The Twin Deficit and the Macroeconomic variables in Kenya

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Abstract

The purpose of this paper is to test the twin deficit hypothesis and empirical relationship between current account balance and budget deficit while including other important macroeconomic variables such as growth, interest rates, money supply (M3) in Kenya from 1963-2012. The study was based on co integration analysis and error correction model (ECM). The results reveal a long-run association between the trade deficit and the fiscal deficit. The findings indicate that the Keynesian view fits well for Kenya since the causality runs from budget deficit to current account deficit. We detected unidirectional causation between the twin deficits, running from budget deficit to current account directly and indirectly through budget deficits which raise real interest rates, crowd out domestic investment, and cause the currency to appreciate in relation to the other currencies and further deteriorates the current account deficit.

Keywords: current account, fiscal balance, co integration, granger causality, Kenya.

1. Introduction

A country is deemed to have a double deficit if it has a current account deficit and a fiscal deficit. Kenya is likely to experience a persistent double deficit unless fiscal deficit is checked. The country's fiscal situation stands at 6.4 per cent of GDP, while that of the current account deficit stands at 10.8 per cent of GDP in 2014. Large fiscal deficits may lead to currency depreciation or appreciation, and also affect inflation or price levels which in turn will make interest rates rise. The deficit is likely to grow to become severe if the government continues to maintain the current huge budget deficit. Therefore the immediate priority of the government is to contain the fiscal deficit and the current account deficit. The twin deficit hypothesis suggests that when a government increases its fiscal deficit mostly by cutting taxes or increasing expenditure, domestic residents use some of the additional income to boost consumption, causing private and public saving to decline. This may force the country to either borrow from abroad or reduce its foreign lending, unless domestic investment decreases enough to offset the saving shortfall.

No doubt Kenya has joined countries that have both a fiscal deficit and a current account deficit for years.

Current account refers to the sum of the net revenue on exports minus payments for imports of goods and services, earnings on foreign investments minus payments made to foreign investors and cash transfers. Current account can be depicted by the following formula:

$$CA = BT + NI + NT \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 1$$

Where:

CA is the current account; BT is the export and import of goods and services; NI is the net income from abroad; and NT is the net current transfers.

Current account deficit is therefore the difference between the value of exports of goods and services and the value of imports of goods and services, net income and transfers from abroad. The current account can also be expressed as the difference between both public and private savings and investment. Kenya is considered to be trapped in an excessive debt position for its current account showed substantial deficit except for a few years during the 1996, 2000 and 2005 when it recorded a surplus of ksh 6228m, ksh7461m, and ksh 1387m respectively from independence in 1963. Higher current account deficit means higher demand for foreign currency, which may result in depreciation of the Kenyan currency. It may also discourage capital inflow and lead to capital flight from the country which would complicate the adjustment process. Therefore the high current account deficits in recent years have no doubt led to an increase in inflation, exchange rate depreciation and interest rates rise. As a result the twin deficit problem is magnified due to the presence of higher government deficit which rendered the current account in a deficit timidly threatening Kenya to be a debtor country in the long future.

On the other hand, fiscal deficit is used to describe the scenario when a nation's expenses exceed its revenues. A large budget deficit will spill over to current account deficit through tax cuts or increased spending which may increase the deficit and reduce revenues, resulting in increased consumption. The increased spending lowers the national savings rate which increases a nation external borrowing. Therefore, higher fiscal deficit, apart from affecting savings and growth, affects business confidence. As a result, addressing the issue of twin deficit will possibly be the biggest policy challenge for the Kenya government.

Thus our study focused on the twin deficits hypothesis in Kenya, and used time-series econometrics

2. Literature review
2.1 Theoretical Literature

Economic theory predicts that a deterioration in the budget balance results in a weakening of the current account. Therefore we refer to four competing views that explain the association between budget deficit and current account deficit.

According to the traditional approach or Keynesian absorption approach, when the economy is in a state of full employment, an increase in budget deficit leads to current account deficit as a result of an increase in aggregate demand for goods and services, both domestic and imported (Charusheela, 2005). The classical approach to this issue claims that a substantial and sustained fiscal deficit significantly affects the size of savings and investments, the prices of production factors, income distribution, exchange rate and the size of foreign trade. As such the conventional or Keynesian proposition, emphasize that an increase in budget deficit enhances domestic absorption through greater spending on domestic as well as foreign goods which will reduce exports, and increase imports, leading to a decline in trade deficit. Therefore the Keynesian proposition can be summarized to explain, a positive relationship between current account and budget deficit and there exists a unidirectional Granger causality that runs from the budget deficit to the current account deficit.

On the other hand, the Mundell -Fleming model modified the conventional model of twin deficit hypothesis. It emphasized that increases in the government's budget deficit leads to an increase in the trade deficit in an open economy through increased consumer spending. Therefore according to this quantitative approach, high fiscal deficit leads to higher interest rates which in turn would attract capital inflows and thereby, causing appreciation in the exchange rate (Cebula, 1988 and 2003; Feldstein, 1986; Rosensweig and Tallman, 1993). This will make exports to become dearer and imports cheaper, thereby, worsening the trade deficit, under flexible exchange rate if prices remain constant.

Similarly, Ricardian equivalence approach advanced by Barro (1989) argued that an increase in budget deficits due to an increase in government spending, must be paid for either now or later, with the total present value of receipts   fixed by the total present value of spending. Thus, a cut in today's taxes must be matched by an increase in future taxes, leaving interest rates, and thus private investment, unchanged. Ricardian equivalence hypothesis (REH) posits that lower public savings are met by equal increases in private savings, and as a result the current account does not respond to the changes in government spending and consequently to general fiscal balance.

1.   The hypothesis asserts that there is absence of causal relationship between the budget deficit and trade deficit. This happens as people foresee higher tax liabilities in future, as budgetary deficit expands and attempt to save more by spending less. Hence, a budget deficit does not result in a widened trade account deficit (Enders and Lee, 1990).Thus, under Ricardian equivalence hypothesis, the balance of state budget and the balance of current account are mutually independent or even negatively related (Makin, 2002).

2.2 Empirical evidence

Two forms of causality have been tested in studies of twin deficit hypothesis. They are the Reverse Causality and Bi-directional Causality. The Reverse Causality view involves unidirectional causality running from current account deficit to budget deficit. As a result therefore a deteriorated current account reduces the pace of economic growth. On the other hand, Bi-directional Causality assumption occurs when the two deficits are mutually dependent and there prevails bi-directional causality between the two deficits.

The twin deficit hypothesis started to attract thoughts in the 1980's though there were early studies, such as the one of Milne (1977) and Bernheim (1987) who found positive and statistically significant relationship between the two deficits using ordinary least squares (OLS) regressions on cross-country data.

The early empirical evidence mainly based on the USA is mixed. Abell (1990) suggested that the hypothesis holds and indicated that budget deficits impact current account deficits through movements in interest rates and exchange rates. He used a seven-variable VAR system and data for the period 1979–1985. In contrast, Enders and Lee (1990 estimated a six variable structural VAR with the differenced data for 1947 to 1985 but did not find any evidence that budget deficits raise the trade deficit. Kim and Roubini (2008) estimated a VAR in levels for the post-Bretton- Woods's period. The results suggested that the U.S. government budget deficits improved the U.S. current account balance, which is exactly the opposite of what the theoretical model predicts.

Siddiqui (2007) analyzed the relationship between budget deficit and current account deficit in the six countries of South Asia (Bangladesh, Bhutan, India, Nepal, Pakistan, Sri Lanka) during the period 1960-2004 by using

the vector error correction model. The results of analysis indicated the presence of the twin deficits hypothesis in four of the six examined economies. Similar results were obtained by Lau, Baharumshah and Khalid (2006) who analyzed the relationship between budget deficit and current account deficits in four Asian countries (Indonesia, Malaysia, Philippines and Thailand) in the period 1976-2000. The results indicated presence of long-run relationship between budget deficit and current account deficit. They also confirmed the existence of the twin deficits hypothesis in the case of Thailand.

Baharumshah, Ismail and Lau (2009) found evidence for the twin deficits hypothesis for Malaysia, Thailand and Philippines but there was no evidence for Indonesia and Singapore. Similarly Azgun (2012) also found evidence for the twin deficit hypothesis in context of Turkish economy for the post adoption of economic reforms in the period 1980-2009.

Marinheiro (2006) examined the relationship between the fiscal deficit and the current account deficit in Egypt during the period 1974-2002, using a VAR model. The results indicated a one-way influence of the current account deficit on the fiscal deficit.

Nickel and Vansteenkiste (2008) examined the relationship between the current account and the government budget balance in 22 industrialized countries in the period 1981- 2005. They found that in very high indebted countries this relationship was negative but insignificant, suggesting that a rise in the government deficit does not result in a rise in the current account deficit. Hence, these results suggested that households in indebted countries tend to become Ricardian.

Vamvoukas (1997) used co-integration analysis, error-correction modeling and Granger causality to evaluate the validity of both the twin deficit hypothesis and the rational expectations hypothesis for the Greek economy. The results showed a one-way causality from budget deficit to current account deficit. Additionally the error-correction modeling evidence supports robustly the twin deficit hypothesis proposition in the short and long run.

Khalid and Guan (1999) used co-integration analysis to determine the causal relationship between current account and budget deficits and its direction, using a sample of annual time series data from five developed and five developing countries. The results from co-integration appear to suggest that a high correspondence between the two deficits in the long run is more likely to occur in the developing countries than the developed ones. Results on the Granger test of causality support the existence of a causal relationship between the current account deficit and the budget deficit in mixed direction for developing countries. The evidence suggests that current account deficits cause budget deficits for Indonesia and Pakistan, whereas the reverse is true for Egypt and Mexico. The data does not support any causal relationship for UK and Australia and supports only some weak evidence of bi-directional causality for Canada and India.

Saleh et al. (2005) tested the twin deficit hypothesis by using autoregressive distributed lag (ARDL) model for SriLanka. They found a long-run relationship between current account imbalances and budget deficit for the period 1970 to 2003. Their empirical results also showed that the direction of causality runs from the budget deficit to the current account deficit. Piersanti (2000), Leach man and Francis (2002) also used the modern statistical time series technique and found strong evidence to support the Keynesian view.

Kouassi et al. (2004) suggested that the twin deficit hypothesis fitted well for Thailand as the causality ran from budget deficit to current account deficit. For Indonesia, the causality ran in an opposite direction while the empirical results indicate that a bidirectional pattern of causality exists for Malaysia and the Philippines. They

also found indirect causal relationship runs from budget deficit to higher interest rates, and higher interest rates leading to the appreciation of the exchange rate, which in turn leads to the widening of the current account deficit.

Baharumshah et al. (2006) examined the twin deficit hypothesis in the ASEAN countries and found that there is a long run relationship between budget and current account deficits. They found out that budget deficits lead to the current account deficit. Lee (1990) and Mohammadi (2004) found that the increase of budget surplus/GDP ratio by one percent improves the current account/GDP ratio by 0.31 to 0.49 percent in developing countries.

Hoelscher (1986) and Cebula and Koch (1989), concluded that Federal budget deficits contributed to higher levels of interest rate yields. Knoester and Mak (1994) showed that only in Germany (among eight OECD economies) did the government budget deficit contribute to explain of higher interest rates. Abell (1990) showed that the link between the two deficits is indirect. Fieleke (1987), found that an increase in government borrowing lead to increase in interest rate other things being equal.

Chaudhry and Shabbir (2005), in their study tried to show the impact of budget deficit on money supply, foreign reserve and balance of payments. They used the annual data for the period 1965-1999 and the 2SLS technique and they concluded that changes in money supply affect the trade balance through output.

3. Methodology

Our paper is built on two strands of literature: the literature on the conventional or Keynesian proposition and the literature on the Mundell- Fleming model to test the two hypotheses. We start the analysis of the twin deficit hypothesis with a review of a basic national accounting identity. We begin by relating the external deficit to the difference between national investment and national saving, which in turn is the sum of private and public saving. This is because a fall in national saving due to a government deficit other things kept constant lead into a fall in the current account balance.

3.1 Empirical model

We start by clarifying the relationship between the balance of government budget and the balance of current account, using the national income identity expressed as:

Y = C + I + G + (X - M) …………………………………………….. (2)

Where:

      Y is the national income; C is the private consumption; I is investment expenditures;
      G is government expenditure; X is exports of goods and services; M is imports of goods and services.

Given that

      Y= C+I+G+NX and *Y-C-T=S*, then *S=G-T+NX+I,*
      which if simplified come to:
      (S-I) + (T-G) = (NX) …………………………………………… (3)
 Where:

S= Saving and T=Taxes.

If (T-G) is negative, we have a budget deficit.

On the other hand, current account balance can be represented by the following expression:

$$S = Y - C - G + CA \ or \ S = I + CA \ \dots\dots\dots\dots\dots\dots\dots(4)$$

Where: I is investment.

Starting with the national income equation, national savings in an open economy can then be express as: *S*.

We can also express the national income equation, whereby investments can be expressed by the formula:

$$I = Y - C - G \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots(5)$$

National savings comprise private sector saving (Sp) and public sector saving (Sg). Thus:

$$S = Sp + Sg$$

Whereby: private savings are the part of personal disposable income which is not consumed and can be re written as:

$$Sp = Yd - C = (Y - T) - C \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots \ (6)$$

Where:

Yd is the disposable personal income; and T is Taxes.

While public savings are the difference between the government revenue (taxes) and budget expenditures, which include government purchases (G) and government transfers (R), which can be written as:

$$Sg = T - (G + R) = T - G - R \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots \ (7)$$

Thus, national saving (s) can be expressed as:

$$S = [S_p + S_g] = (Y - T - C) + (T - G - R)] = I + CA \dots\dots\dots\dots\dots(8)$$

If: *S=I+CA*; then, finally, current account balance can be presented in the form of:

$$CA = Sp - I - (G + R - T)\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots(9)$$

This shows that, if there is constant difference between private savings and investments, then the fiscal balance changes are reflected in the changes in the balance of current account, an indication of twin deficits hypothesis. This situation results from the fact that the increase in budget deficit leads to an increase in national savings due to the expected increase in taxes in the future, which in turn does not lead to an increase in consumer spending and to the deficit of current account.

The twin deficits hypothesis asserts that an increase in budget deficit will cause similar increase in current account deficit and vice versa. Theoretically the mechanism behind the twin deficits could also simply be explained through the Keynesian income-expenditure approach. An increase in budget deficit will cause an increase in domestic absorption, and therefore the domestic income. When the domestic income increases, it will encourage imports and eventually will reduce the surplus in the trade balance. In addition, the Keynesian

open economy model states that an increase in the budget deficit will cause an increase in the aggregate demand and domestic real interest rates. High interest rates will lead to net capital inflow and result in appreciation of domestic currency. Higher value of the domestic currency will then adversely affect net exports, and thus there will be worsening in the current account deficit.

The historical statistical data from independent showed that Kenya is experiencing fiscal deficits or 'government deficit, except for the year of 1973, and 1998-2001. The Kenya current account balances are in surpluses for only the year of 1970, 1973-76, 1980-81, and 1991.

We therefore developed a general model for estimation based on the theory:

$$CAD = f(DEF, INT, GDP, MON) \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots .10$$

Our estimated model is presented as:

$$CAD = f(\beta 0 + \beta 1\, DEF + \beta 2 INT + \beta 3 GDP + \beta 4 MON) + \varepsilon t \dots\dots\dots\dots\dots\dots 11$$

Where:

> *CAD* is the current account measured in US dollar; *DEF* is fiscal deficit measured in US dollar; *INT* is interest rates; *GDP* is nominal *GDP*; *MON* is money supply measured in US dollar and; ε_t is Error term.

Thus in the analysis, we extend the bivariate model to include interest rates, nominal GDP and money supply.

3.2 Data types and sources

All the data used in this study, were obtained from several International Financial Statistics (IFS) issues published by the International Monetary Fund (IMF), Kenya's economic surveys various, and statistical Abstracts. The variables employed in the study were the current account (CAD), budgetary deficit, interest rate, nominal GDP and money supply.

3.3 Unit root tests and Co integration Analysis

We utilized the Johansen and Juselius (1990) maximum likelihood co integration test and granger causality in identifying the linkage between the twin deficits. Pair wise causality test and Error Correction Model (ECM) technique were applied on annual budget deficit and current account deficit. The Johansen test permits the identification of multiple co integration relationships.

Then Johansen technique is based on a VAR model with k lags as:

$$Y_t = A_1 * y_{t-1} + A_2 * y_{t-2} \dots\dots + A_K * y_{t-k} + \varepsilon t \dots\dots\dots\dots\dots\dots\dots (12)$$

Where:

> Y_t is a vector (n x 1); Ai is the parameters matrix (n x n).

We transformed the VAR into an error correction mechanism, and obtained:

$$\Delta Y_t = \Gamma 1 \Delta y_{t-1} + \dots + \Gamma 1 \Delta y_{t-k} + 1 + \Pi y_{t-k} + \varepsilon t \dots\dots\dots\dots\dots\dots\dots (13)$$

Where:

> $\Gamma i = -(I - A_1 - \dots - A_i),\ i = 1,\ k - 1;\ \Pi = -(I - A_1 - \dots - A_k),\ \Pi = \alpha\beta',$

α - represents the speed of adjustment and β the matrix of long-run coefficients. The number of the co integrating relationships is given by the rank of *Π*.

4. Results and discussion

Detailed results of all the analysis are found in annexes 1-10.

4.1. Results of Augmented Dickey Fuller test

Table 1 presents the results of Augmented Dickey Fuller (ADF) test. The ADF statistics confirmed that all the variables (trade deficit, budget deficit, interest rate money supply and gross domestic product) were not stationary at levels. However they became stationary after first difference indicating that they were integrated of order one i.e. I (1), an indication of a significant co-integration relationship among the variables. The ADF results shown in Table 1 suggested that all the variables are found to be non-stationary in level but were stationary in first difference at 5% level of significance.

Table 1:   ADF test of nonstationarity hypothesis

Variable	test critical at levels	test critical at 5%	test critical first difference	test critical at 5%	probability
CAD	-2.087	-2.925	-2.692	-1.948	0.008
DEF	0.116	-2.922	-7.289	-2.928	0.000
GDP	1.321	-3.504	-5.063	-2.928	0.000
MON	0.101	-2.929	-3.998	-2.925	0.003
INT	-1.728	-2.925	-12.091	-2.925	0.000
U (-1) error term	-6.243	-3.574	stationary	at levels	0.000

Source: Authors

The second step in the empirical analysis was to test for co integration among the variables to detect any possible long-run equilibrium between the series. The results of the Johansen co integration test are influenced by the considered lag length. Therefore the lag length was chosen using various criteria including the Akaike Information Criteria (AIC), LR (Likelihood Ratio Criterion), SIC (Schwarz Information Criterion), FPE (Final Prediction Error) and HQ (Hannan-Quinn Information Criterion) . The results of lag length selection are presented in Table 2.

Table 2. VAR lag order selection criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-1728.202	NA	3.67e+26	75.35661	75.55537	75.43107
1	-1567.939	278.7176	1.03e+24	69.47562	70.66822*	69.92238
2	-1531.817	54.96872	6.62e+23	68.99205	71.17846	69.81109
3	-1505.406	34.44901	6.91e+23	68.93070	72.11095	70.12204
4	-1448.887	61.43363*	2.17e+23*	67.56031*	71.73439	69.12395*

Source: Authors

* indicates lag order selected by the criterion
      LR is the sequential modified LR test statistic (each test at 5% level)
      FPE is the final prediction error
      AIC is the Akaike information criterion
      SC is the Schwarz information criterion
      HQ is the Hannan-Quinn information criterion.

The maximum lag length for GDP, Money supply and government deficit is four periods according to LR, FPE, AIC and HQ criteria.

In the third step we proceeded to run the co integration tests which showed that Kenya's fiscal balance, current account balance, nominal GDP and interest rates (short- and long-run) were co-moved over the periods, as shown in Table 3.

Table 3: Unrestricted Co integration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigen value	Trace Statistic	0.05 Critical Value	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.878353	207.9289	76.97277	92.69172	34.80587*	0.0000
At most 1 *	0.807137	115.2371	54.07904	72.41412	28.58808*	0.0000
At most 2 *	0.379253	42.82303	35.19275	20.98060	22.29962	0.0756
At most 3 *	0.264711	21.84243	20.26184	13.52961	15.89210	0.1135
At most 4	0.172154	8.312820	9.164546	8.312820	9.164546	0.0724

Source: Authors
Trace test indicates for 3 co integrating eqn (s) at the 0.05 level
 * denotes rejection of the hypothesis at the 0.05 level
 **MacKinnon-Haug-Michelis (1999) p-values
Max-eigen value test indicates 2 co integrating eqn (s) at the 0.05 level

The results in Table 3 indicate four and two co integration equations by trace statistics and Max-Eigen statistics. This suggests that there exists a long-run equilibrium relationship binding all these variables. The equilibrium mechanism then was established through two major channels whereby budget deficit affects the current account in the country. The first one we established was a direct causal link from budget deficit to current account deficit, and the other was the indirect channel that runs from budget deficit to higher interest rate; higher interest rates lead to appreciation of the currency and this in turn worsens the current account deficit.

4.2 Results on granger causality tests

Determination on whether or not fiscal deficits Granger cause exchange rates and other variables and vice-versa, using Vector Error Correction Model (VECM). In the presence of co integration, there exists an error correction representation, which captures the deviation or disequilibrium from long-run equilibrium. The disequilibrium is corrected gradually through a series of partial short-run adjustments.

Our findings show that there is a unidirectional causality running from budgetary to current account. The estimated co integrating equation is:

CAD = -299.033+1.8585 DEF + 0.24206GDP + 49.7560 INT - 0.82922 MON ………(14)

The signs of the normalized co integrating coefficients indicate two points: First, there is a positive relation between current account deficit and fiscal deficit, GDP and interest rates. Second, money supply growth exerts a negative impact on CAD. In other words, current account deficit tends to increase along with the increase in fiscal deficit, GDP and interest rate in the long run. The coefficients of the error correction have the expected negative sign and are less than unity. The coefficient of the speed of adjustment (*see annex 8*) for the error term of about - 0.8, implying that the model corrects by about 80 percent of the disequilibrium in the short run will be corrected each year.

The results from granger causality tests are reported in Annex 10. There existed bidirectional causality between GDP and fiscal deficit. Also a unidirectional causality is found between GDP and CAD, which runs from GDP to CAD and bidirectional relation between money and fiscal deficit. In the overall, the empirical results support the existence of a co integrating relation among the variables and the twin deficits hypothesis in Kenya. Its effect on the current account deficit is positive and significant. Its likely mechanism is through the interest rate, a monetary expansion leads to an interest rate drop, which in turn encourages investment and, in the absence of an important saving effect, a rise in the current account deficit.

An increase in the domestic output (GDP) has the effect of enlarging the current account deficit. A 1 percentage point rise in the GDP growth rate leads to an increase of about 24.2 percentage increase in the current account deficit.

According to our estimates, a rise in real interest rates of 1 percentage point leads to a current account deficit increase of about 49.8 percentage points the findings are consistent with the Feldstein chain). Both GDP and interest rates have a positive impact on a country's current account balance by either households' saving behaviour or investors' decision to invest. Also, there is a statistically significant negative and stable relationship between money supply and the current account balance. The results show that a decrease in the money supply by one percentage point improves the current account balance by 82.8 percentage points. So money supply does increase whenever we try to finance budget deficit through Government, private or external borrowing.

5. Conclusions and policy implications

We concluded that Keynesian view fits well for Kenya since the causality runs from budget deficit to current account deficit .The results showed a positive and significant relationship between budget deficit and current account. The signs of the normalized co integrating coefficients suggest that there is also a positive relationship between current account deficit and interest rates, GDP and negatively related to money supply. In other words, current account deficit tends to increase along with the increase in fiscal deficit, GDP, interest rates and decrease with money supply in the long run. This means, a rise in budget deficit would be followed by an increase in external balance. We find the causal relationship works through two channels: first is the direct causal link from budget deficit to current account deficit, and the second is the indirect channel that runs from budget deficit to higher interest rate; which lead to appreciation of the currency, in turn worsening the current account deficit. Interest rates seem to cause current account deficits through the exchange rate. So we suggest Kenya to embrace on a flexible exchange rate regime, higher degree of openness, export diversification, development of the financial sector, and adopt sound fiscal and monetary policies to improve on the twin deficit.

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7. Annexture

Annex1: Unit root tests

Null Hypothesis: D(CAD) has a unit root:
Exogenous: None
Lag Length: 1 (Automatic - based on SIC, maxlag=10)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-2.691956	0.0082
Test critical values: 1% level	-2.615093	
5% level	-1.947975	
10% level	-1.612408	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(CAD,2)
Method: Least Squares
Date: 09/25/13   Time: 19:00
Sample (adjusted): 1966 2012
Included observations: 47 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(CAD(-1))	-0.566090	0.210289	-2.691956	0.0099
D(CAD(-1),2)	-0.480912	0.146795	-3.276078	0.0020

R-squared	0.636175	Mean dependent var	2.436170
Adjusted R-squared	0.628090	S.D. dependent var	644.7168
S.E. of regression	393.1767	Akaike info criterion	14.82802
Sum squared resid	6956455.	Schwarz criterion	14.90675
Log likelihood	-346.4584	Hannan-Quinn criter.	14.85764
Durbin-Watson stat	1.895933		

Annex 2: Unit root test (Deficit)

Null Hypothesis: D(DEFICIT) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=10)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-7.289259	0.0000
Test critical values: 1% level	-3.574446	

5% level	-2.923780
10% level	-2.599925

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(DEFICIT,2)
Method: Least Squares

Sample (adjusted): 1965 2012
Included observations: 48 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(DEFICIT(-1))	-1.119218	0.153543	-7.289259	0.0000
C	-39.52049	31.75759	-1.244443	0.2196

R-squared	0.535978	Mean dependent var	-9.208333
Adjusted R-squared	0.525891	S.D. dependent var	316.7914
S.E. of regression	218.1286	Akaike info criterion	13.64882
Sum squared resid	2188683.	Schwarz criterion	13.72679
Log likelihood	-325.5717	Hannan-Quinn criter.	13.67828
F-statistic	53.13330	Durbin-Watson stat	1.969002
Prob(F-statistic)	0.000000		

3: Unit root test GDP

Null Hypothesis: D(GDP) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=10)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.062792	0.0001
Test critical values:	1% level	-3.574446	
	5% level	-2.923780	
	10% level	-2.599925	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(GDP,2)
Method: Least Squares

Sample (adjusted): 1965 2012

Included observations: 48 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(GDP(-1))	-0.911723	0.180083	-5.062792	0.0000
C	728.6463	288.3606	2.526858	0.0150

R-squared	0.357828	Mean dependent var		160.3958
Adjusted R-squared	0.343867	S.D. dependent var		2271.879
S.E. of regression	1840.268	Akaike info criterion		17.91398
Sum squared resid	1.56E+08	Schwarz criterion		17.99195
Log likelihood	-427.9356	Hannan-Quinn criter.		17.94345
F-statistic	25.63187	Durbin-Watson stat		1.672792
Prob(F-statistic)	0.000007			

4. Unit root tests (interest rates)

Null Hypothesis: D(INTEREST) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=10)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-12.09119	0.0000
Test critical values:	1% level	-3.577723	
	5% level	-2.925169	
	10% level	-2.600658	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(INTEREST,2)
Method: Least Squares
Date: 09/25/13   Time: 18:53
Sample (adjusted): 1965 2011
Included observations: 47 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(INTEREST(-1))	-1.532488	0.126744	-12.09119	0.0000
C	0.348020	0.762973	0.456136	0.6505

R-squared	0.764641	Mean dependent var	0.075106
Adjusted R-squared	0.759410	S.D. dependent var	10.65932
S.E. of regression	5.228392	Akaike info criterion	6.187706
Sum squared resid	1230.124	Schwarz criterion	6.266436

Log likelihood	-143.4111	Hannan-Quinn criter.	6.217332
F-statistic	146.1969	Durbin-Watson stat	2.291625
Prob(F-statistic)	0.000000		

5. Unit root test (Money)

Null Hypothesis: D(MONEY) has a unit root
Exogenous: Constant
Lag Length: 3 (Automatic - based on SIC, maxlag=3)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.997587	0.0032
Test critical values:	1% level	-3.584743	
	5% level	-2.928142	
	10% level	-2.602225	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(MONEY,2)
Method: Least Squares

Sample (adjusted): 1968 2012
Included observations: 45 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(MONEY(-1))	-2.100514	0.525446	-3.997587	0.0003
D(MONEY(-1),2)	1.397955	0.504486	2.771049	0.0084
D(MONEY(-2),2)	1.042802	0.515273	2.023786	0.0497
D(MONEY(-3),2)	2.942860	0.438228	6.715364	0.0000
C	303.4572	276.6712	1.096815	0.2793

R-squared	0.838587	Mean dependent var	0.407556
Adjusted R-squared	0.822446	S.D. dependent var	3688.863
S.E. of regression	1554.383	Akaike info criterion	17.63998
Sum squared resid	96644314	Schwarz criterion	17.84073
Log likelihood	-391.8997	Hannan-Quinn criter.	17.71482
F-statistic	51.95288	Durbin-Watson stat	2.523938
Prob(F-statistic)	0.000000		

6. Unit root tests

Null Hypothesis: U has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=10)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.243170	0.0000
Test critical values:	1% level	-3.574446	
	5% level	-2.923780	
	10% level	-2.599925	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(U)
Method: Least Squares

Sample (adjusted): 1964 2011
Included observations: 48 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
U(-1)	-0.946227	0.151562	-6.243170	0.0000
C	0.351638	54.01141	0.006510	0.9948

R-squared	0.458678	Mean dependent var	12.10443
Adjusted R-squared	0.446910	S.D. dependent var	502.8569
S.E. of regression	373.9747	Akaike info criterion	14.72703
Sum squared resid	6433425.	Schwarz criterion	14.80499
Log likelihood	-351.4486	Hannan-Quinn criter.	14.75649
F-statistic	38.97717	Durbin-Watson stat	1.961528
Prob(F-statistic)	0.000000		

7: OLS
Dependent Variable: CAD
Method: Least Squares

Sample: 1963 2012
Included observations: 50

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DEFICIT	1.174543	0.234181	5.015539	0.0000
GDP	-0.060615	0.012951	-4.680149	0.0000

INTEREST	33.68432	7.315676	4.604403	0.0000
MONEY	-0.094996	0.021625	-4.392974	0.0001
C	61.02026	114.7689	0.531679	0.5976

R-squared	0.917243	Mean dependent var	-751.5820
Adjusted R-squared	0.909886	S.D. dependent var	1266.763
S.E. of regression	380.2686	Akaike info criterion	14.81427
Sum squared resid	6507190.	Schwarz criterion	15.00547
Log likelihood	-365.3568	Hannan-Quinn criter.	14.88708
F-statistic	124.6895	Durbin-Watson stat	1.872535
Prob(F-statistic)	0.000000		

8: VECM

Dependent Variable: D(CAD)

Method: Least Squares

Sample (adjusted): 1968 2012

Included observations: 45 after adjustments

D(CAD) = C(1)*(CAD(-1) + 0.0217883717257*MONEY(-1) - 67.7747587613
) + C(2)*(DEFICIT(-1) + 0.135470469731*MONEY(-1) +
    107.976877543) + C(3)*(GDP(-1) - 2.87256533765*MONEY(-1) -
    1032.22520531) + C(4)*(INTEREST(-1) - 0.00510215328413
    *MONEY(-1) - 5.02050118619) + C(5)*D(CAD(-1)) + C(6)*D(CAD(-2)) +
    C(7)*D(CAD(-3)) + C(8)*D(CAD(-4)) + C(9)*D(DEFICIT(-1)) + C(10)
    *D(DEFICIT(-2)) + C(11)*D(DEFICIT(-3)) + C(12)*D(DEFICIT(-4)) +
    C(13)*D(GDP(-1)) + C(14)*D(GDP(-2)) + C(15)*D(GDP(-3)) + C(16)
    *D(GDP(-4)) + C(17)*D(INTEREST(-1)) + C(18)*D(INTEREST(-2)) +
    C(19)*D(INTEREST(-3)) + C(20)*D(INTEREST(-4)) + C(21)*D(MONEY(
    -1)) + C(22)*D(MONEY(-2)) + C(23)*D(MONEY(-3)) + C(24)*D(MONEY(
    -4))

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-0.799559	0.333818	-2.395191	0.0260
C(2)	-0.774719	0.492110	-1.574281	0.1304
C(3)	-0.138532	0.110437	-1.254399	0.2235
C(4)	65.83889	15.92456	4.134423	0.0005
C(5)	0.109734	0.324550	0.338112	0.7386
C(6)	0.266581	0.312648	0.852653	0.4035
C(7)	-0.144324	0.253713	-0.568847	0.5755
C(8)	-0.481166	0.180339	-2.668124	0.0144
C(9)	0.604959	0.567758	1.065523	0.2987
C(10)	0.379027	0.554859	0.683105	0.5020
C(11)	0.697848	0.450659	1.548507	0.1364

C(12)	-0.233313	0.298212	-0.782373	0.4427
C(13)	0.035971	0.107430	0.334834	0.7411
C(14)	-0.084006	0.077469	-1.084384	0.2905
C(15)	0.048660	0.068379	0.711627	0.4845
C(16)	-0.040380	0.075996	-0.531339	0.6008
C(17)	-76.01828	19.38525	-3.921449	0.0008
C(18)	-89.91503	20.13051	-4.466605	0.0002
C(19)	-74.48662	16.93876	-4.397408	0.0003
C(20)	-50.09351	9.290434	-5.391945	0.0000
C(21)	-0.007095	0.289433	-0.024515	0.9807
C(22)	0.038893	0.240085	0.161998	0.8729
C(23)	-0.070791	0.230563	-0.307033	0.7618
C(24)	0.200933	0.156206	1.286330	0.2123

R-squared	0.934986	Mean dependent var	-77.33333
Adjusted R-squared	0.863780	S.D. dependent var	437.6979
S.E. of regression	161.5452	Akaike info criterion	13.31197
Sum squared resid	548034.2	Schwarz criterion	14.27553
Log likelihood	-275.5194	Hannan-Quinn criter.	13.67118
Durbin-Watson stat	2.350906		

Annex 9
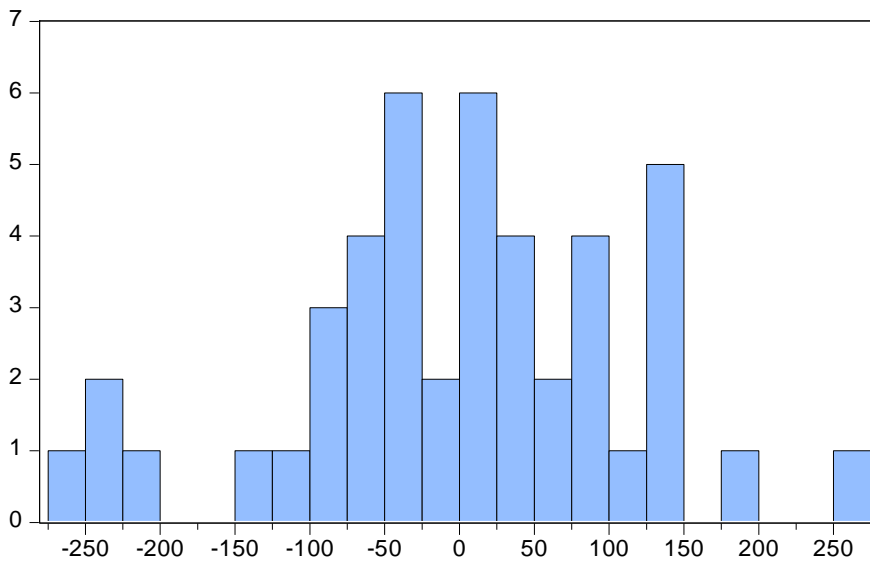
Series: Residuals	
Sample 1968 2012	
Observations 45	
Mean	0.188691
Median	0.752236
Maximum	254.7899
Minimum	-263.5255
Std. Dev.	111.6033
Skewness	-0.316662
Kurtosis	3.272783
Jarque-Bera	0.891582
Probability	0.640318

Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	0.684418	Prob. F(25,19)	0.8148
Obs*R-squared	21.32264	Prob. Chi-Square(25)	0.6745
Scaled explained SS	5.271913	Prob. Chi-Square(25)	1.0000

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	0.575114	Prob. F(2,19)	0.5721
Obs*R-squared	2.568596	Prob. Chi-Square(2)	0.2768

10. VAR lag order selection criteria

Sample (adjusted): 1968- 2011
Included observations: 44 after adjustments
Trend assumption: No deterministic trend (restricted constant)
Series: CAD DEF GDP INT MON
Lags interval (in first differences): 1 to 4

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.878353	207.9289	76.97277	92.69172	34.80587*	0.0000
At most 1 *	0.807137	115.2371	54.07904	72.41412	28.58808*	0.0000
At most 2 *	0.379253	42.82303	35.19275	20.98060	22.29962	0.0756
At most 3 *	0.264711	21.84243	20.26184	13.52961	15.89210	0.1135
At most 4	0.172154	8.312820	9.164546	8.312820	9.164546	0.0724

Trace test indicates 4 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values
Max-eigenvalue test indicates 2 cointegrating eqn(s) at the
0.05 level

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.878353	92.69172	34.80587	0.0000
At most 1 *	0.807137	72.41412	28.58808	0.0000
At most 2	0.379253	20.98060	22.29962	0.0756
At most 3	0.264711	13.52961	15.89210	0.1135
At most 4	0.172154	8.312820	9.164546	0.0724

Max-eigenvalue test indicates 2 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

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

CAD	DEFICIT	GDP	INTEREST	MONEY	C
0.014462	-0.017163	-0.003501	-0.719468	0.011988	4.736024
3.01E-05	0.009282	0.002896	-0.030004	-0.006561	-1.392996
0.006962	-0.019609	-0.001009	-0.292954	0.002953	0.929213
0.007371	-0.015939	-0.000697	-0.256790	0.002894	1.238343
-0.010469	0.012588	0.000857	0.180896	-0.003264	0.238610

Unrestricted Adjustment Coefficients (alpha):

D(CAD)	-127.3257	-147.7538	5.382200	4.090633	-11.28189
D(DEFICIT)	-59.64641	41.28463	13.78281	8.102224	-44.08798
D(GDP)	352.4688	84.65421	-530.0570	219.5626	21.70393
D(INTEREST)	-1.296693	-0.579500	0.809794	0.749792	0.967729
D(MONEY)	-381.9158	319.5844	-191.7703	-108.4241	95.21592

1 Cointegrating Equation(s):   Log likelihood   -1351.779

Normalized cointegrating coefficients (standard error in parentheses)

CAD	DEFICIT	GDP	INTEREST	MONEY	C
1.000000	-1.186726	-0.242067	-49.74867	0.828907	327.4793
	(0.08554)	(0.01779)	(1.51523)	(0.04413)	(21.7321)

11.Pairwise Granger Causality Tests

Sample: 1963 2012
Lags: 2

Null Hypothesis:	Obs	F-Statistic	Prob.
DEFICIT does not Granger Cause CAD	48	7.08185	0.0022
CAD does not Granger Cause DEFICIT		20.6519	5.E-07
GDP does not Granger Cause CAD	48	4.40555	0.0182
CAD does not Granger Cause GDP		0.56317	0.5735
INTEREST does not Granger Cause CAD	47	1.41068	0.2553
CAD does not Granger Cause INTEREST		0.31167	0.7339
MONEY does not Granger Cause CAD	48	3.03734	0.0584
CAD does not Granger Cause MONEY		0.68659	0.5087
GDP does not Granger Cause DEFICIT	48	5.63536	0.0067

DEFICIT does not Granger Cause GDP		4.41399	0.0180
INTEREST does not Granger Cause DEFICIT	47	0.50428	0.6076
DEFICIT does not Granger Cause INTEREST		6.05087	0.0049
MONEY does not Granger Cause DEFICIT	48	10.2843	0.0002
DEFICIT does not Granger Cause MONEY		10.9794	0.0001
INTEREST does not Granger Cause GDP	47	0.10872	0.8972
GDP does not Granger Cause INTEREST		1.96554	0.1528
MONEY does not Granger Cause GDP	48	5.40573	0.0080
GDP does not Granger Cause MONEY		5.98832	0.0051
MONEY does not Granger Cause INTEREST	47	0.19763	0.8214
INTEREST does not Granger Cause MONEY		0.27472	0.7611