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# The Impact of Real Exchange Rate Misalignment on Economic Growth; Kenyan Evidence

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**Abstract**
This paper examines Real Exchange Rate *(RER)* Misalignment on economic growth in Kenya by using Johansen Cointegration, and Error Correction Model Technique to establish the factors that determine equilibrium real exchange rate, calculate the real exchange rate misalignment as the difference between equilibrium and actual real exchange rate. Generalized Method Moments (GMM) technique was used to assess the impact of the real exchange rate misalignment on economic growth for the period of January 1993 to December 2009. Data for the study was collected from Kenya National Bureau of Statistics, Central Bank of Kenya and International Monetary Fund Data Base by taking monthly frequency. Thus, 204 data values were analysed, which assisted in evaluating the extent of the trade Kenya had with different countries and used in the construction of the Real Exchange Rate (*RER*). The results of the study on the extent of *RER* misalignment suggest that over the study period 1993-2009, Kenya's *RER* generally exhibited a depreciating trend, implying that in general, the country's economic growth deteriorated over the study period.
***Keywords****: Real Exchange Rate, Nominal Exchange Rate, Real Effective Exchange Rate, Nominal Effective Exchange Rate, Misalignment*

## 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 behavior. In particular, overvaluation is expected to hinder economic growth, while undervaluation is sometimes thought to provide an environment conducive to growth. 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. Large volatilities in nominal exchange rates have since characterized Kenya financial market (Kiptoo, 2007).

Evidence from other parts of the world suggest that under the floating exchange rate system, movements of nominal and real exchange rates have not reflected the movement of economic fundamentals between countries, especially, in the short-run (Obstfeld and Rogoff, 1995, Mark, 1995). Deviations of exchange rates from economic fundamentals have been substantial, implying that the adoption of the floating exchange rate regime has not considerably mitigated the problem of RER misalignment (Williamson, 1985, Dornbusch, 1986, Rogoff, 1996, Hinkle and Montiel, 1999).

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. The few available literature on RER misalignment in Kenya include: Elbadawi and Soto (1997), Ndung'u, and Mwega (1999), Maturu (2002), Kiptoo (2007), and Sifunjo, 2011. The purpose of this study is to elucidate the issues pertaining to the RER volatilities, and misalignment on Kenya's economic growth during the study period, June 1983 to December 2009.

### 1.1 The Real Exchange Rate Concept

An exchange rate is defined as the rate at which one currency may be converted into another. Among other things, the exchange rate determines how much the residents of a country pay for imported goods, and services, and how much they receive as payment for exported goods, and services. It can be expressed in nominal or real terms. It 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 been excluded (Copeland, 1989:4, Lothian, and Taylor, 1997).

The NER can be expressed in bilateral or multilateral term. A bilateral exchange rate refers to the exchange rate of one currency, say the Kenya shilling, in terms of another, say, the US dollar (Copeland, 1989:6). On the other hand, a multilateral exchange rate, also referred to as the Nominal Effective Exchange Rate (NEER).It is the rate of one currency against a weighted composite basket of that country trading partner currencies. The movements in the multilateral exchanges rates represented by NEERs rather than those of the bilateral exchange rates are the focus of this study. This is because Kenya trades with more than one country, and hence, the need to focus on the composite basket of trading partner currencies. Subsequent use of Norminal Exchange Rate (NER) in this study therefore refers to NEER except where specific reference is made to NER.

The RER, on the other hand is expressed as the NER adjusted for inflation. This adjustment can be obtained through the multiplication of the NER with the ratio of the foreign price level to the domestic price level (Adler, and Lehman, 1983). Alternatively, the inflation adjustment can be achieved by multiplying the NER with the domestic relative price of tradable to non-tradable goods (Edwards, 1989).

### 1.2 Real Exchange Rate Misalignment

RER misalignment, on the other hand, refer's 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.

### 1.3 The Relationship between RER, and Economic Growth

There are at least two possible channels through which RER misalignment might influence growth. First, they could influence domestic and foreign investments, thereby influencing the capital accumulation process. Capital accumulation is considered to be well established "engine of growth". Second, RER that is out of line could affect the tradable sector, and the competitiveness of this sector vis a vis the rest of the World. This sector's performance is also generally thought to be an important component of an economy's overall growth.

## 2.0 EXCHANGE RATE DETERMINATION

Economists and financial experts are yet to agree on a single theory that defines the exchange rate. Hitherto, there are at least five competing theories of the exchange rate concept, which may either be classified as traditional or modern. The traditional theories are based on trade and financial flows, and purchasing power parity, and are important in explaining exchange rate movements in the long run.

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, however, focuses on the importance of capital and international capital flows, and hence, explains the short run volatility of the exchange rates and their tendency to overshoot in the long run. Below is a brief discussion of each of these theories of exchange rate determination.

## 3.0 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:

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

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:

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

where, the $\boldsymbol{NER_c}$ 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:

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

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 $i=1, 2 .....,n$ 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:

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

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:

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

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:

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

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:

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

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

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

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, $\varepsilon_t$ 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:

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

where, the $\psi$ 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*.

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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:

$$rer_t^* = \alpha_0 + \beta_t F_t + \varepsilon_t \quad \text{..........} \quad Eqn\ (10),$$

where, $rer_t$* is the equilibrium *rer*, $_0$ is a constants vector, $\beta_t$ 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:

$$\Delta Y_t = \alpha_0 + \beta_I \Delta X_t + u_t \quad \text{..........} \quad Eqn\ (11).$$

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. $\mathbf{ECM_{t-1}}$) 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:

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

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.

### 3.1 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.

## 4.0 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.

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.

### 4.1 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 below (entitled model 1).

The long-run relationship for *RER* was consequently derived 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$_t$ .......... 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).***

### 4.2 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).

Considering that each regress, and in Table 1.1 (Appendix 1) 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 1.1 (appendix 1). The final dynamic equation for equilibrium *RER* is presented as follows:-

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

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:-

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

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 display 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.

### 4.3 Real Exchange Rate Equilibrium, and Misalignment

The results of the estimated long run parameters shown in equation 15 above 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 3). 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 3), and equation 15, which we re-specify as:-

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

Figure 1.1 (Appendix 2) show 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 1.2 (Appendix 2). 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 1.1 (Appendix 2) show 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 1.1 (Appendix 2) show 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.

### 4.4 Results of Stationarity Tests

The model robustness was tested as shown in table 1.2 (Appendix 3). *rer* misalignment coefficient remains negative, and insignificant. A one percent increase in *rer* volatility decreases growth by 0.000288 .Government expenditure ,primary enrolment coefficient are negative but significant. The per capita, the coefficient is negative, and insignificant. Life expectancy (health) remains positive but insignificant. Secondary enrolment is significantly positive. Terms of trade remain negative though insignificant. This could perhaps be attributed to the fact that Kenya remained a net importer hence during the study period and therefore experienced unfavorable terms of trade. The R-squared for the model is 42. However the values of Durbin-Watson (DW) statistics is above the standard 2.3 indicating positive autocorrelation of the model

### 4.5 Economic Growth Model

This section employed the GMM methodology: first, to empirically examine the impact of misalignment on economic growth. The findings, and results were presented, interpreted, and evaluated against theory, and results of other studies.

Table 1.3 (Appendix 4) provides all the variables but eliminating the misalignment from the model. This does not affect the negative impact of the government expenditure on economic growth. However, the influence is significant. This mean that *rer* misalignment does not affect how government expenditure influence growth. The same argument applies to primary enrolment, secondary enrolment, and terms of trade. Their effect on economic growth is not influenced by *rer* misalignment. However and notably is education (primary and secondary enrolment), have significant negative, and positive influence on economic growth respectively. Per capita insignificantly negatively influences economic growth. The R-squared value is 42 percent indicating the highest fit model, A Durbin-Watson statistics of 2.3 indicating a positive autocorrelation of the model.

## 5.0 DISCUSSION

Results of output growth equation show that real exchange rate overvaluations have significantly and positively affected output growth rate in Kenya. Even after controlling the growth regression for several types of control variables, the study could not reject the statistical significance of overvaluations in explaining growth. These results were in line with existing theory, which states that small to moderate overvaluations may drive real exchange rate to a level that adversely enhances output growth (Dooley et.al., 2005, Razin and Collins, 1997). Like many other developing countries Kenya may also reap growth benefits by maintaining its real exchange rate undervalued at moderate level, as it will improve international competitiveness of the country, which will help to sustain its balance of payments at a sustainable level. Nevertheless, one should be extremely careful not to push the argument for a policy target of high level undervaluation, as this could cause other undesirable effects to the economy and invite competitive devaluations by other countries. The results also stress the role of other factors in determining output growth, particularly, high capital per worker, well-established higher human capital in education and health have the theoretical predicted signs, other than primary education which is statistically significant. As exogenous variables, *rer* volatility and misalignment reflect various shocks that have wider implication on growth.

## 6.0 CONCLUSION

The results of the study on the extent of *RER* misalignment suggest that over the study period 1993-2009, Kenya's *RER* generally exhibited a depreciating trend, implying that in general, the country's economic growth 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 a appreciating trend, *rer* misalignment continued to hamper the country's economic growth

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# APPENDICES

## Appendix 1

**Table 1.1 : 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<br>(-2.482) | -0.242<br>(-3.324) |
| Lagged RER | D(LNRER(-1)) | 0.0065<br>(0.0723) | 0.0522<br>(0.6031) |
| | D(LNRER(-2)) | 0.1849<br>(2.002) | 0.2074<br>2.5029) |
| Productivity growth/technological progress | D(TP (-1)) | -10.632<br>(-0.7729) | -5.956<br>(-0.7179) |
| | D(TP (-2)) | 3.600<br>(0.2752) | 4.950<br>(0.599) |
| | D(TP (-3)) | -8.915<br>(-0.8588) | --5.678<br>(-0.7232) |
| Government Expenditure | D(LNGEX(-1)) | -7.555<br>(-0.3511) | 4.456<br>(0.2189) |
| | D(LNGEX(-3)) | -4.931<br>(-0.2243) | |
| Constant | C | 34809.67<br>(43610.3)<br>[ 0.79820] | 14246.82<br>(36942.2)<br>[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) | | | |

**Appendix 2**

**Figure 1. 1 : Actual and Equilibrium Real Exchange Rate in Kenya, 1993 - 2009**

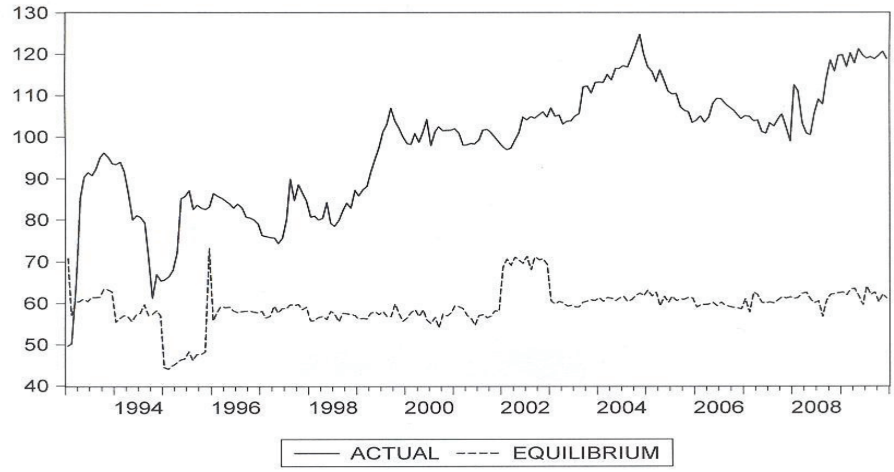
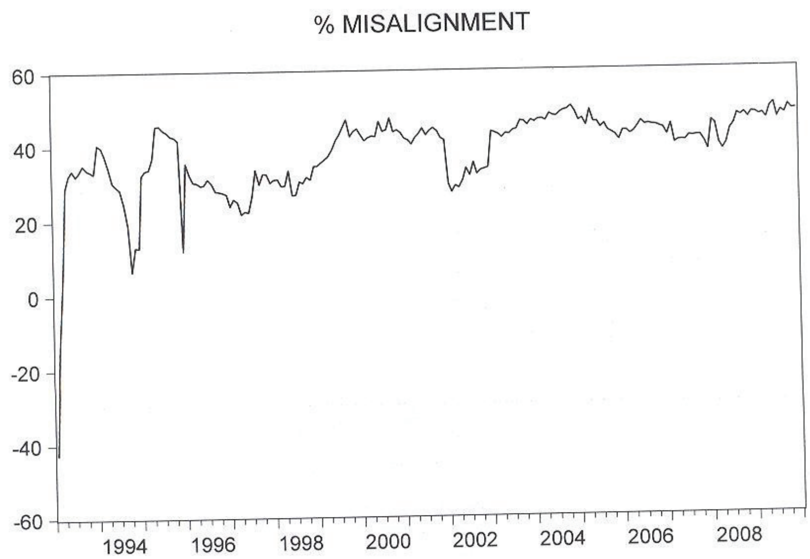



**Figure 1. 2 : Real Exchange Rate Misalignment in Kenya, 1993 - 2009**



**Appendix 3**

**Table 1.2 : Estimation of Economic Growth**

Dependent Variable: GROWTH
Method: Generalized Method of Moments
Date: 10/04/11 Time: 12:27
Sample: 1993 2009
Included observations: 17
Linear estimation with 3 weight updates
Estimation weighting matrix: HAC (Bartlett kernel, Newey-West fixed bandwidth = 3.0000)
Standard errors & covariance computed using estimation weighting matrix
Instrument specification: GOVT CAPITA HEALTH PRI SEC TOT MISA
Constant added to instrument list

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| GOVT | -0.000541 | 0.000309 | -1.750297 | 0.1106 |
| CAPITA | -5.56E-05 | 7.35E-05 | -0.757171 | 0.4664 |
| HEALTH | 0.001393 | 0.001519 | 0.917133 | 0.3807 |
| PRI | -0.006004 | 0.003472 | -1.729052 | 0.1145 |
| SEC | 0.009312 | 0.005641 | 1.650711 | 0.1298 |
| TOT | -0.005938 | 0.024182 | -0.245554 | 0.8110 |
| MISA | -0.000288 | 0.000799 | -0.360248 | 0.7262 |

| | | | |
|---|---|---|---|
| R-squared | 0.422849 | Mean dependent var | 0.011765 |
| Adjusted R-squared | 0.076559 | S.D. dependent var | 0.048507 |
| S.E. of regression | 0.046613 | Sum squared resid | 0.021728 |
| Durbin-Watson stat | 2.338092 | J-statistic | 0.019595 |
| Instrument rank | 8 | Prob(J-statistic) | 0.888674 |

**Appendix 4**

**Table 1. 3 : Estimation of Economic Growth**

Dependent Variable: GROWTH
Method: Generalized Method of Moments
Date: 10/16/11 Time: 22:48
Sample: 1993 2009
Included observations: 17
Linear estimation with 3 weight updates
Estimation weighting matrix: HAC (Bartlett kernel, Newey-West fixed bandwidth = 3.0000)
Standard errors & covariance computed using estimation weighting matrix
Instrument specification: GOVT CAPITA HEALTH PRI SEC TOT
Constant added to instrument list

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| GOVT | -0.000539 | 0.000298 | -1.806386 | 0.0983 |
| CAPITA | -4.20E-05 | 0.000123 | -0.340737 | 0.7397 |
| HEALTH | 0.000867 | 0.000901 | 0.962582 | 0.3564 |
| PRI | -0.006116 | 0.003321 | -1.841724 | 0.0926 |
| SEC | 0.009681 | 0.005307 | 1.824333 | 0.0954 |
| TOT | -0.003723 | 0.020686 | -0.179965 | 0.8605 |

| | | | |
|---|---|---|---|
| R-squared | 0.421403 | Mean dependent var | 0.011765 |
| Adjusted R-squared | 0.158405 | S.D. dependent var | 0.048507 |
| S.E. of regression | 0.044500 | Sum squared resid | 0.021782 |
| Durbin-Watson stat | 2.340381 | J-statistic | 0.163588 |
| Instrument rank | 7 | Prob(J-statistic) | 0.685874 |