REAL EXCHANGE RATE MISALIGNMENT AND IMPLICATIONS FOR THE NOMINAL EXCHANGE RATE LEVEL IN KENYA IN 2012

BY

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Abstract

This paper (i) investigates whether the real exchange rate in Kenya is over-valued despite the adoption of a flexible exchange rate regime since the early 1990s; and (ii) examines the relationship between the nominal and the real exchange rate and the implications for the appropriate level of the nominal exchange rate in 2012. Using quarterly data and a 1995Q4 base, the analysis in the paper shows that the real effective exchange rate has not significantly deviated from the estimated equilibrium rate in the study period. Hence the poor performance of exports in the country lie outside the realm of exchange rate policy and has been constrained by the poor provision of productivity enhancing public inputs, with high transaction costs negating the advantages of its coastal location (O'Connell et al. 2010, Kiringai 2012).

In 2012Q1, the results tentatively show that the real exchange rate is only slightly misaligned, with an overvaluation of about 4.3%, with the nominal exchange rate a principal factor driving the real exchange rate. With the elasticity of RER with respect to NER of about 0.76, it would require a depreciation of about 5.5% to close this gap. This would require depreciation of the Kenya shilling to about Ksh 88.9 to the dollar from Ksh 84.14 in 2012Q1. Data also suggest that developments in the rest of 2012 may have reduced the degree of misalignment.

I. Introduction[1]

Kenya has recently experienced a large increase in the current account deficit. According to CBK estimates, the current account deficit for example increased from 9.8 percent of GDP in December 2011 to 11.4 percent of GDP in April 2013 so that export earnings have been financing a decreasing share of the import bill. The rising deficit would not be a major problem if it was financed by long-term capital inflows. However, the deficit is mainly financed by net short-term capital inflows, making the Kenya shilling highly vulnerable to external shocks. The easy reversibility of these inflows increases the risk of a 'sudden stop' if a shift in market sentiments creates a flight away from domestic assets (O'Connell et al. 2010). The large current account deficit is a structural problem that raises the concern that the exchange rate may be misaligned, encouraging imports and limiting exports growth[2].

Since the early 1990s, the central bank has pursued a flexible exchange rate regime. Its policy is to intervene only when the shilling is driven by speculative activities in order to reduce excessive instability in aggregate demand; to build reserves; or to retire or service external debt on behalf of the Treasury. With its adoption in the early 1990s, a floating exchange rate system was expected to deliver several advantages for Kenya (Ndung'u and Mwega 1999). First, it would allow a more continuous adjustment of the exchange rate to shifts in the demand for and supply of foreign exchange. Second, it would equilibrate the demand for and supply of foreign exchange by changing the exchange rate, rather than the level of reserves. Third, it would allow Kenya the freedom to pursue its own monetary policy without having to be concerned about the balance of payments effects.

Several observations can be made from the Kenyan experience with the flexible exchange rate system that somewhat undermines these expectations. First it was expected that with

[1] This is an updated version of a paper presented at a CBK Monetary Policy Advisory Committee (MPAC) meeting held in Naivasha in June 2007.

[2] There are however difficulties in measuring the current account deficit and establishing the nature of the net short-term capital inflows which CBK has been trying to rectify in consultation with the Kenya National Bureau of Statistics (KNBS).

the adoption of the regime, the interplay of market forces of demand and supply for foreign exchange would raise the price of exportables *vis a vis* non-tradeables and hence stimulate the production of exports and boost the producers' incomes. There is no evidence that this objective has been substantially achieved, as it requires other fundamental reforms, although there have been some success in the horticultural sector (Musyoki et al. 2012). Second, there is also little evidence of import substitution, in part reflecting the ineffectiveness of exchange actions on imports demand (Pollin and Heintz 2007). Lastly, the large net inflows of capital that are not mediated by government have not been an unmitigated blessing. While increased capital inflows are accompanied by a marked accumulation of foreign exchange reserves, some episodes have been accompanied by inflationary pressures, a real exchange rate appreciation and deterioration in the current account deficit.

The rest of the paper addresses two issues. Section II inquires whether the real exchange rate is over-valued despite the adoption of a flexible exchange rate regime; while Section III examines the relationship between the nominal and the real exchange rate and the implications for the appropriate level of the nominal exchange rate in 2012. The paper is concluded in Section IV.

II. Is the Kenyan Real Exchange Rate Overvalued?

The exchange rate can be used to achieve two objectives: to anchor inflation and to achieve exports competitiveness. Use of the nominal exchange rate as an anchor for inflation, however, conflicts with its use as an instrument to enhance the international competitiveness of the country's exports. An appreciation of the exchange rate for example promotes price stability but reduces the country's international competitiveness. According to Adam (2012), for a small open economy with a large traded goods sector, an exchange rate peg is likely to anchor domestic prices to world inflation rates more robustly than a floating rate with a domestic anchor. On the other hand, a floating rate may be better suited to ensure that efficient adjustment of the real economy to external shocks, thereby avoiding prolonged growth-retarding real exchange rate misalignment.

There is no easy way to resolve this trade-off, but policy makers need to establish clear priorities and operational targets within a formal analytical framework. We focus here on the real exchange rate as an instrument to achieve exports competitiveness, and hence analyze the extent to which the RER is overvalued[3].

The real exchange rate is one of the most important relative prices in the economy, as it influences the price of domestic vis-à-vis foreign goods and services. One objective of economic reforms in Kenya should therefore be to reduce real exchange rate misalignment, defined as the sustained deviations of the actual real exchange rate from the "equilibrium" real exchange. Real exchange rate misalignment is commonly believed to be a major cause of poor economic performance. It discourages exports and the production of importables. It is also associated with an external debt problem through a weakening of the balance of payments, encouragement of capital flight and discouragement of foreign investment, hence contributing to an unstable macroeconomic environment detrimental to enterprise, investment and price responsiveness (Collier and Joshi 1989, Killick 1991, Aguirre and Calderón 2005). Misalignment may be a particularly serious problem under a liberalized but poorly supervised financial system. When the exchange rate is over-valued, financial liberalization may give rise to a lending or consumption boom that appreciates the exchange rate even more (Montiel 2000). According to Frenkel and Taylor (2006), the most fundamental justification for avoiding a persistently strong exchange rate is that it is an invitation to disaster. While exchange rate appreciation is politically welcome because it may be expansionary (at least in the short-run), is non-inflationary and reduces import costs, it can have devastating effects on resource allocation and economic development.

An overvaluation of the real exchange rate will adversely affect a country's competitiveness in various ways. First, it may make producers to lose markets as well as skills and expertise in producing for export, which may not be recoverable when the real exchange rate depreciates to the pre-shock level. Competitiveness leads to accumulation

[3] The IMF classifies Kenya as operating an independent float between 1992 and 1997 and a managed float since 1998 (O'Connell et al. 2010).

of knowledge or benefit of learning-by-doing, so that there may be long-run adverse effects on the economy from temporary shocks. This process, called hysteresis, implies that the future path of exports is governed by the historical starting point. Second, due to sunk costs in entering and securing markets (advertising, distribution, market research, etc), it may make substantial exchange rate changes to induce exporters to quit or to enter markets, so that the effects of a misalignment are not easily discerned in the short-term. Lastly, misalignment may be accompanied by RER uncertainty which adversely affects exports.

The equilibrium RER is defined as the rate at which the economy would be at internal and external balance for given sustainable levels of the other variables such as taxes, international prices and technology. Internal equilibrium is attained when the non-tradeables sector clears in the present and in the future while the external balance is attained when the current account balance is compatible with long-run sustainable net capital inflows. The equilibrium RER therefore varies continuously in response to changes in actual and expected economic fundamentals.

Measurement and analysis of the determinants of RER should distinguish between the relative importance of the short-term disequilibrium impacts of monetary and nominal exchange rate policies and the long-term equilibrium impacts of changes in economic fundamentals on RER. While the monetary and nominal exchange rate policies are destabilizing and hence require policy interventions, changes in the fundamental factors induce equilibrium adjustments and hence do not require policy interventions.

RER is formally defined as the price of tradeables in terms of non-tradeables (Pt/Pnt). Based on the small country assumption, Pt is influenced by world prices, the nominal exchange rate and trade taxes, while Pnt is a function of domestic supply and demand and hence macroeconomic and trade policies. Since it is difficult to find an exact empirical counterpart to this definition, various proxies for RER have been utilized in the literature (Chinn 2005). In much of the literature, RER is usually approximated by the product of an index of the nominal exchange rate (NER) and an index of foreign prices (CPI^f)

divided by an index of domestic consumer prices (CPI^d), so that an increase in RER denotes a depreciation and vice-versa.

The real exchange rate misalignment (RERMIS) is then measured by:

RERMIS = (ERER-RER)*100/RER (1)

where ERER is the equilibrium exchange rate and RER the actual rate. Important determinants of ERER include terms of trade shocks; net capital inflows; commercial policy particularly trade taxes and quantitative restrictions; government expenditure on non-tradeables; and productivity growth (Edwards, 1989).

Since ERER is not observable, we estimate, as in Ghura and Grennes (1993), the time path of ERER from a cointegration equation, and normalize the predicted RER so that it starts from a common base with the actual RER during a period when the economy was to a large extent in internal and external balance, in Kenya taken to be 1970. This is supported by Figure 1 (in the appendix) that shows the sum of inflation and the current account deficit was lowest in 1970 and 1986 followed by 1995. We therefore use 1995 as the base year when the economy was closest to internal and external equilibrium, although this underestimates the extent of misalignment compared to 1970. The cointegration vector is derived from the equation

RER = RER (TOT, KFLOW_GDP, OPENNESS, GEXPE_GDP, GROWTH) (2)

where RER is the observed real exchange rate; TOT is external terms of trade; KFLOW_GDP is net capital inflows as proxied by (imports minus exports) /GDP; OPENNESS measures the severity of trade restrictions and capital controls as proxied by (exports plus imports) /GDP; GEXPE_GDP is government expenditure ratio; and GROWTH is economic growth. The model is estimated over the period 1995Q1-2012Q1[4].

[4] The trade-weighted NER and RER data were derived from CBK Monetary Policy Committee Indicator Table and chain linked to estimates by Dr. Maturu for an earlier

The impact of terms of trade (TOT) shocks on ERER cannot be signed *a priori* because they have counteracting income and substitution effects on the economy with the net impact a function of the source of the TOT changes. The literature however finds an RER appreciation more likely following an improvement in the terms of trade (and vice-versa), however, suggesting that the income effect is dominant. On the other hand, it is possible for the opposite to be the case when the substitution effect dominates the income effect, or the TOT impact to be non-significant. Following a TOT deterioration, for example due to an increase in import prices, ERER may appreciate if imports are competitive and have many domestic substitutes (hence the initial increase in Pt is more than counteracted by movements in Pnt) or if importables constitute a small proportion of tradeables.

Similarly, ERER appreciates with an increase in net capital inflows, which increases the aggregate demand for both tradeables and non-tradeables, hence raising the prices of non-tradeables more than those of tradeables, which are determined in external markets. Net capital inflows however may have a limited impact if they are directly tied to imports (e.g., where production and investment are highly import intensive) so that these resources do not spill over into increased demand for non-tradeables. Net capital inflows may also induce an increase in savings to service the accumulation of external debt in the future according to the Ricardo Equivalence hypothesis, hence having a limited impact on the RER.

Trade liberalization such as reduction in tariff rates and relaxation of quantitative restrictions on imports (hence making the economy more open) cause ERER to depreciate because increased competition puts downward pressure on the price of non-tradeables relative to tradeables. The impact of an increase in government expenditures on ERER will depend on its composition. If it is mainly expended on the tradeables sector products the rate will depreciate, but if it is mainly expended on the non-tradeables

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project on "Kenya: Policies for Prosperity". The rest of the data were derived from diverse sources, including the MPC Indicator Table, KNBS and other websites, the Kenya Economic Survey and the IMF International Financial Statistics. Where quarterly data were not available (e.g. TOT), they were interpolated from annual data.

sector products (as expected), the rate will appreciate. Lastly, ERER may appreciate or depreciate with productivity growth. Technological progress that favours the tradeables sector will induce an appreciation by causing a relative decline in the sector's product prices. On the other hand, it will induce a depreciation if it favours the non-tradeables sector. Many studies show economic growth to be highly correlated to productivity growth, the so-called Verdoorn's law. Faster growth permits the exploitation of scale economies, better use of factor inputs and absorption of new technologies through capital formation.

Figure 2 (in the appendix) show the data used in the cointegration equation. They appear to conform to Kenya's economic history, although the size of net capital inflows in recent years are higher than expected. The RER depreciated to a peak in 2004Q4 and have since then generally appreciated (29% by 2012Q4); the terms of trade generally declined until 2006Q4 and thereafter improved; while net capital inflows and openness reached a trough in 2002 and then have substantially increased[5]. Government expenditure ratio and growth have been fairly constant over time.

Table 1 shows results from the ADF stationarity tests with the size of lags determined by the Schwarz information criteria. The results show that the RER and five fundamentals are I (1) at least at the 1% level. The Johansen test for cointegration (Table 2) gives mixed results. According to the trace test, there are two cointegration vectors and according to the eigenvalue test, there is one. For convenience, we go by the latter test and utilize the Granger-Engle two-step method which is justified when there is one cointegration vector. The cointegration equation in Table 3 shows that terms of trade, net capital inflows, government expenditure and growth have negative and significant impacts on the real exchange rate (at least at the 10% level) while openness has a positive and significant coefficient, as expected.

[5] According to O'Connell et al. (2010), openness in Kenya vaulted in 1996 from the most closed 7% of developing countries to the most open 25% in terms of capital account liberalization.

Figure 3 shows the evolution of the actual RER and the estimated ERER in Kenya given a benchmark of 1995Q4. The two closely track one another suggesting the real exchange rate was not much misaligned during the study period. Figure 4 explicitly shows the estimated evolution of the real exchange rate misalignment in Kenya. Focusing on the period since 2000, the results shows some overvaluation in 2006Q1 (0.65%) and 2006Q4 (1.31%); 2007Q1 (3.04%); 2007Q4-2008Q4 (average 2.47%); 2009Q4 (1.95%) and 2012Q1 (4.2%), with undervaluation the rest of the period[6].

III. The Relationship between NER and RER and Implications for the Nominal Exchange Level in 2012

Based on the analytical framework suggested by the classic study by Edwards (1989), changes in the actual observed RER are dynamically influenced by three broad factors. First is the degree of deviation of the equilibrium exchange rate (ERER) from the actual RER observed in the previous period. Second is the variation of macroeconomic policies (Z) from their sustainable levels (Z*), representing departure of fiscal and monetary policies from their optimal levels. Third is changes in the nominal exchange rate (ΔNER). Formally:

$$\Delta RER = f(ERER - RER_{t-1}, Z-Z^*, \Delta NER) \qquad (3)$$

where the variables are as defined above.

While a nominal depreciation may cause a depreciation of RER, excessive credit and monetary growth cause the actual RER to appreciate at least in the short-run. This gives the following basic estimation equation derived by substituting the determinants of ERER into the equation above:

[6] A relatively recent study by Musyoki et al. (2012) chooses 2007 as base year; but do not normalize the fitted RER to that base. They find RER systematically above ERER, indicating systematic undervaluation over 1994-2009. They however wrongly interpret this as overvaluation, implausibly averaging about 40% throughout this period.

RER = RER(TOT, KFLOW_GDP, OPENNESS, GEXPE_GDP, GROWTH, Z-Z*, ΔNER) (4)

where RER is the observed real exchange rate; Z-Z* is an index of macroeconomic imbalances, proxied by $(\Delta M3/M3-\Delta y/y-\Delta NER/NER-\Delta Pf/Pf)_{t-1}$ (Ghura and Grennes 1993)[7]; and NER is the nominal exchange rate.

Table 4 shows that ΔNER and (Z-Z*) are I(0) at the 1% level. Table 5 shows the reduced (parsimonious) short-run RER model with the ECM from the estimated cointegration equation with each of the variables lagged twice in the general model. The results show that RER is to a large extent driven by the contemporaneous nominal exchange rate, which has the most significant coefficient. Some part of this impact is however dissipated in the following quarter (see the negative lagged coefficient) because of an increase in domestic prices. The offset nevertheless is only partial, so that nominal devaluations plays a role in Kenya's real exchange rate evolution, with a 10% depreciation of the NER increasing RER by about 4.3%. Terms of trade and net capital inflows significantly appreciate the real exchange rate as expected. Unlike in the long-run equation, economic growth significantly depreciates the real exchange rate by favouring productivity growth in the non-tradeables sector. The other variables including the error correction term are non-significant.

With a ΔNER coefficient of 0.43 and NER/RER ratio of 1.76 in 2012Q1, the elasticity of RER with respect to NER is 0.76. Closing a RER misalignment gap of 4.2% would therefore require a depreciation of the 5.5%. This implies a movement from an exchange rate of Ksh 84.14 per US dollar to about Ksh 88.9 per US dollar in 2012Q1[8].

[7] This expression is derived from the quantity theory of money assuming a constant money velocity and the operation of the law of one price in the long-run, i.e., P=NER*Pf. Hence ΔLog M = ΔLog NER + Δlog Pf + ΔLog y, where Δlog Pf is proxied by the US inflation rate.

[8] . It should be mentioned that this is a tentative result driven by the adopted models, the benchmark period and the quality of data utilized.

For the rest of 2012, the degree of misalignment in 2012Q1 may be an upper estimate for several reasons. First, the RER has depreciated from an index of 66.2 in 2012Q1 to 67.1 in 2012Q4. Second, while the government expenditure ratio can be taken as constant, growth accelerated in 2012, and the ratio of net capital inflows to GDP may have increased due to an expanded current account deficit. Our estimates also suggest that openness, as measured by the trade ratio, declined in 2012, all these variables appreciating the ERER. These developments were however offset by a decline in TOT in 2012[9].

IV. Conclusions

Using quarterly data and a 1995Q4 base, the analysis in the paper shows that the real effective exchange rate has not significantly deviated from the estimated equilibrium rate in the study period. Hence the poor performance of exports in the country lie outside the realm of exchange rate policy and has been constrained by the poor provision of productivity enhancing public inputs, with high transaction costs negating the advantages of its coastal location (O'Connell et al. 2010, Kiringai 2012).

In 2012Q1, the results show that the real exchange rate is only slightly misaligned, with an overvaluation of about 4.3%, with the nominal exchange rate a principal factor driving the real exchange rate. With the elasticity of RER with respect to NER of about 0.76, it would require a depreciation of about 5.5% to close this gap. This would require depreciation of the Kenya shilling to about Ksh 88.9 to the dollar from Ksh 84.14 in

[9] Estimates of selected variables in 2012:

Quarter	RER	GROWTH	KFLOW_GDP	OPENNESS	TOT
2012Q1	66.2	3.5	18.3	81.5	115.2
2012Q2	64.9	4.4	18.2	78.1	114.7
2012Q3	65.9	4.5	20.7	79.2	114.2
2012Q4	67.1	5.3	19.8	74.1	113.7

2012Q1. Data also suggest that developments in the rest of 2012 may have reduced the degree of misalignment.

Eliminating misalignment could be achieved by some non-radical interventions such as buying foreign exchange reserves to build reserves (for example to the six months cover recommended by the East African Community) or to pay external debt arrears, even if this requires sterilization and hence an increase in interest rates unless the authorities are willing to accept a higher inflation rate. Some countries have implemented more radical policies such as the Tobin tax, asking such flows be in the country for a certain minimum period or revert to a crawling peg regime that would contain and lead to better management of both short-term capital flows and the exchange rate. According to O'Connell et al. (2010), the CBK is not yet in a trilemma which postulates that a country that operates an open capital account cannot peg the exchange rate and have an independent monetary policy at the same time. Given a combination of imperfect asset substitutability, prudential regulations and residual capital controls, the bank has scope to target inflation while also exerting some influence over the path of the nominal exchange rate in the short-run and perhaps for extended periods.

References

Adam C. (2012), Exchange Rate Policy. In Ernest Aryeetey et al, T*he Oxford Companion to the Economics of Africa*. OUP.

Aguirre A. and C. Calderón (2005), Real Exchange Rate Misalignment and Economic Performance. Central Bank of Chile Working Paper 315, April.

Chinn M. D. (2005), A Primer on Real Effective Exchange Rates: Determinants, Overvaluation, Trade Flows and Competitive Devaluation. NBER Working Paper No. 11521.

Collier P. and V. Joshi (1989), Exchange Rate Policy in Developing Countries. *Oxford Review of Economic Policy*, Vol 5, No. 3.

Edwards S. (1989), *Real Exchange Rates, Devaluation and Adjustment*. MIT Press, Cambridge, Massachusetts.

Frenkel R. and Lance Taylor (2006), Real Exchange Rate, Monetary Policy and Employment. DESA Working Paper No. 19, 2006

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

Killick T. (1991), Exchange Rates and Structural Transformation. ODI Working Paper No. 33.

Kiringai J. (2012), Kenya: A Structural Transformation Paradox and Challenges. . In Ernest Aryeetey et al, *The Oxford Companion to the Economics of Africa*. OUP.

Montiel P. (2000),"What Drives Consumption Booms?", *World Bank Economic Review*, Vol. 14 No. 3, pages 457-480, September.

Musyoki, Danson, Ganesh P. Pokhoriyal and Moses Pundo (2012), Real Exchange Rate Equilibrium and Misalignment in Kenya. *Journal of Business Studies Quarterly*, Vol 3, No. 4, pp 24-42.

Ndung'u N.S and F. M. Mwega, 'Macroeconomic Policies and Exchange rate Management in Kenya'. In R. Luder (Ed), *Macroeconomic Policies and Exchange rate Management*, San Francisco, ICEG, 1999.

Pollin, Robert and James Heintz (2007), Expanding Decent Employment in Kenya: The Role of Monetary Policy, Inflation Control and the Exchange Rate. International Poverty Centre, Country Case Study No. 6, March.

Appendix

Figure 1: Sum of Inflation and the BOP Current Account Deficit in Kenya

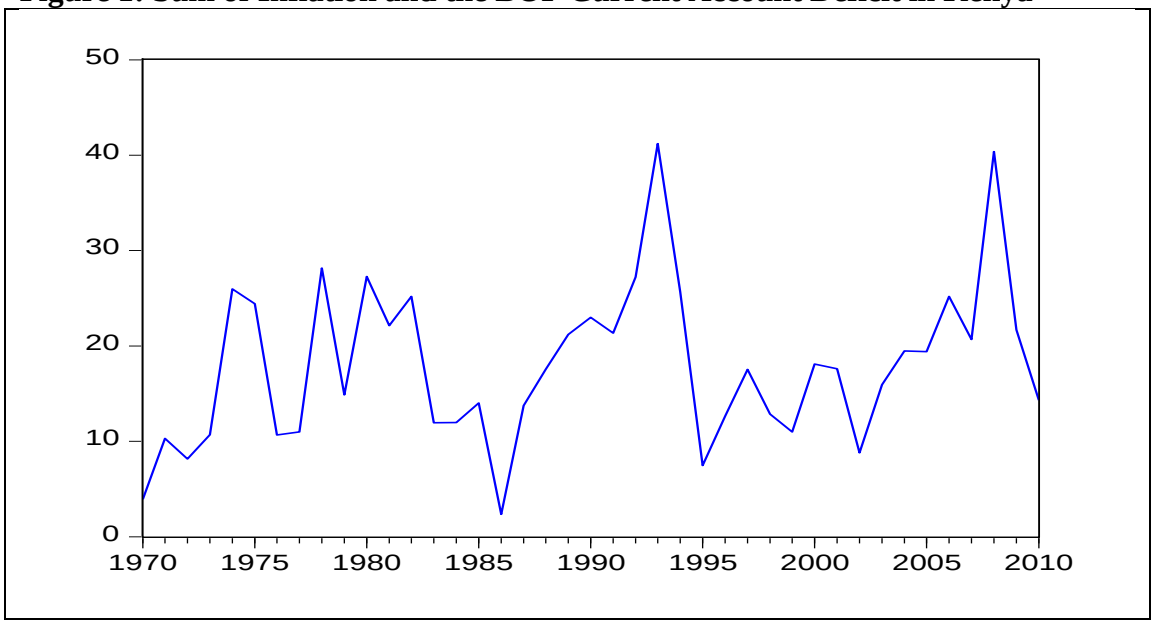
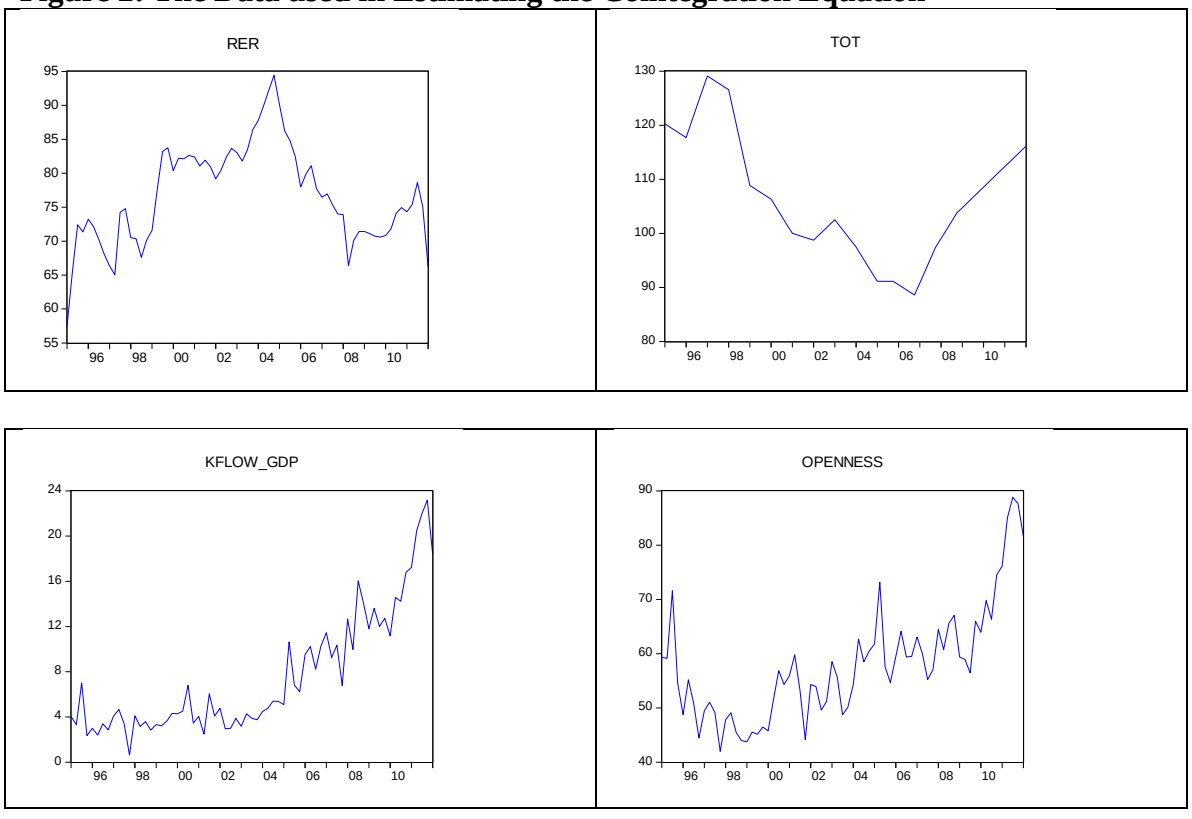


Figure 2: The Data used in Estimating the Cointegration Equation



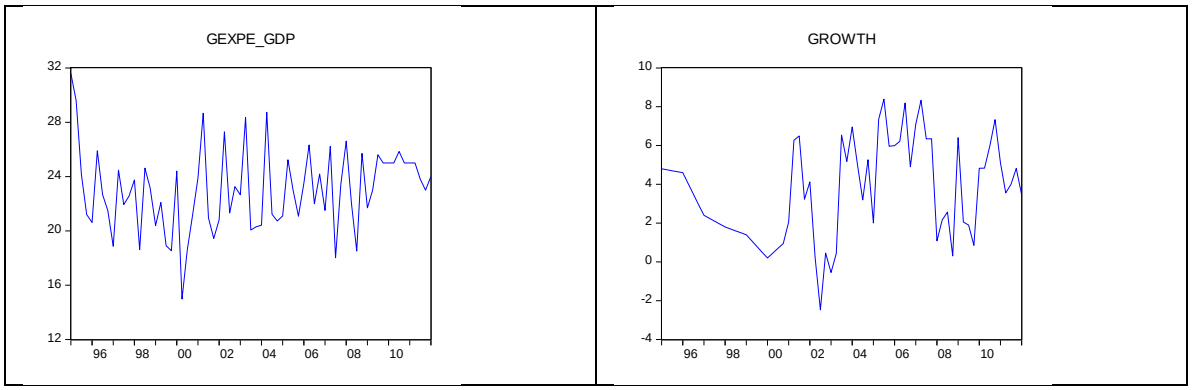


Table 1: Augmented Dickey Fuller Stationary Tests

	Level Variables		First Difference Variables	
	t-Statistic	Prob.*	t-Statistic	Prob.*
RER	-2.31488	0.4202	-8.60684	0.0000
TOT	-1.38497	0.8566	-6.887329	0.000
KFLOW_GDP	-1.61904	0.7753	-14.3926	0.0001
OPENNESS	-3.59719	0.0375	-9.12287	0.0000
GEXPE_GDP	-2.72870	0.0748	-8.92243	0.0000
GROWTH	-3.86882	0.0193	-11.4383	0.0001
Test critical values	1% level 5% level 10% level	-4.098741 -3.477275 -3.166190		
*MacKinnon (1996) one-sided p-values				

.

Table 2: Johansen Cointegration Tests

Sample (adjusted): 1995Q4 2012Q1
Included observations: 66 after adjustments
Trend assumption: Linear deterministic trend
Series: RER TOT KFLOW_GDP OPENNESS GEXPE_GDP GROWTH
Lags interval (in first differences): 1 to 2

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.01 Critical Value	Prob.**
None *	0.533662	134.2131	104.9615	0.0000
At most 1 *	0.444237	83.86540	77.81884	0.0025
At most 2	0.282705	45.09617	54.68150	0.0888
At most 3	0.215327	23.16649	35.45817	0.2380
At most 4	0.102438	7.162284	19.93711	0.5589
At most 5	0.000446	0.029465	6.634897	0.8637

Trace test indicates 2 cointegrating equation(s) at the 0.01 level
* denotes rejection of the hypothesis at the 0.01 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.01 Critical Value	Prob.**
None *	0.533662	50.34767	45.86900	0.0025
At most 1	0.444237	38.76924	39.37013	0.0120
At most 2	0.282705	21.92967	32.71527	0.2240
At most 3	0.215327	16.00421	25.86121	0.2246
At most 4	0.102438	7.132818	18.52001	0.4736
At most 5	0.000446	0.029465	6.634897	0.8637

Max-eigenvalue test indicates 1 cointegrating equation(s) at the 0.01 level
* denotes rejection of the hypothesis at the 0.01 level
**MacKinnon-Haug-Michelis (1999) p-values

Table 3: The Cointegration Equation

Dependent Variable: RER
Method: Least Squares
Sample: 1995Q1 2012Q1
Included observations: 69

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	123.6621	7.482069	16.52779	0.0000
TOT	-0.451938	0.049364	-9.155253	0.0000
KFLOW_GDP	-0.879784	0.202684	-4.340670	0.0001
OPENNESS	0.395360	0.107677	3.671735	0.0005
GEXPE_GDP	-0.588615	0.143542	-4.100636	0.0001
GROWTH	-0.401649	0.235682	-1.704201	0.0933

R-squared	0.661626	Mean dependent variable	76.72904
Adjusted R-squared	0.634771	S.D. dependent variable	7.228189
S.E. of regression	4.368298	Akaike information criterion	5.869565
Sum squared residual	1202.168	Schwarz criterion	6.063835
Log likelihood	-196.5000	Hannan-Quinn criterion	5.946639
F-statistic	24.63688	Durbin-Watson statistic	0.727505
Prob(F-statistic)	0.000000		

Figure 3: Actual RER versus the Equilibrium RER

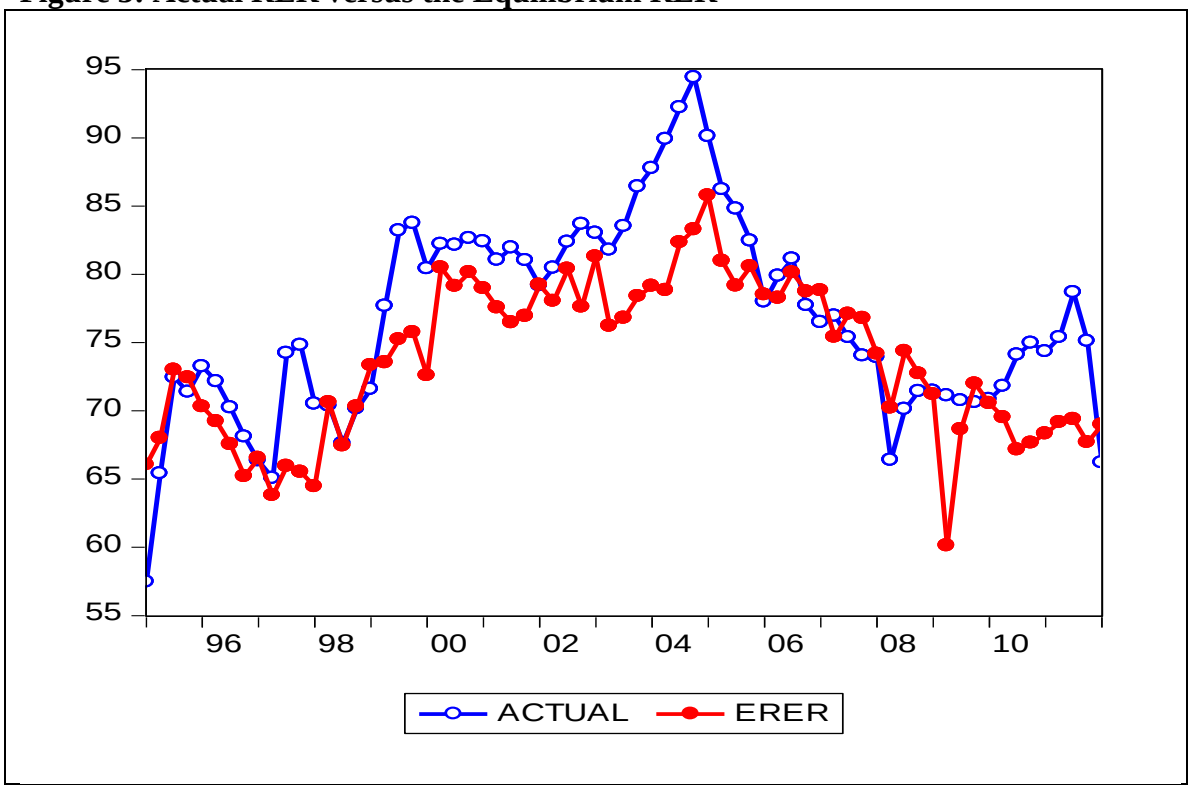


Figure 4: Estimated RER Misalignment in Kenya, 1995q1-2012q1 from the Cointegration equation

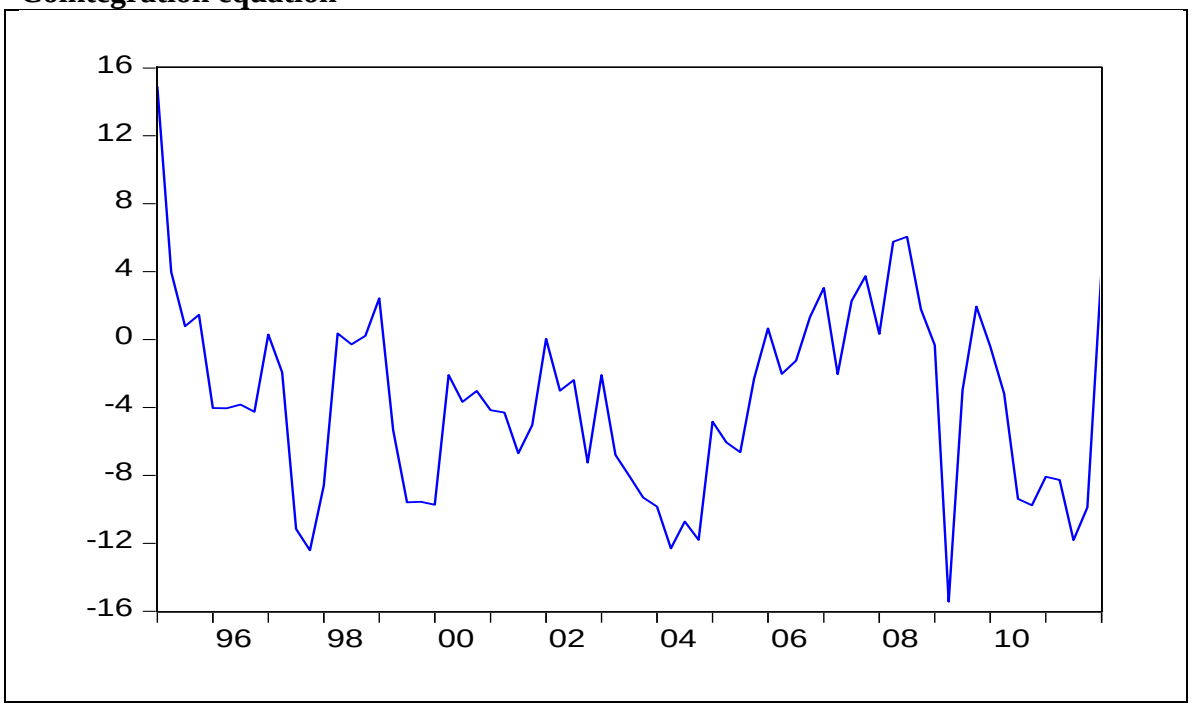


Table 4: Augmented Dickey Fuller Stationary Tests

	Level Variables		First Difference Variables	
	t-Statistic	Prob.*	t-Statistic	Prob.*
NER	-2.529838	0.3133	-7.783163	0.0000
Z-Z*	-7.726155	0.000	-6.476482	0.000

*MacKinnon (1996) one-sided p-values.

Table 5: The RER Short-run Equation

Dependent Variable: DRER
Method: Least Squares
Sample (adjusted): 1995Q3 2012Q1
Included observations: 67 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.116460	0.178502	-0.652430	0.5168
DRER(-1)	0.379241	0.117006	3.241218	0.0020
DTOT(-2)	-0.289415	0.120941	-2.393030	0.0201
DKFLOW_GDP	-0.145332	0.070009	-2.075917	0.0425
DOPENNESS(-2)	-0.011403	0.026900	-0.423882	0.6733
DGEXPE_GDP	-0.035973	0.030570	-1.176764	0.2443
DGROWTH(-1)	0.149088	0.072659	2.051895	0.0449
ZZSTAR(-1)	0.017856	0.014557	1.226617	0.2251
DNER	0.581360	0.039606	14.67855	0.0000
DNER(-1)	-0.155926	0.091084	-1.711895	0.0924
ECM(-1)	-0.013466	0.040016	-0.336505	0.7377

R-squared	0.860077	Mean dependent variable	0.012004
Adjusted R-squared	0.835091	S.D. dependent variable	2.966947
S.E. of regression	1.204848	Akaike info criterion	3.359602
Sum squared residual	81.29292	Schwarz criterion	3.721566
Log likelihood	-101.5467	Hannan-Quinn criterion	3.502832
F-statistic	34.42200	Durbin-Watson statistic	2.034368
Prob(F-statistic)	0.000000		