 14.90866 + 0.94043LnGEXG_t - 3.61717LnIRD_t + 3.6925LnOPENt - 1.15586LnPG_t - 2.41721 LnTOT_t - 0.797919 LnEXMS_t - 3.6280TREND_t \ldots \text{ Eqn (13).}$$

Based on equation 13 above, the error term (*err*) is derived as follows:

$Err = LnRER_t - 14.90866 - 0.94043LnGEXG_t + 3.61717LnIRD_t + 3.6925LnOPENt + 1.15586LnPG_t + 2.41721 LnTOT_t + 0.797919\ LnEXMS_t + 3.6280TREND$………………………………………...…………Eqn(14).

The long-run relationship for *RER* from model 2, which excluded excess money supply variable, is:

$LnRER = 6.56631 + 1.14085LnGEXG_t + 5.12832LnIRD_t + 6.34340LnOPENt - 1.16553LnPG_t - 5.76432\ LnTOT_t - 4.62750TREND_t$ ………………………………………………......................................Eqn (15).

The error term (*err*) of model 2, is thus:

$Err = LnRER - 6.56631 - 1.14085 - 5.12832LnIRD_t - 6.34340LnOPENt + 1.16553LnPG_t + 5.76432\ LnTOT_t + 4.62750TREND_t$ ……………………………………………….…………………….......Eqn (16).

3.2 The Short-Run Model of the Real Exchange Rate

According to the Granger representation theorem, a dynamic error –correction representation of a set of data exists if a co integrating relationship exists among a set of 1 (1) series. Based on this theorem, the study proceeded to find this representation for equilibrium *RER* by using the general-to-specific principle describe by Hendry et. al., (1984). Table 1.5 (appendix 5) shows the parsimonious results.

Considering that each regress, and in Table 1.5 (Appendix 5) is cast in first-difference, the empirical results suggest that the statistical fit of the models to the data is weak, as indicated by the value of R^2, which is 0.15 and 0.17 in models 1 and 2. The statistical appropriateness fulfilled the condition of no serial correlation and homoscedasticity, but not the normality of residuals, based on the results of model 1 in Table 1.5 (appendix 5). The final dynamic equation for equilibrium *RER* is presented as follows:

$$D(LNRER) = -0.158ECM + 0.0065\,(LNRER(-1)) + 0.1849(LNRER(-2)) - 0.0395(LNRER(-3)) - 10.632(LNTP(-1)) + 3.6(LNTP(-2)) - 8.915(LNTP(-3)) - 7.5555\,(LNGEX(-1)) + 4.931\,(LNGEX(-3)) \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots Eqn\ (17)$$

Model 2 fulfilled all diagnostic tests of no serial correlation, homoscedasticity, and normality of residuals. The dynamic equation for equilibrium *RER* is therefore presented as follows:-

$$D(LNRER) = -2.42ECM + 0.0522\,(LNRER(-1)) + 0.2074\,(LNRER(-2)) - 0.0266\,(LNRER(-3)) - 5.956\,(LNTP(-1)) + 4.950\,(LNTP(-2)) - 5.678\,(LNTP(-3)) + 4.456(LNGEX(-1)) + 10.591(LNGEX(-3)) \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots Eqn\ (18).$$

The above dynamic equation shows that the rate of change of the *RER* had significant inertia on its historical value in the previous period, changes in the government expenditure (*GEX*) had the strongest impact in the short term in model two. Changes in productive/technological progress, (in the case of model 1) is also shown to strongly influence the dynamism of the *RER* in the short run.

The estimated values of the *ECMs* in models 1 and 2 have a statistically significant coefficient; and displays the appropriate (negative) sign. This findings therefore supports the validity of an equilibrium relationship among the variables in each cointegrating equation. It indicates that the system corrects its previous period's level of disequilibrium by 15.7 percent a month in model 1 and 24.4 percent in model 2. These estimates of *ECM* suggest, that in the absence of further shocks, the gap would be closed within a period of 6.3 months in model 1, and 4.1 months in model 2.

3.3 Real Exchange Rate Equilibrium, and Misalignment

The results of the estimated long run parameters shown in Table 1.3 (Appendix 4) were used to calculate the equilibrium *RER*, and the degree of *RER* misalignment over the period 1993 -2009. In particular, the long run relationship for *RER* from model 2, which excludes excess money supply variable, was used due to its good results of diagnostic tests (Table 1.4- Appendix 4). Thus, the equilibrium *rers* were obtained by using the actual values of fundamentals in the fitted (i.e. estimated) model 2, whose results are shown in Table 1.3 (Appendix 4), and equation 15, which we re-specify as:

$$LNRERt = 6.56631 - 5.76432LNTOTt - 1.16553LNPGt + 6.3430LNOPENt + 1.140857LNGEXGt + 5.12832\,LNRIDt - 4.62750TREND \ldots\ldots\ldots\ldots\ldots\ldots\ldots Eqn\ (19).$$

Figure 1.4 (Appendix 5) shows the profile of both the equilibrium *RER* and the actual *RER* over the study period. Average deviations of the fitted values of *RER* form the actual ones were expected to be zero by construction. Hence, deviations of actual indices form the fitted values merely showed the short run *RER* misalignment. Such *RER* misalignment was expressed in percentage form, and are shown in Figures 1.5 (Appendix 6). Based on these resulted, Kenya lost international competitiveness when the value of *RER* misalignment was positive (i.e. was overvalued), and gained international competiveness when the value of *RER* misalignment was negative (i.e. was undervalued). When *RER* misalignment was zero, then Kenya did not lose international competitiveness. Consequently economic growth deteriorates with *RER* over valuation and improved with *RER* under valuation.

Figure 1.4 (Appendix 5) shows that the actual *RER* rate was more often than not above its equilibrium value in the period between January 1993, and December 2009, implying that the *RER* was generally overvalued during this period. The appreciation of the *RER* during this period was attributed to significant appreciation in the *NER* brought about by capital, and financial inflows owing to the then prevailing high interest rates regimes in government security markets. The appreciation pressures observed in the trend of *RER* over this period could also be attributed to significant improvements in the terms of trade as a result of the coffee boom, and the corresponding increased in commodity prices.

These results are mainly attributed to developments in some of the fundamentals. Over these periods, there was an increase in the degree of openness variable, and this is assumed to be due to decline in customs tariff rates, which led to a fall in the domestic prices of importable.

This led to high, demand of foreign currency (to take advantage of cheap imports), and less demand for domestic currency. Hence the increase in the degree of openness that led to the depreciation of the equilibrium *RER*. The *RER* was, however, overvalued in the period, implying also deterioration in the country's international competitiveness hence deterioration of economic growth, albeit marginal. It is also a reflection of relatively high interest rates domestically that led to capital and financial inflows, hence the appreciation of the *RER*.

Overall, figure 1.5 (Appendix 6) shows that, between 1993 and 2009, Kenya's *RER* misalignment generally exhibited a appreciating trend, implying that in general, the country's international competitiveness deteriorated over the study period.

4.0 CONCLUSIONS AND DISCUSSIONS

One of the main objectives of this study was to estimate Kenya's equilibrium *RER* path, determine the degree of *RER* misalignment between the observed, and equilibrium *RER*. Drawing heavily from the works of, among others, Edwards (1989), and Baffes *et. al.,* (1997), the study employed the technique of Johansen cointegration analysis based on a single equation approach to establish the equilibrium *RER* over the period 1993 to 2009. The deviations of actual *RERs* from the equilibrium *RER* path, which represent *RER* misalignment, was then calculated.

The result show that during the study period, the actual *RER* rate was more often than not above its equilibrium value in the period between June 1993 and December 2009, implying that the *RER* was generally overvalued. Overall, however, Kenya's RER generally exhibited a appreciating trend, implying that in general, the country's international competitiveness deteriorated over the study period.

The conclusion drawn from these results is that the adoption of the floating exchange rate regime has not achieved the intended purpose for which it was established, namely to reduce *RER* misalignment, and in particular *RER* overvaluation. Although declining, and generally exhibiting an appreciating trend, *RER* misalignment continued to hamper the country's economic growth. Results similar to this study were reported by various authors, mostly dealing with developing countries.

The study by Elbadawi, and Soto (1997) focused on capital flows, and long-term equilibrium *RERs* in Chile, and found that under a pegged NER expansionary fiscal, and monetary policy tended to cause persistent *RER* overvaluation. Similar conclusions were drawn by the study of Norman et. al., (1997), who examined the degree of misalignment of the *RER* in Argentina, Brazil, Chile, Colombia, Mexico, Peru, the United States, and Venezuela. The study by Zalduendo (2006) also found that parallel market rate of Venezuela was 15 percent more-appreciated than its equilibrium rate (but still below the official rate), and that the -speed of adjustment to this equilibrium was much higher.

The studies carried out in Africa were: Baffes, et. al., (1997), Aron et. al., (1997), Mongardini (1998), Nabli and Veganzones-Varoudakis (2002), MacDonald and Ricci (2003), Mathisen (2003), Koranchclian (2005), and Limi (2006), majority of these studies used the technique of Johansen cointegration to estimate the equilibrium *RER* path, and derive the degree of *RER* misalignment in the respective countries. A number of them also established that countries were characterized by a significant overvaluation of their currency, and that this overvaluation had a cost for the region in terms of export competitiveness, particularly, to manufactured goods. Most of the results also showed that *RER* overvaluation had declined in the 1990s and beyond.

The study by Ranki (2002) also derived equilibrium *RERs*, and calculated the misalignment by subtracting the equilibrium *RER* from the actual *RER*. The results showed that the deviations from the equilibrium *RER* have been transitory and surprisingly small (15% at the highest). These results were supported by a study by Beguna (2002), who estimated the equilibrium *RER* for Latvia. Based on the Fundamental Equilibrium Exchange Rates (*FEER*) methodology, the study found that on a yearly basis, the *RER* in Latvian was overvalued by 2 percent.

The study by Ghura, and Grennes (1993) found that Edwards (1989) model of *RER* determination performed well for Kenya, and the region at large. Black market premia tended to show a greater degree of misalignment in *RER* than alternative measures. The study observed that misalignment of the *RER* acted as an implicit tax on exports, and that as the *RER* gets more overvalued, the profitability of producing exportable goods falls, and hence less was produced.

Elbadawi and Soto (1997) estimated the long run cointegrated equilibrium of the *RER*, and a set of fundamentals consistent with internal, and external balances for seven developing countries including 4 countries from Sub-Saharan Africa (SSA) for the period 1960-93. The SSA countries were: CoteD'Ivoire, Mali, Kenya, and Ghana. Both Cote D'lvoire and Mali belonged to the fixed exchange rate economies of Communaute Financiere Africanised (CFA) Monetary Union while Kenya and Ghana represented the other flexible exchange rate economies covered by the study.

In particular, the results indicated that the Kenya shilling was generally overvalued during the study period 1960-93.

Bleaney, and Greenaway (2001) estimated investment, and growth equations on a reasonably sized panel of annual data from 14 sub-Saharan African countries (including Kenya) from 1980 to 1995. Both growth and investment were higher when the, terms of trade were more favorable, and the *RER* was less overvalued. The most striking feature of the sample was that all countries had experienced considerable *RER* depreciation by more than 4% per annum on average.

Finally, the study by Maturu (2002), examined the *RER* behaviour for Kenya using quarterly data drawn for the period 1980:1998:4 using Johansen cointegration analysis. The results showed that a linear relationship binding together the **RER**, and its fundamentals existed in Kenya during the study period. The study show Kenya RER was overvalued

The study by Kiptoo (2007), focused on *RER* volatility and misalignment on international trade and investment. The study found out that *RER* was undervalued, and that *RER* volatility and misalignment has a negative and significance impact on trade and investment during the study period 1993 to 2003.

REFERENCES

Aron, J., Elbadawi 1. & Khan, B., 1997. Determinants of the Real Exchange Rate in South Africa, Centre for the Study of African Economies Working Paper Series, No. 16, University of Oxford.

Baffes, J.B., Elbadawi, LA., & O'ConneIlS. A., 1997. Single-Equation Estimation of the Equilibrium Exchange Rate, A World Bank Policy - Research Working Paper in http://www.worldbank.org/html/dec/Publications/Workpapers/WPSI800series/wps1800/wps1800.pdf

Bleaney, M. & Greenaway, D., 2001. The Impact of Terms of Trade and Real Exchange Rate Volatility on Investment and Growth in Sub-Saharan Africa, Journal of Development Economics, Vol. 65, pp. 491-500 www.elsevier.comrlocatereconbase.

Copeland, L. S., 1989. Exchange Rates and International Finance, University of Manchester Institute, United Kingdom pp. 41-75.

Edwards, S., 1989. Exchange Rate Misalignment in developing Countries, National Bureau of Economic Research (NBER) Working Paper Series, No. 2950, April, Oxford University Press.

Elbadawi, I. & Soto, R., 1997. Real Exchange Rates and Macroeconomic Adjustment in Sub-Saharan Africa and Other Developing Countries, Journal of African Economies, Vol. 6(3), pp. 74-120.

Engle, R.F. & Granger, C.W.G., 1987. Co-Integration and Error Correction: Representation, Estimation, and Testing, Econometrica, Vol. 55, No 2.

Ghura, D. & Grennes T.J., 1993. The Real Exchange Rate and Macroeconomics Performance in Africa, Journal of Development Economics, Vol. 32: 155-174, North-Holland.

Gylfason, T., 2002. The Real Exchange Rate Always Floats, center for Economic Policy Research (CEPR) Discussion Paper Series No. 3376, London.

Hendry D. Pagan, A & Sargan, J.D., 1984. Dynamic Specification, in Handbook of Econometrics, Vol. 1, (EDS, Griliges, Z. and Intrilagor, M.), Amsterderm, North Holland.

Kiptoo C., 2007. Real Exchange Rate Volatility, and misalignment in Kenya,1993-2003 , Assessment of its impact on International Trade, and investments, unpublished Ph.D Thesis, University of Nairobi .

Koranchelian, T., 2005. The Equilibrium Real Exchange Rate in a Commodity Exporting Country: Algeria's Experience, IMF Working Paper Series, WP/051135, IMF, Washington DC, 20431, USA.

Limi, A., 2006. Exchange Rate Misalignment: An Application of the Behavioural Equilibrium Exchange Rate (BEER) to Botswana, IMF Working Paper, WP/061140, IMF, Washington DC, 20431.

Lothian, J.R. & Taylor, M.P., 1997. Real Exchange Rate behaviour, Journal of International Money and Finance, Vol. 116, No. 6, pp.945-954.

MacDonald R. & Ricci, L. 2003. Estimation of Equilibrium Real Exchange Rate for South Africa, IMF Working Paper NO. WP/03/44, IMF, Washington DC, 20431.

Mathisen, J. 2003. Estimation of Equilibrium~ Real Exchange Rate for Malawi, IMF Working Paper No. WP/031104, IMF, Washington D.C., 20431, USA.

Maturu, B.O. 2002. Modeling the Real Exchange Rate for Kenya, 1980-1998, Unpublished Ph.d Thesis, Jomo Kenyatta University of Agriculture and Technology.

Mongardini, J. 1998. Estimating Egypt's Equilibrium Real Exchange Rate, IMF Working Paper No. WP/98/5, IMF, Washington D.C. 20431,USA.

Nabli, M.K. & Veganzones-Varoudakis M. 2002. Exchange Rate Regime and Competitiveness . of Manufactured Exports: The Case of MENA Countries, http://lnweb18.worldbank.org/mna/mena.nsf/Attachments/Nabli-Veganzones/$File/Nabli-Veganzones.pdf

Ndung'u, N.S. 1999. Monetary and Exchange Rate Policy in Kenya, AERC, Research, Paper No. 94, Nairobi, Kenya.

Norman, L., Humberto, L. J. & Fernando B. 1997. Misalignment and Fundamentals: Equilibrium Exchange Rates in Seven Latin American Countries, World Bank, Policy Research Department, Washington, DC. http://wbln0018.worldbank.org/Research/workpapers.nsf.

Ranki, S. 2002. The Real Exchange Rate as an Indicator of Baltic Competitiveness, Bimonthly Review, Institute of Economies in Transition, Bank of Finland.

Sifunjo, E. K 2011. Chaos and Non-linear Dynamical Approaches to Predicting Exchange Rates in Kenya, Unplished PhD Thesis University of Nairobi.

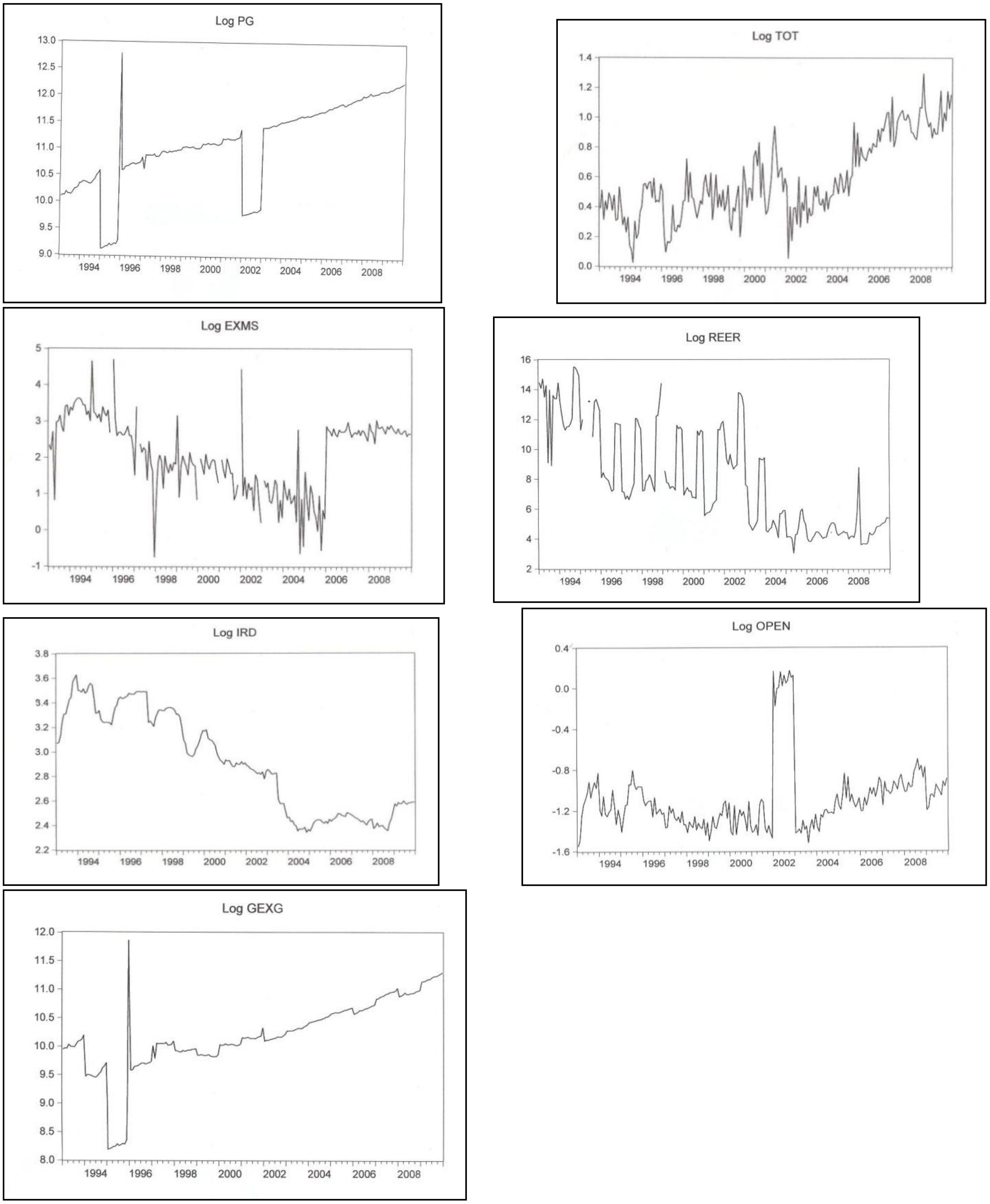
Were, M., Geda, A., Karingi, S. and Njuguna, S.N. (2001). Kenya's Exchange rate Movement in a Liberalised Environment:, An Empirical Analysis, The Kenya Institute for Public Policy Research and Analysis (KIPPRA), Discussion paper Series No. 10, Nairobi, Kenya.

Zalduendo, J. 2006. Determinants of Venezuela's Equilibrium Real Exchange, IMF Working Paper Series, No. WP/06174, IMF, Washington DC, 20431.

Journal of Business Studies Quarterly
2012, Vol. 3, No. 4, pp. 24-42

Appendix 1

Figure 1.2: Charts used in the Equilibrium Real Exchange Rate Model

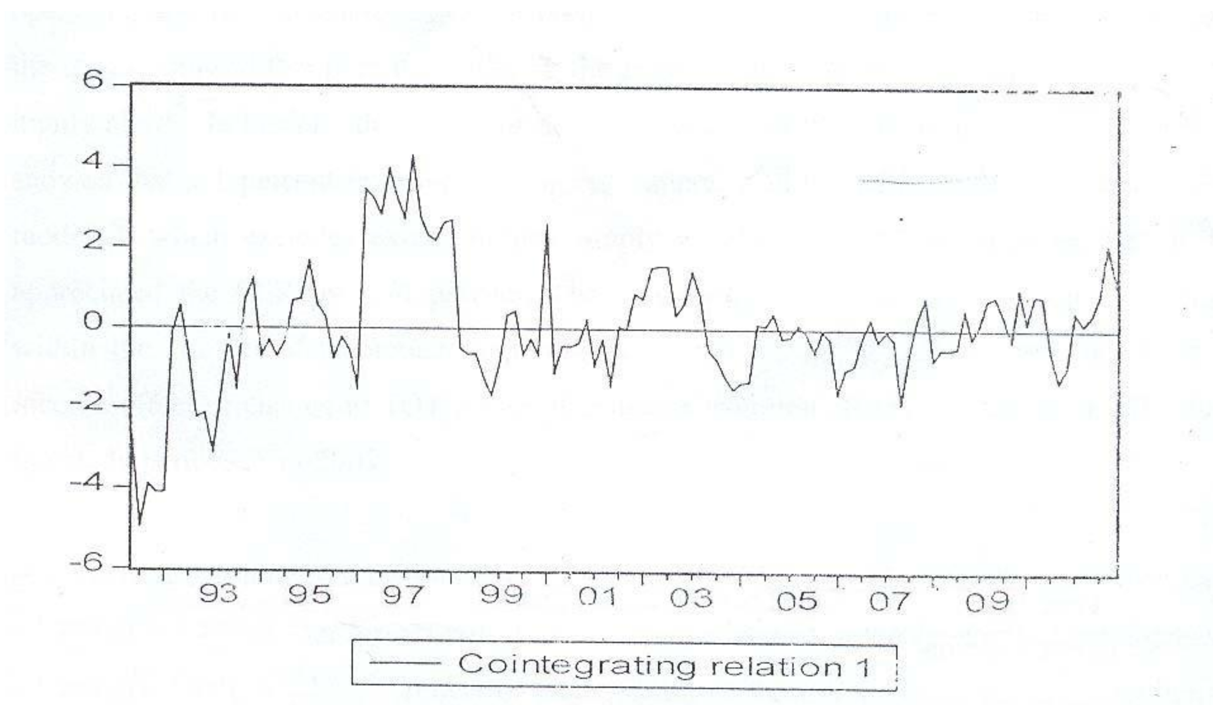


Appendix 2

Table 1.1 : Unrestricted Johansen cointegration Rank Test (Maximum Eigenvalue) for Equilibrium Real Exchange Rate

Assumption on constant and trend on CE	Hypothesized No. of CE(s)	Eigen-value	Max-Eigen Statistics	0.05 Critical Value	Prob.**	Decision
No trend in data: *No intercept nor trend in CE*	None*	0.457883	122.4547	42.77219	0.0000	Max-eigenvalue test indicates 1 cointegrating equations at the 0.05 level
	At most 1	0.243318	55.76232	36.63019	0.1000	
No trend in data: *Intercept nor trend in CE*	None*	0.463067	124.3765	47.07897	0.0000	Max-eigenvalue test indicates 1 cointegrating equations at the 0.05 level
	At most 1	0.243763	55.88019	40.95680	0.6000	
Linear trend in data: *No intercept nor trend in CE*	None*	0.440020	115.9707	46.23142	0.0000	Max-eigenvalue test indicates 1 cointegrating equations at the 0.05 level
	At most 1	0.237745	54.29474	40..07757	0.7000	
Linear trend in data: *Intercept nor trend in CE*	None*	0.484735	132.6147	50.59985	0.0000	Max-eigenvalue test indicates 1 cointegrating equations at the 0.05 level
	At most 1	0.268237	62.45959	44.49720	0.1517	
*denotes rejection of the hypothesis at the 0.05 level **Mack innon-Haug-Michelis (1999) p-values						

Figure 1.3 Cointegrating Relationship for Equilibrium Real Exchange Rate Model



Appendix 3

Table 1.2 : Unrestricted Cointegrating Coefficient For Equilibrium Real Exchange Rate

Date: 09/11/11 Time: 20:31
Sample (adjusted): 1993M05 2009M12
Included observations: 200 after adjustments
Trend assumption: Linear deterministic trend (restricted)
Series: RER GEXG IRD OPEN PG TOT EXMS
Lags interval (in first differences): 1 to 3

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

Beta	RER	GEXG	IRD	OPEN	PG	TOT	EXMS	@TREND(93M02)
B_1	1.71E-06	-8.79E-05	0.189734	-1.511758	-5.43E-06	-0.422278	0.004991	0.054123
B_2	-1.66E-06	-8.68E-05	-0.151063	5.807931	5.74E-05	0.380043	0.009970	-0.059493
B_3	-3.17E-07	-3.02E-05	0.281399	-3.771042	-1.08E-05	-1.915682	-0.002386	0.074166
B_4	-5.29E-07	-5.63E-05	-0.150837	9.788109	0.000106	-4.178516	0.007780	-0.074320
B_5	3.61E-07	-0.000255	0.111931	9.076741	8.51E-05	1.110357	-0.002028	0.002097
B_6	2.93E-07	-0.000169	-0.190697	3.206685	9.74E-05	-0.585394	0.002275	-0.053679
B_7	-4.69E-07	-5.89E-05	0.094505	0.043380	2.10E-05	0.298785	-0.001296	-0.008595

Unrestricted Adjustment Coefficients (alpha):

Alpha	α_1	α_2	α_3	α_4	α_5	α_6	α_7
D(RER)	-92151.55	160042.4	105065.8	30029.06	-2579.340	-31984.96	45187.68
D(GEXG)	2243.262	3066.727	645.1425	-1643.135	342.2098	54.60329	-1235.762
D(IRD)	-0.212937	0.271022	-0.186574	0.088506	0.002128	0.076598	-0.044116
D(OPEN)	-0.000456	0.002513	0.006369	-0.009605	-0.020466	0.013055	0.006080
D(PG)	5664.534	7159.392	886.9866	-3623.345	1038.540	-1296.716	-3653.079
D(TOT)	0.044367	-0.008213	0.047142	0.036104	-0.032588	0.006532	-0.021266
D(EXMS)	-70.68190	-69.82344	-6.528857	37.28489	-2.757803	5.699976	28.72398

Normalized cointegrating coefficients (standard error in parentheses)

RER	GEXG	IRD	OPEN	PG	TOT	EXMS	@TREND(93M02)
1.000000	0.94043	-3.61717	3.6925	-1.15586	-2.41721	-0.797919	-3.6280
	(15.5528)	(19669.2)	(673167.)	(7.94206)	(217458.)	(665.438)	(5546.69)

Adjustment coefficients (standard error in parentheses)

D(RER)	-0.157533
	(0.06347)
D(GEXG)	0.003835
	(0.00129)
D(IRD)	-3.64E-07
	(1.1E-07)
D(OPEN)	-7.80E-10
	(1.3E-08)
D(PG)	0.009684
	(0.00332)
D(TOT)	7.58E-08
	(2.9E-08)
D(EXMS)	-0.000121
	(3.0E-05)

Appendix 4

Table 1.3: The Results of the long run (equilibrium) Real Exchange Rate

Variables	Variables name	Model 1	Model 2
Level of Government Expenditure (% of GDP)	LNGEXG	0.94043 (-3.30750)	1.14085 (-0.69300)
Interest Rate Differential (Proxy for net capital inflows)	LNIRD	-3.61717 (5.64272)	5.12832 (5.39231)
Degree of openness	LNOPEN	3.6925 (-1.31368)	6.34340 (-2.90823)
Productivity Growth/Technological Progress	LNPG	-1.15586 (-0.40000)	-1.16553 (-1.65418)
Terms of trade	LNTOT	-2.41721 (-1.13593)	-5.76431 (-2.19395)
Excess Money Supply (Proxy for Monetary Shocks)	LNEXMS	-0.797919 (4.38744)	-
Trend	T	-3.6280 (5.70790)	-4.62750 (6.98815)
Constant	C	14.90866	6.56631
Notes: t-statistics in parentheses *** Significant at 1% (critical value is 2.58 for two tailed test) ** Significant at 5% (Critical value is 1.96 for two tailed test) *significant at 10% (critical – value is 1.64 for two tailed test)			

Table 1.4 : Diagnostic Test For Real Exchange Rate Model

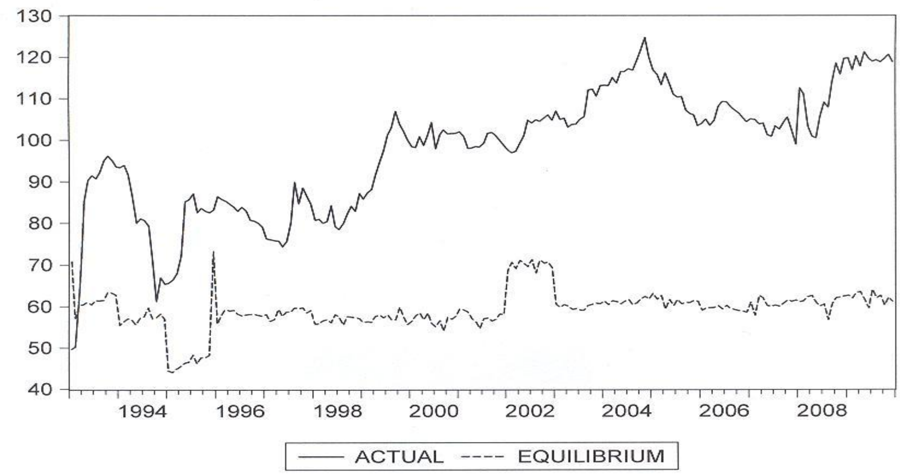
Model 1 – RER Model (with Excess Money Supply)				
Type of Diagnostic Test	**Specific Test**	**Statistic**	**Chi-sq**	**Prob.**
VEC Residual Normality Tests	Skewness	0.04595	0.073648	0.6143
	Kurtosis	2.007167	12.2096	0.0000
	Jarque-Bera	12.2322	2	0.0001
VEC Residual Serial Correlation LM Tests	LM-Test	61.64001		0.1635
VEC Residual Portmanteau Tests for Autocorrelations	Q-Stat	64.9214		0.129
Model 2 –Equation (Without Excess Money Supply)				
Type of Diagnostic Test	**Specific Test**	**Statistic**	**Chi-sq**	**Prob.**
VEC Residual Normality Tests	Skewness	-0.1315	0.4831	0.4701
	Kurtosis	2.243	3.58431	0.0521
	Jarque-Bera	4.65123		0.1384
VEC Residual Heteroskedasticity Tests : No Cross Terms (only levels and squares)	Joint Test	31.3681		0.5126
VEC Residual Serial Correlation LM Tests	LM-Test	47.33985		0.1462
VEC Residual Portmanteau Tests for Autocorrelations	Q-Stat	143.1032		0.0000

Appendix 5

Table 1.5: the results of the short-run model of the Real Exchange Rate (Dependent Variable DLNRER)

Variable	Variable Name	Model 1	Model 2
Error correction model (ECM)	ECM	-0.158 (-2.482)	-0.242 (-3.324)
Lagged RER	D(LNRER(-1))	0.0065 (0.0723)	0.0522 (0.6031)
	D(LNRER(-2))	0.1849 (2.002)	0.2074 2.5029)
Productivity growth/technological progress	D(TP (-1))	-10.632 (-0.7729)	-5.956 (-0.7179)
	D(TP (-2))	3.600 (0.2752)	4.950 (0.599)
	D(TP (-3))	-8.915 (-0.8588)	--5.678 (-0.7232)
Government Expenditure	D(LNGEX(-1))	-7.555 (-0.3511)	4.456 (0.2189)
	D(LNGEX(-3))	-4.931 (-0.2243)	
Constant	C	34809.67 (43610.3) [0.79820]	14246.82 (36942.2) [0.38565]
R-squared		0.158163	0.177776
Adj. R-squared		0.053528	0.090986
Sum sq. resids		4.88E+13	4.77E+13
S.E. equation		525038.3	514544.0
F-statistic		1.511572	2.048341
Log likelihood		-2905.816	-2903.459
Akaike AIC		29.28816	29.23459
Schwarz SC		29.66747	29.56442
Mean dependent		-3625.465	-3625.465
S.D. dependent		539681.1	539681.1
Notes : Standard errors between parents” Significant at 1% (critical value is 2.58 for two tailed test), ** Significant at 5% (critical value is 1.96 for two tailed test and * significant at 10% (critical-value is 16.4 for the two tailed test)			

Figure 1.4: Actual and Equilibrium Real Exchange Rate in Kenya, 1993 - 2009



Appendix 6

Figure 1.5: Real Exchange Rate Misalignment in Kenya, 1993 - 2009