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Dynamics of Current Account Deficit: A Kenyan Experience

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Abstract:
Large and persistent current account deficits are among the most serious problems of many developing countries. The Current Account in Kenya has continuously been in deficit in the last three decades prompting the country to rely increasingly on risky short-term flows to balance the accounts. This has consistently created a financing gap. The purpose of this study was to provide empirically characterization of the dynamics of current account deficit and other macroeconomic variables. Based on the absorption approach, the study established the persistence and determinants of the current account deficit; Explanatory research design was adopted. Due to the time series nature of the study, Multivariate Vector Autoregressive, Granger causality test together with Variance decomposition and impulse response functions were used to empirically establish the determinants and dynamics of the current account deficit. The results indicate that current account deficit, gross domestic product growth, inflation and foreign direct investment are I(0). Degree of openness, terms of trade, external debt stock, foreign exchange, gross domestic savings, fiscal deficit, exports and imports are $I(1)$ *. The major determinants of the current balance are the degree of openness, terms of trade, oil price on the international market and inflation. The variance in the current account is better explained by its own shocks followed by shocks from degree of openness, fiscal deficit, terms of trade, external debt of stock, foreign direct investment, growth rate of gross domestic product, and inflation. From the findings, the study recommends the Country to focus on current account targeting policies together with policies that focus on increasing and stabilizing gross domestic product in order to increase exports and its competitiveness and focus on policies that reduce the burden of depending on oil from the world market.*

Keywords: *Current account deficit, Kenya, fiscal deficit, terms of trade*

1. Introduction

Global current account imbalances are one of the key macroeconomic imbalances that underlie the global financial crisis (Adams and Park, 2009). Large and persistent current account deficits are among the most serious problems of many developing countries since they result in economic crises like currency crises, burgeoning external debts and reduction in international reserves.

In the last few decades, most financial crises have highlighted the role of large current account deficit in the run up to crisis episodes. Consequently, Corsetti *et al*. (1998) concluded that, on the whole, those countries hit hardest by currency crises were those running persistent current account deficit throughout the 1990s. Hence the relevance of current account imbalances as a concern of economic policy

In Africa, given the macroeconomic fragility, a clear understanding of the factors that affect the current account balance appears to be a sensible strategy for effective policymaking. A stylized characterization of the Africa region includes deficits in the current account that have been very large in recent years, dismal rates of growth, strong reliance on foreign aid, low public and private savings, concentration of exports on single primary products, and large distortions in the economy. All of these characteristics emphasize the fact that understanding the determinants of current account balances in Africa is crucial, in order to understand policy implications not only in terms of magnitude but, given the many peculiarities of the region, also in terms of direction.

Kenya's current account is significantly out of balance and needs urgent attention. The current account has deteriorated and has registered deficits, thoroughly undermining Kenya's path towards industrialization. This high level of Kenya's current account deficit remains a concern as any exogenous shocks could heighten macroeconomic instability. The current account deficit stood at 10 percent in 2012, the same level as in 2011 despite monetary policy action. According to World Bank, (2012a), Kenya is walking a tight rope with deficits at 13.1% of GDP, a record high amongst the highest external deficits in the world, with imports growing by 20% compared to export growth at 10%.

Kenya needs to manage a number of risks if it is to achieve baseline growth projections. Chief among these are possible fluctuations in the foreign exchange rate and other economic disturbances the current account deficit (World Bank 2012b). It is thus not only important to know the sources of the current account deficit, but also the size and time profile of the balancing adjustments. That makes it important for policy makers to understand the dynamics of the current account deficit in relation to other macroeconomic variables.

On the other hand, in spite of the relatively extensive body of theoretical literature on the subject, there are only a few country studies that analyze the effect of macroeconomic variables on the current account deficit. In line with these strong demands, the study was considered timely to empirically assess the determinants current account deficit and its dynamic interaction with other macroeconomic variables in Kenya.

2. Literature Review and Theoretical Framework

2.1. Literature Review

2.1.1. Empirical Literature on Determinants of Current Account Deficit

Several empirical studies have reviewed the determinants and consequences of current account adjustment. Milesi-Ferretti and Razin (2000) by adapting Eichengreen, Rose and Wyplosz' (1995) methodology from currency crises to current account adjustment, focused on low- and middle- income countries as their work was motivated by the Asian crisis of 1997- 98. The authors detect several adjustment episodes ("reversals") on the basis of a set of empirical criteria and find that slightly more than half of them are associated with an economic slowdown. Using a probit analysis, they find that adjustments are more likely in countries with large current account deficits, lower reserves, higher GDP per capita, worsening terms of trade, an increasing investment rate and floating exchange rate. Two external variables, namely OECD growth and the US interest rate, also turn out to be robust predictors of adjustment.

Khan and Knight (1983) investigate the evolution of the current account balances for 32 non-oil developing countries over the period 1973-1980 by using a pooled time series cross section data and adopting an Ordinary Least Square (OLS) estimation approach. Their results indicate that both internal factors (the increase in fiscal deficits and the appreciation in real effective exchange rates) and external factors (the deterioration in terms of trade, the decline of economic growth and the increase in foreign real interest rates) are important in explaining the deterioration of the current account of the countries under review.

Debelle and Faruqee (1996) using economic theories of saving and investment as a guide, examined the extent to which a common set of underlying determinants has been of historical relevant in explaining current account dynamics across countries over time. Using a panel of 21 industrial countries over 1971-93 and an expanded cross sectional data set that included 34 industrial and developing countries found that fiscal surplus, terms of trade and capital controls do not play a significant role on the long term (cross sectional) variation of the current account, while relative income, government debt and demographics do. Furthermore, a short-run examination of the determinants using both a partial adjustment model with fixed effects and an error correction model (to account for the possibilities of stationarity or non-stationarity of the ratio of net foreign assets to GDP, respectively) suggested that changes in fiscal policy, movements in terms of trade, the state of business cycle, and the real exchange rate affect the current account balance in the short run.

Calderon, Chong and Loayza (2002) attempt to extend the work of Debelle and Faruqee (1996) by applying more advanced econometric techniques to control for joint endogeneity and by distinguishing between within-economy and cross-economy effects. They used a panel data of 44 developing countries over the period 1966-1995 to examine the empirical links between current account deficits and a broad set of economic variables proposed in the literature. By adopting a reduced-form approach rather than holding a particular structural model, they found that current account deficits in developing countries are moderately persistent. Higher domestic output growth, increase in the terms of trade and the real exchange rate appreciation tend to worsen the current account deficit. On the other hand, increases in the public and private savings, higher growth rates in industrial countries and higher international interest rates have favourable impacts on the current account balance.

Gruber and Kamin (2007) assess some of the explanations that have been put forward for the global pattern of current account imbalances that have emerged in recent years, particularly the large U.S. current account deficit and the large surpluses of the developing Asian economies. Their work is based on the work of Chinn and Prasad (2003), using a panel data of 61 countries over the period 1982-2003 and including the standard current account determinants (per capita income, relative growth rates, fiscal balance, demographic factors and international trade openness). They find that a model that incorporates, in addition to standard determinants, the impact of financial crises on current accounts, can better explain the Asian surpluses. However, their model fails to explain the large U.S. current account deficit when the model is augmented by measures of institutional quality.

Using Feasible Generalized Least Squares (FGLS) Least Squares Dummy Variable (LSDV), the Random Effects Method (REM) and Generalized Methods of Moments-Instrument Variables (GMM-IV) Aristovnik (2007), examines the short- and medium-term empirical link between current account balances and a broad set of [economic] variables proposed by theoretical and empirical literature. He focused on the Middle East and North Africa (MENA), an economically diverse region. A [dynamic] panel-regression technique is used to characterize the properties of current account variations across selected MENA economies in the 1971-2005 periods. The results indicate that higher [domestic and foreign] investment; government expenditure and foreign interest rates have a negative effect on the current account balance. On the other hand, a more open economy, higher oil prices and domestic economic growth generate an improvement in the external balance, whereas the latter implies that the domestic growth rate is associated with a larger increase in domestic savings than investment. Finally, the results show a relatively high persistence of current accounts and reject the validity of the stages of development hypothesis as poorer countries in the region reveal a higher current account surplus [or lower deficit].

Arghyrou and Chortareas (2008) apply the Johansen and Juselius time series cointegration methodology in assessing the role of real exchange rates after controlling for the income catching-up process. For ten members of the euro area in 2008 (Austria, Belgium, Finland, France, Germany, Greece, Italy, the Netherlands, Portugal and Spain), they find that current account balances are determined by shifts in relative income as well as shifts in real exchange rates. The real exchange rate is found to be negatively related to the current account balance; domestic and foreign national income is negatively and positively, respectively, connected respectively to the current account balance. On the other hand, differences in the significance of the three variables namely real exchange rate, domestic and foreign national income exist. For one subset of the countries, domestic and foreign national incomes alone are significant enough as determinants in the long-run relationship. For the second subset, only real exchange rates are significant, whereas for the third subset all three variables are significant. Moreover, current account adjustment toward its equilibrium is gradual, with the disequilibrium term being the main determinant of short-run current account dynamics. For the majority of the members of the euro area, current account adjustment is a nonlinear process, with the speed of adjustment depending on the sign of the disequilibrium term.

Sekmen (2008) examines the interaction of current account deficits with other macroeconomic and demographic variables such as per capita GDP, inflation rate, government consumption, electric consumption, and fertility rate, domestic credit to private sector, industry value added, and life expectancy for Turkey, and population age 65 or above using specification methods on Least Squares Methods (OLS). The dependent variable is per capita GDP since it represents the well-being of a country. In the Turkish Congress and in the media the exhibit acrimony about the accretion of the CA deficits because they believe that huge current account deficit is a sign of an economic crisis in the near future. The priority of the study by Sekmen (2008) therefore was to test whether the CA deficit may deteriorate well-being of Turkey and which in turn cause economic crises or not.

Based on the saving-investment theory, Nkuna and Kwalingana (2009) use cointegration analysis to identify the long run and short-run determinants of Malawi’s current account deficit using annual data from 1980 to 2006. Results suggest that openness, terms of trade, external debt accumulation, and current account liberalization fundamentally determined the current account deficit in Malawi. Furthermore, results reveal that these deficits have been, to a large extent, persistent.

Kayikçi (2011) examines the theoretical linkages between current account deficits and a broad set of economic variables in Turkey for the purpose of exploring the sustainability of these deficits. The choice of the set of explanatory variables are motivated by existing debates of these theories about the current account behavior assuming that there is a stable underlying structure that links the current account to these macroeconomic variables. Data for the last two decades indicate that high growth and investment rates are not only the main causes of current account deficits in Turkey, but also indicators of their sustainability. Turkey would continue to have current account deficits in the subsequent years and sustainability of these deficits has become increasingly difficult as long as it has high growth rates.

Despite the importance of the topic for individual country policy formulation, comprehensive empirical studies on the subject are quite limited, especially in the case of developing countries. Furthermore, determinants of the current account balance can vary from country to country, since countries have different characteristics, resources, economic structures, and economic policies according to their different needs. Nonetheless, the studies that have examined the determinants of the current account balances in developing countries using different methodologies have given different findings although they remain inconclusive. Further, most of the available empirical literature tends to focus on multi-country analyses. Thus, the specific characteristics of the economy being analyzed should be given more priority than standard econometric techniques in discovering the determinants of the current account balance for a country.

2.1.2. Literature on Current Account Deficit and Other Macroeconomic Variables Affecting the Deficit in Kenya.

Most of the African countries, in the 1970s and early 1980s marked a watershed. Since that time, there has largely been crisis; in the expansion in external public debt with debt servicing difficulties rising sharply and stagnant or falling exchange rate earnings. It is noted that the root of the crisis lies both in the international and domestic spheres, (Duncan and Howell, 1992). However, the author does not look at the dynamic relationship between the variables.

In Kenya, Bigstein and Ndung’u (1992), note that it was not until nearly ten years after independence in 1963 that the country first began to experience the budget deficit and current account deficit which in turn ran into the balance of payment difficulties. These balance of payment difficulties were owing to falling terms of trade and expansionary budgets.

Using an approach that highlights macroeconomic determinants of longer-term saving and investment balances, Chinn and Prasad (2003) investigated the medium-term determinants of current accounts for a sample of industrial and developing countries [including Kenya] using cross-section and panel regression techniques. They found that government budget balances and initial stocks of net foreign assets are positively correlated with current account balances. Their findings also indicated that, among developing countries, indicators of financial deepening and terms of trade are positively associated with current account surpluses [or smaller deficits], while measures of openness to international trade are associated with larger current account deficits.

Using the Generalized Instrumental Variable Estimation (GIVE) method and OLS, Özmen (2004) empirically investigates the effects of institutional and macroeconomic policy stance variables on current account deficits (CAD). Based on cross-section data for a broad number of developing and industrial countries, including Kenya, the results strongly suggested that better governance increases whilst the presence of original sin decreases the ability of an economy to sustain CAD. Exchange rate flexibility and openness appear to put a discipline on CAD. Consistent with the equity home bias and Feldstein-Horioka puzzle, CAD decreases with country size. The net impacts of the financial deepening and monetary credibility on CAD are found to be insignificant.

Abmann (2007) analyzes the dynamic effect of macroeconomic crises as currency crises and the current account reversals on economic growth using the panel data from 1975-1997 for 67 countries including Kenya. The two specifications of the influence of both the crises are assessed. Within each specification, both types of crises have an effect on economic growth in the period of occurrence. While the effect of a currency crisis is significantly persistent over time, the effect of a reversal is not. Furthermore, significant heterogeneity prevails within the growth equation connected with the steady state level and growth dynamics captured via random coefficients. The estimation results suggest differences in the estimated costs of both types on economic growth.

Osakwe and Verick (2007) analyzes the determinants of both short and medium-term current account deficits in Africa, Kenya included. They find that countries are more likely to have a deficit exceeding five percent if the economy is small, less open and diverse, and is experiencing macroeconomic instability. Less democratic governments also have a higher probability of running a deficit. Overall, the main message is that though most African economies are characterized by current account deficits, only a few have real concerns regarding the sustainability of this imbalance. As long as these countries can finance their deficits via aid and debt accumulation, they face no immediate crisis. However, this allows the economies to continue with the status quo rather than addressing the structural causes of the deficit such as export supply constraints. This is due to poor infrastructure. African leaders and policymakers should therefore focus on removing such impediments thereby providing a boost to long-term growth and development prospects.

Chinn and Ito (2005) investigate the medium-term determinants of the current account using a model that controls for factors related to institutional development, with the goal of informing the recent debate over the existence and relevance of the "savings glut." The economic environmental factors that are considered are the degree of financial openness and the extent of legal development. They find that for industrial countries, the government budget balance is an important determinant of the current account balance whereby the budget balance coefficient is 0.21 in a specification controlling for institutional variables. The empirical findings are not consistent with the argument that the more developed financial markets are, the less saving a country undertakes. The relationship posited here is applicable only to countries with highly developed legal systems and open financial markets. For less developed countries including Kenya, and emerging market countries, they found the reverse correlation; greater financial development leads to higher savings. Furthermore, there was no evidence of "excess domestic saving" in the Asian emerging market countries. Rather, they seem to have suffered from depressed investment in the wake of the 1997 financial crises. They also find evidence that the more developed equity markets are, the more likely countries are to run current account deficits.

Using the theoretical framework of National Income Identity in economic theory, Nyongesa and Onyango (2009,2012) provide an exhaustive characterization of the empirical long run equilibrium linkage and causality between the current account deficit and budget deficit for Kenya using a Vector Autoregressive Model (VAR) with extension of Vector Error Correction Model and extend its empirical research by using time series data from 1973-2008, adopt Johansen Maximum Likelihood Estimation Cointegration methodology, which also involves unit root test and the use of Granger test to investigate the causality between the two deficits. The results indicate that both the current account and budget deficits are integrated of order one and there exists a long run relationship between them. On the other hand, causality ran from current account deficit to Budget deficit. The econometric analysis suggests that managing current account deficit offers scope for improvement in the budget deficit in turn supporting the Current Accounting Targeting proposition. The point of departure in this study was that it was looking at the relations between the twin deficits and not the dynamic relations of current account deficit and other macroeconomic variables.

Cheung, Furceri and Rusticelli (2010) assess the link between structural and cyclical factors and current account balances using a panel of 94 countries (industrial, emerging and developing countries including Kenya) from 1973-2008. They found that the medium-term evolution of the global external imbalances can be related in large part to structural factors including cross country differences in demographics, fiscal deficits, oil dependency and intensity, stage of economic development, financial market development and institutional quality. What lacks in this panel study is the specific characteristics for Kenya and the dynamic relations in the variables.

Liesenfeld, Guilherme and Jean-Francois (2010) use different nonlinear panel data specifications to investigate the causes and dynamics of current account reversals in low and middle-income countries. This includes Kenya with data from 1984-2001. They analyze four sources of serial persistence: a country-specific random effect reflecting time invariant differences in institutional, political or economic factors, serially correlated transitory error component capturing persistent country-specific shocks, dynamic common time-specific factor effects, designed to account for potential spillover effects and global shocks to all countries, and a state dependence component to control for the effect of previous events of current account reversal and to capture slow adjustments in international trade flows. The results suggest that current account balance, terms of trade, foreign reserves and concessional debt are important determinants of current account reversal. Furthermore, they find strong evidence for serial dependence in the occurrence of reversals. While the likelihood criterion suggests that state dependence and serially correlated errors are essentially observationally equivalent, measures of predictive performance provide support for the hypothesis that the serial dependence is mainly due to serially correlated country-specific shocks related to local political or macroeconomic events. The point of departure is that the results give a general picture of low and middle level countries leaving out the specificities for Kenya.

From the empirical literature, evidence is still inconclusive as to the specific determinants of the current account balances in developing countries. This is apparent can be seen from the conflicting results on the different variables. Most of the available empirical literature tends to focus on multi-country analysis/framework. To be more specific, the methodological approaches that have been adopted widely in the existing empirical literature have a major focus on cross section and panel/pool data analysis. The main limitation with this kind of estimation approach is that the corresponding results can only provide a generalized picture of the developing and industrial economies or both and could only be able to explain the behavior of current accounts in these economies thereby losing the country-specific characteristics. Although Kenya has been included in a number of panel studies, there is no study that has specifically examined the determinants of Kenya's current account deficits. This study tries to go beyond this generalization and empirically investigates the macro variables that may influence the behavior of the current account deficit and assess its dynamics over time Kenya.

2.2. Theoretical Framework

Theoretically, there are three basic models applied to explain the determinants of current account balances. These models include the elasticity approach, the absorption/ saving investment balance approach and the intertemporal approach (Yang, 2010). The elasticity approach features the price elasticity of demand for imports and exports by allowing changes in the exchange rate. This approach is widely applied to evaluate the impact of currency and the role of exchange rate and trade flows on current account balances.

The absorption approach is also known as the saving investment and balance approach or macroeconomics oriented approach. This approach says that economies with current account deficit should import from other countries to cover its excess consumption and spending. It is predicted that the current account is in surplus when the absorption is smaller than income. On the other hand, it is in deficit when the absorption is larger than income.

The absorption approach provides more inclusive and potentially less misleading framework compared to elasticity approach in analyzing the current account dynamics, (Hung and Gamber, 2010). Under this approach, the current account is the difference between monetary values of domestic production and aggregate demand. Government expenditure has impacts on imports.

In determining the determinants of the current account deficit, the study adopts the absorption approach. In order to explain the absorption approach, the study uses the basic national income identity which shows the relationship between external and internal balances. The basic national income identity defines Income, Y_t as the sum of private and public consumption, C_t and G_t investment, I_t and net exports, $X_t - M_t$; that is

$$Y_t = C_t + I_t + G_t + X_t - M_t \quad (2.1)$$

Rearranging the variables in (1.1) we have,

$$X_t - M_t = Y_t - C_t - G_t - I_t = S_t - I_t \quad (2.2)$$

where $S_t = Y_t - C_t - G_t$ is the National Savings.

This means that the external account has to equal the difference of National Savings (defined as income less private and public consumption) and Investment.

By definition, $CA_t = X_t - M_t$, thus equation (1.2) becomes

$$X_t - M_t = S_t - I_t \quad (2.3)$$

Equation (1.3) can also be written as

$$CA_t = S_t - I_t \qquad (CA_t > 0 \Rightarrow Surplus;\ (CA_t < 0 \Rightarrow Deficit) \quad (2.4)$$

This relation implies that the current account balance is the difference between exports and imports of any country and is related to savings and investment in the economy. Rather than test if the components of internal balances (C, I and I and G) and external balances $(X_t - M_t)$ have impacts on current account balances, the study investigated the factors that can determine the movements or balances of these components. The possible factors that determine the internal balances are inflation; productivity and foreign exchange, while the factors that determine the external balances can be terms of trade, oil prices and trade openness.

3. Econometric Methodology

3.1. Research Design

The study adopted the positivist paradigm to scientific inquiry. Creswell (1994) and Hussey and Hussey (1997) notes that positivism is founded on the belief that objective reality exists independent of what individuals perceive. That is, the positivist seeks facts or causes of social phenomena with little regard for the subjective states of individuals. It seeks to apply logical reasoning to research so that precision, objectivity and rigour replaces hunches, experience and intuition as a means of investigating research problem. Consequently, high regard is placed on identifying causal relationships among variables. This positivist view encompasses the following: - (i) The observation of real world phenomena or facts, (ii) the formulation of explanations for such phenomena or facts using deductive processes, (iii) the generation of predictions about real world phenomena using the previously formulated explanations and deductive processes, (iv) the attempted verification of these predictions through systematic, controlled experimentation or observation. A major tenet of the positivist paradigm is formulation and testing of hypotheses. The study used a time series design.

3.2. Model Specification for Determinants of Current Account Deficit

On the basis of theoretical framework and the literature reviewed, the study identified a number of factors that potentially determine the country's current account position. The study specified the following general function:

$$CA_t = f(CA_{t-i}, TOT, FX, FD, FDI, EDS, INF, OIL, GDP, GDS, DOP) \quad (3.1)$$

where the dependent variable CA_t is the Current Account Balance to GDP ratio; CA_{t-i} is the Current Account Balance lagged ; TOT is the terms of trade; FX is foreign exchange(Ksh/USD), FDI is Foreign Direct Investment ratio to GDP; EDS is the country's external debt stock; FD is fiscal deficit (%); INF is Inflation (%), OIL is the oil price on the world market (in billion US$), GDP is the annual growth of Gross Domestic Product [productivity] (%), GDS is Gross Domestic savings (%), and DOP is the indicator of openness to international trade.

3.3. Data Sources and Analysis

The study used all the macro economic variables that have a bearing on the current account deficit in Kenya. The data for the study was obtained from the world Development Indicators, a publication of the World Bank, and statistical abstracts from the Kenya National Bureau of statistics (KNBS). This was aimed at achieving comprehensive coverage and gives much accurate results.

Due to the nature of the study that involved the adoption of the stationarity tests, Vector Autoregressive model, granger causality tests and Impulse responses, the analysis was conducted using the Econometric Estimation software Eviews. The analysis also involved used descriptive statistics.

3.3.1. Vector Autoregressive (VAR)

In order to analyze the determinants of current account deficit, the study used the multivariate data analysis in the context of vector autoregressive models (VAR). This model helps us to determine the interdependencies and dynamic relationships between variables by incorporating non-statistical a priori information.

In its basic form, a VAR consists of a set of K endogenous variables $y_t = (y_{1t},..., y_{kt},..., y_{Kt})$ for $k = 1,...K$. The $VAR(p)$-process is then defined as:

$$y_t = A_1 y_{t-1} + ... + A_p y_{t-p} + CD_t + u_t \qquad (3.2)$$

with A_i are $(K \times K)$ coefficient matrices for $i = 1,..., p$ and u_t is a K-dimensional process with $E(u_t) = 0$ and time invariant positive definite covariance matrix $E(u_t u_t^T) = \sum_u$ (white noise).The matrix C is the coefficient matrix of potentially deterministic regressors with dimension $(K \times M)$ and D_t is an $(M \times 1)$ column vector holding the appropriate deterministic regressors, such as a constant, trend, and dummy and /or seasonal dummy variables.

A vital characteristic of a $VAR(p)$ process is its stability. This means that it generates stationary time series with time invariant means, variances and covariance structure, given sufficient starting values. This can be checked by evaluating the characteristics polynomial:

$$\det(I_K - A_1 z - ... - A_p z^p) \neq 0 \text{ for } |z| \leq 1 \qquad (3.3)$$

If the solution of the above equation has a root for $|z| = 1$,then either some or all variables in the $VAR(p)$ process are integrated of order one i.e. $I(1)$.

In practice, the stability of an empirical $VAR(p)$ process can be analyzed by considering the companion form and calculating the eigenvalues of the coefficients matrix (Lütkepohl, 2006). A $VAR(p)$-process can be written as a $VAR(1)$-process as

$$\xi_t = A\xi_{t-1} + v_t \qquad (3.4)$$

with

$$\xi_t = \begin{bmatrix} y_t \\ \vdots \\ \vdots \\ y_{t-p+1} \end{bmatrix}, A = \begin{bmatrix} A_1 & A_2 & \cdots & A_{p-1} & A_p \\ I & 0 & \cdots & 0 & 0 \\ 0 & I & \vdots & 0 & 0 \\ \vdots & \vdots & \ddots & \vdots & \vdots \\ 0 & 0 & \cdots & I & 0 \end{bmatrix}, v_t = \begin{bmatrix} u_t \\ 0 \\ \vdots \\ 0 \end{bmatrix} \qquad (3.5)$$

where the dimension of the stacked vectors ξ_t and v_t is $(Kp \times 1)$ and that of the matrix A is $(Kp \times Kp)$. If the moduli of the eigenvalues of A are less than one, then the $VAR(p)$ is stable. For a given sample of the endogenous variables $y_1, \cdots y_T$ and sufficient presample values $y_{-p+1}, \cdots, y_0$, the coefficients of a $VAR(p)$- process can be estimated efficiently by least squares applied separately to each of the equations. If the error process u_t is normally distributed, then this estimator is equal to the maximum likelihood estimator conditional on the initial values.

Once a $VAR(p)$ model has been estimated, the study has to check for diagnostic tests, such as testing for the absence of autocorrelation, heteroscedasticity or non-normality in the error process.

The study further tested the Granger causality, impulse response functions and forecast error variance decomposition in order to test the dynamics of current account deficit. These two methodologies are based upon the Wold moving average decomposition for stable $VAR(p)$ -a process which is defined as:

$$y_t = \Phi_0 u_t + \Phi_1 u_{t-1} + \Phi_2 u_{t-2} + \cdots, \qquad (3.6)$$

With $\Phi_0 = I_K$ and Φ_s can be computed recursively according to:

$$\Phi_s = \sum_{j=1}^{s} \Phi_{s-j} A_j \quad \text{for } s = 1,2,\cdots \qquad (3.7)$$

whereby $A_j = 0$ for $j > p$

Finally, forecasts for horizons $h \geq 1$ of an empirical $VAR(p)$ -process can be generated recursively according to:

$$y_{T+h|T} = A_1 y_{T+h-1|T} + \cdots + A_p y_{T+h-p|T} \qquad (3.8)$$

where $y_{T+j|T} = y_{T+j}$ for $j \geq 0$. The forecast error covariance matrix is given as:

$$Cov\left(\begin{bmatrix} y_{T+1} - y_{T+1|h} \\ \vdots \\ y_{T+h} - y_{T+h\backslash T} \end{bmatrix}\right) = \begin{bmatrix} I & 0 & \cdots & 0 \\ \Phi_1 & 1 & & 0 \\ \vdots & & \ddots & 0 \\ \Phi_{h-1} & \Phi_{h-2} & \cdots & I \end{bmatrix} (\Sigma_u \otimes I_h) \begin{bmatrix} I & 0 & \cdots & 0 \\ \Phi_1 & 1 & & 0 \\ \vdots & & \ddots & 0 \\ \Phi_{h-1} & \Phi_{h-2} & \cdots & I \end{bmatrix} \qquad (3.9)$$

and the matrices Φ_i are the empirical coefficient matrices of the Wold moving average representation of a stable $VAR(p)$ -process as shown above. The operator $\otimes$ is the Kronecker product.

4. Results and Discussions

4.1. Descriptive Statistics

To assess the distributional properties of the macro variables that have a direct bearing on Current Account balance, descriptive statistics are reported in Table 1. Current account deficits are a persistent feature of Kenyan economy. As shown in Table 1, the average current account balance (CA) has mostly remained in the negative territory for a large sample of Kenya's data. The average current account deficit as a ratio to GDP is 5.6%, it can also indicate that CA has surpassed more than ten times the threshold set by Mann (1999) of 5%, this result would make one to say that the current account deficit is unsustainable. Degree of openness has been on the upward trend. However, the Foreign Direct Investment has never gone beyond 2.7% of the GDP. Oil Prices have been on the upward trend from the year 2000 while the Kenyan currency has been weakening against the US dollar.

Variables	Mean	Median	Maximum	Minimum	Std. Dev	Skewness	Kurtosis	Jarque-Bera	Probability
CA	-5.6287	-5.1345	0.8885	-18.6798	4.9803	-1.1040	3.7087	9.4105	0.0090
GDP	4.3561	4.1062	22.1739	-4.6554	4.4037	1.9313	9.0852	90.9126	0.0000
DOP	54.1752	54.1766	75.1311	35.8839	11.7656	0.0216	1.9222	2.0360	0.3613
OIL	47.0671	38.6050	104.4900	16.8000	23.5703	0.7468	2.5465	4.2643	0.1186
FD	-4.0443	-4.2750	0.0800	-8.9000	2.3581	-0.0135	2.2119	1.0883	0.5803
FDI	0.6112	0.4689	2.6767	0.0047	0.5699	2.1007	7.8951	72.8246	0.0000
EDS	52.5192	47.7507	131.8994	0.0000	24.8757	0.9504	4.3095	9.3243	0.0094
INF	12.6603	11.3798	45.9789	1.5543	8.4589	1.6635	7.1454	49.4430	0.0000
TOT	99.1645	93.2177	167.9000	70.1493	20.5843	1.2455	4.4564	14.5706	0.0007
FX	39.0782	26.0790	85.0681	5.5000	29.9734	0.2306	1.3005	5.4269	0.0663
GDS	15.0056	16.7351	27.0230	5.0902	6.0161	-0.0704	1.7614	2.7196	0.2567

Table 1: Descriptive Statistics of the Macro-variables
Note: Sample 1974-2015; N=42

4.2. Correlation between Current Account and Other Macroeconomic Variables

Table 2 presents simple correlation coefficients relating Kenya's current account to the other macro variables. The sample period is from 1974 to 2015. The current account is strong negatively correlated with productivity growth (GDP) [-0.615] and Foreign exchange (FX) [-0.811] at 5% level of significance. The correlation between current account and degree of openness (DOP), external debt stock (EDS), imports (IM) and terms of trade (TOT) are -0.073, -0.076, -0.234 and – 0.121 respectively at 5% level of significance indicating a negative but weak relationship. Finally, current account is strong and positively correlated with oil price on the international market (OIL) with a value of 0.703 at 5% level of significance. The correlation between current account and inflation is -0.078 and FDI is 0.017 but not significant at 5% level of significance.

	CA	GDP	DOP	OIL	FDI	EDS	FD	INF	TOT	GDS
GDP	-0.615**									
	(0.027)									
DOP	-0.073**	0.230								
	(0.046)	(0.143)								
OIL	0.703**	-0.044	0.128							
	(0.037)	(0.782)	(0.420)							
FDI	0.017	0.011	0.231	0.159						
	(0.916)	(0.944)	(0.141)	(0.313)						
EDS	-0.076**	-0.227	-0.678**	-0.296	0.049					
	(0.033)	(0.148)	(0.000)	(0.057)	(0.757)					
FD	-0.180	0.099	0.523**	-0.308**	-0.140	-0.376**				
	(0.254)	(0.534)	(0.000)	(0.047)	(0.375	(0.014)				
INF	0.067**	-0.291	-0.111	0.155	0.261	0.560**	-0.266			
	(0.004)	(0.062)	(0.485)	(0.328)	(0.095)	(0.000)	(0.088)			
TOT	-0.121**	0.225	0.349**	-0.101	0.266	-0.296	0.142	-0.069		
	(0.006)	(0.153)	(0.023)	(0.523)	(0.088)	(0.057)	(0.371)	(0.666)		
GDS	0.241	0.149	-0.399**	-0.185	0.136	0.340**	-0.415**	0.217	0.286	
	(0.124)	(0.347)	(0.009)	(0.241)	(0.389)	(0.028)	(0.006)	(0.168)	(0.067)	
FX	-0.811**	-0.258	0.400**	-0.012	-0.012	-0.046	0.368**	0.020	-0.292	-0.809**
	(0.038)	(0.099)	(0.009)	(0.939)	(0.942)	(0.773)	(0.017)	(0.901)	(0.061)	(0.000)

Table 2: Correlation Matrix

*NOTE. -The first statistic in each pair is the Spearman rank correlation coefficient. The numbers in parenthesis () are the probability that the absolute value of the observed correlation will occur for null hypothesis of zero correlation. The values with ** are significant at 5%*

4.3. Integrated Properties of Variables

The first task before testing for cointegration and Vector Autoregressive between variables is to determine the order of integration of all the series. The study employed a battery of stationarity tests including classical unit root tests (first generation tests) namely the Augmented Dickey-Fuller (ADF) test and the Phillips Perron (PP) test. Since these tests cannot distinguish between unit root and near unit root stationary processes, the study also used other stationarity (second generation) tests, these included the Dickey-Fuller Generalized Least Square (DF GLS) and Kwiatkowski-Phillips-Schmidt-Shin (KPSS) test of Kwiatkowski *et al*. (1992).

The results for ADF and PP test for different models and lag lengths (determined automatically by SIC) with Null hypothesis that the series has a unit root are presented in Table 3. The test results indicate that CA, GDP, INF and FDI are integrated of order zero denoted by $I(0)$; and DOP, OIL, FD, EDS, TOT, EX, IM, GDS and FX are integrated of order one [$I(1)$].

To confirm the results of unit root, the study tested the stationarity of the variables by use of DF- GLS and KPSS tests for different models and lag length. The results are indicated in Table 4 below. The tests gave the same results as the classical test except for TOT which is was found to be $I(0)$ and not $I(1)$ as had been previously indicated by the ADF and PP tests.

Variables	Augmented Dickey Fuller (ADF) Test		Phillips Perron (PP) Test		Inference
	Intercept	Intercept with Trend	Intercept	Intercept with Trend	
Level					
CA	-3.6682** (0.0084)	-3.6274** (0.0397)	-3.6682** (0.0084)	-3.6274** (0.0397)	*I(0)*
GDP	-5.0926**(0.0001)	-5.6792**(0.0002)	-5.0926**(0.0001)	-5.6792** (0.0002)	*I(0)*
DOP	-0.9481 (0.7625)	-1.4761 (0.8217)	-1.0369 (0.7310)	-1.4761 (0.8217)	
Oil	-1.5528 (0.4972)	-1.5646 (0.7896)	-1.5523 (0.4974)	-1.5722 (0.7867)	
FD	-3.1305 (0.0520)	-3.3020 (0.0802)	-3.0819 (0.0558)	-3.1598 (0.1067)	
FDI	-7.0123** (0.0000)	-6.9275** (0.0000)	-7.0619** (0.0000)	-6.9737** (0.0000)	*I(0)*
EDS	-2.2516 (0.1921)	-2.2210 (0.4658)	-2.3185 (0.1712)	-2.2125 (0.4703)	
INF	-3.8988** (0.0045)	-3.8478** (0.0238)	-3.8988** (0.0045)	-3.8478** (0.0238)	*I(0)*
TOT	-2.0840 (0.2519)	-2.2171 (0.4673)	-1.9951 (0.2878)	-2.3399 (0.4041)	
EX	-2.8712 (0.0575)	-2.9474 (0.1591)	-2.9757 (0.0457)	-2.9473(0.1591)	
IM	-2.9218 (0.0515)	-3.2158 (0.0955)	-2.7746 (0.0708)	-3.0991 (0.1200)	
GDS	-2.0343 (0.2716)	-3.6756 (0.0355)	-1.8931 (0.3322)	-3.5891 (0.0432)	
FX	-0.0402 (0.9490)	-2.6887 (0.2463)	-0.1518 (0.9365)	-2.4955 (0.3286)	
First Difference					
ΔCA	-8.1917** 0.0000)	-8.0808**(0.0000)	-8.7363** (0.0000)	-8.5963**(0.0000)	
ΔGDP	-11.4134** 0.0000)	-11.5045**(0.0000)	-11.4134** (0.0000)	-11.1592**(0.0000)	
ΔDOP	-7.3325** 0.0000)	-8.6416**(0.0000)	-7.2612** (0.0000)	-8.8675**(0.0000)	*I(1)*
ΔOIL	-6.4119** 0.0000)	-6.3369**(0.0000)	-6.4119**(0.0000)	-6.3369**(0.0000)	*I(1)*
ΔFD	-9.3063**(0.0000)	-9.1206**(0.0000)	-9.3063**(0.0000)	-9.1206**(0.0000)	*I(1)*
ΔFDI	-7.2395** (0.0000)	-7.1281** (0.0000)	-26.6416**(0.0001)	-26.8160**(0.0000)	
ΔEDS	-6.9489** (0.0000)	-7.1055** (0.0000)	-6.9489**(0.0000)	-7.0619**(0.0000)	*I(1)*
ΔINF	-6.6862** (0.0000)	-6.6091** (0.0000)	-8.3322** (0.0000)	-8.1852** (0.0000)	
ΔTOT	-6.3895**(0.0000)	-6.3091**(0.0000)	-6.3899**(0.0000)	-6.3119**(0.0000)	*I(1)*
ΔEX	-6.3615**(0.0000)	-6.2781** (0.0000)	-6.3846**(0.0000)	-6.2939**(0.0000)	*I(1)*
ΔIM	-8.4250**(0.0000)	-8.4836** (0.0000)	-11.4576**(0.0000)	-20.0177**(0.0000)	*I(1)*
ΔGDS	-6.9846**(0.0000)	-6.8972**(0.0000)	-12.3282**(0.0000)	-14.0491**(0.0000)	*I(1)*
ΔFX	-9.3954**(0.0000)	-9.3380**(0.0000)	-9.3954**(0.0000)	-9.3380**(0.0000)	*I(1)*

Table 3: Unit Root Tests

Notes: The Null hypothesis is that the series has a unit root. The rejection of the null hypothesis for the DF and PP test is based on the Mackinnon critical values.** indicate the rejection of the null hypothesis of Unit root at 5% level of significance. The parenthesized values are the probability of rejection while Δ denotes the first difference, Δ

Variables	Elliott-Rothenberg-Stock DF-GLS test		Kwiatkowiski-Phillips-Schmidt-Shin Test		Inference at 5% sig. level
	Intercept	Intercept with Trend	Intercept	Intercept with Trend	
Level					
CA	-3.3837**	-3.6020**	0.0789**	0.0616**	*I(0)*
GDP	-3.3453**	-4.3238**	0.3085**	0.1331**	*I(0)*
DOP	-0.9274	-1.1504	0.2512	0.1967	
OIL	-1.2386	-1.6285	0.1109	0.1130	
FD	-1.5885	-1.9789	0.2341	0.1410	
FDI	-6.7216**	-7.0527**	0.0805**	0.0629**	*I(0)*
EDS	-1.3403	-1.5791	0.1917	0.1916	
INF	-3.5306**	-3.6900**	0.0815**	0.0821**	*I(0)*
TOT	-2.1141	-2.3016	0.2666	0.1047	*I(0)*
EX	-2.7645	-3.0283	0.2196	0.0521	
IM	-2.9885	-3.3802	0.2928	0.1717	
GDS	-1.5378	-3.7678	0.6884	0.1246	
FX	0.5840	-1.6881	0.7561	0.1129	
First Difference					
ΔCA	-6.5089	-7.7535	0.1112	0.1107	
ΔGDP	-0.9345	-2.5771	0.2482	0.1485	
ΔDOP	-6.4500**	-8.0038**	0.5750**	0.0711**	*I(1)*
ΔOIL	-6.4947**	-6.4734**	0.1384**	0.1256**	*I(1)*
ΔFD	-9.2576**	-9.1556**	0.1339**	0.1297**	*I(1)*
ΔFDI	-7.8488	-5.9600	0.4775	0.4233	
ΔEDS	-1.8593**	-6.0945**	0.3815**	0.0595**	*I(1)*
ΔINF	-6.9740	-6.4776	0.1053	0.1053	
ΔTOT	-6.4731	-6.4771	0.0701	0.0720	
ΔEX	-6.3144**	-6.4236**	0.0440**	0.0391**	*I(1)*
ΔIM	-6.3300**	-7.9909**	0.5000**	0.4878**	*I(1)*
ΔGDS	-4.9064**	-6.2856**	0.3554**	0.3578**	*I(1)*
ΔFX	-9.4721**	-9.5743**	0.1398**	0.1028**	*I(1)*

Table 4: Stationarity Tests

For KPSS: Null Hypothesis is that the series is stationary. ** indicate the acceptance of the null hypothesis of stationarity at 5%level of significance. The asymptotic critical values are tabulated in KPSS table.
Note: In this case, we compare the test statistic value with the critical value on desired significance level. If the test statistic is higher than the critical value, we reject the null hypothesis and when test statistic is lower than the critical value, we cannot reject the null hypothesis.
Current account deficit is stationary. This is a sufficient condition for the long-run intertemporal budget constraint (LRBC) to hold, (Trehan and Walsh 1991, Taylor 2002). Existence of stationarity to the terms of trade implies that the shocks of the TOT to the current account are of a temporary nature and are significant in the short-run only. These transitory shocks would have caused more damage to the current account if they were of a permanent nature. These results are consistent with past theoretical and empirical work showing that terms of trade shocks are of a temporary nature in developing countries (Cashin and Dermott, 1998). The terms of trade effect are in line with Harberger-Laursen-Metzler and only has income effect.
The existence of unit root in the Degree of openness variables suggest that its shock to current account are of a permanent nature and are significant in the long run. The existence of stationarity at levels in GDP is a show that the GDP is oscillating up and down thus the economy is struggling to maintain its stability and grow steadily. The existence of unit roots or Integrated of order one denoted by *I(1)* in the other macro variables' time series is expected, as the economic theory suggests unit root in the levels of these variables.

4.4. Determinants of Current Account Deficit in Kenya
In order to establish the determinants of the current account in Kenya, the study estimated the VAR, together with Granger Causality Test.

4.4.1. Vector Autoregressive Model
This is an econometric model used to capture the evolution and the interdependencies between multiple time series, generalizing the univariate AR models. All the variables in VAR are treated symmetrically by including, for each variable, an equation explaining its evolution based on its own lags and the lags of all other variables in the model. Based on this feature, Christopher Sims advocates the use of VAR models as a theory-free method to estimate economic relationships, thus being an alternative to the "incredible identification restrictions" in structural models.

4.4.1.1. Specification (Lag Order Selection) and Estimation

VAR analysis depends critically on the lag order selection, since different lag orders can significantly affect the substantive interpretation of the estimates when those differences are large enough. Mukras (2012) notes that one practical problem in the estimation of VAR models relates to the number of variables to be included in the model and the maximum lag length to be applied. Therefore, selecting the right lag order for each VAR is the first important step in this empirical study. The common strategy in empirical studies is to select the lag order by some pre-specified criterion and to condition on this estimate in constructing the VAR estimates. There are four most commonly used lag order selection criteria in the literature, which are the Akaike Information Criterion (AIC), the Schwarz Information Criterion (SIC), the Hannan-Quinn Criterion (HQC) and the general-to-specific sequential Likelihood Ratio test (LR).

These measures are defined as

$$AIC(p) = \log\det(\tilde{\Sigma}_u(p)) + \frac{2}{T} pK^2 \quad (4.1a)$$

$$HQ(p) = \log\det(\tilde{\Sigma}_u(p)) + \frac{2\log(\log T)}{T} pK^2 \quad (4.1b)$$

$$SC(p) = \log\det(\tilde{\Sigma}_u(p)) + \frac{\log(T)}{T} pK^2 \quad (4.1c)$$

$$FPE(p) = \left(\frac{T+p^*}{T-p^*}\right)^K \log\det(\tilde{\Sigma}_u(p)) \quad (4.1d)$$

with $\tilde{\Sigma}_u(p) = T^{-1}\sum_{t=1}^{T} \hat{u}_t \hat{u}_t'$ and p^* is the total number of parameters in each equation and p assigns the lag order. In each case, the lag order p is chosen to minimize the value of the criterion over a range of alternative lag orders p given by $\{p : 1 \le p \le p^*\}$.

Table 5 below displays the information criterion for the lags. From the results, all the information criteria suggest that the optimal lag length is 2. The optimum lag is marked with an asterisk.

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-1258.168	NA	1.74e+14	64.00840	64.93728	64.34425
1	-901.0858	482.0609	1.70e+09	52.20429	58.24204	54.38735
2	-642.5030	206.8663*	10404402*	45.32515*	56.47175*	49.35541*

Table 5: VAR Lag Order Selection Criteria

* indicate lag order selected by the criterion; LR: Sequential modified LR test statistic (each test at 5% level); FPE: Final prediction error; AIC: Akaike information criterion; SC: Schwarz information criterion; HQ: Hannan-Quinn information criterion. Endogenous variables: CA DOP EDS FD FDI FX GDP GDS INF TOT; Exogenous variables: C OIL

In this model, the framework is described by a 10-dimensional VAR (2) in levels as the data generating process then;

$$y_t = (CA, DOP, TOT, FD, FX, FDI, EDS, INF, GDP, GDS) \quad (4.2)$$

All the variables are treated as endogenous variables except OIL (oil price on the world market) which is an exogenous variable. This is because the variable is determined mostly by the OPEC countries that affect the supply of oil, thereby influencing its price. The VAR models are presented in Table 6 below. Model 1 is the model of interest with CA being the dependent variable. The results indicate that the independent variables account for 0.9363 of the variations in the dependent variable CA.

Model	1	2	3	4	5	6	7	8	9	10
	CA	**DOP**	**EDS**	**FD**	**FDI**	**FX**	**GDP**	**GDS**	**INF**	**TOT**
CA(-1)	0.7890**	0.1834	-0.0227	-0.0743	0.0211	-0.4515	0.0392	0.2973	-0.1531	0.9456
	(0.2776)	(0.2547)	(0.7905)	(0.1119)	(0.0382)	(0.5314)	(0.1649)	(0.2017)	(0.5121)	(0.6691)
CA(-2)	-0.1099	0.0686	0.1697	0.1116	0.02333	0.1213	0.1926	0.1641	0.2232	0.1392
	(0.2341)	(0.2147)	(0.6665)	(0.0944)	(0.0322)	(0.4481)	(0.1391)	(0.1701)	(0.4318)	(0.5641)
DOP(-1)	0.1144**	0.5327	-0.5264	0.0852	0.0100	-0.3761	-0.0645	-0.1986	0.1257	0.6650
	(0.0125)	(0.2866)	(0.8898)	(0.1260)	(0.0430)	(0.5982)	(0.1856)	(0.2271)	(0.5764)	(0.7531)
DOP(-2)	-0.0317	0.3177	0.2795	-0.1137	0.0169	0.6561	-0.0813	0.1778	0.5371	0.7340
	(0.2552)	(0.2341)	(0.7267)	(0.1029)	(0.0351)	(0.4885)	(0.1516)	(0.1854)	(0.4707)	(0.6150)
EDS(-1)	-0.0298	-0.3263	0.3288	-0.0241	-0.0261	-0.4550	0.0475	0.1260	-0.1889	-0.3024
	(0.1740)	(0.1596)	(0.4955)	(0.0702)	(0.0239)	(0.3331)	(0.1034)	(0.1264)	(0.3210)	(0.4194)
EDS(-2)	-0.0417**	0.2844	0.3058	0.0231	0.0393	0.4474	-0.0720	-0.0070	0.4313	0.4705
	(0.0121)	(0.1120)	(0.3476)	(0.0492)	(0.0168)	(0.2337)	(0.0725)	(0.0887)	(0.2252)	(0.2942)
FD(-1)	0.6725	0.4052	-1.1406	0.2458	0.0934	-0.2688	0.3282	0.02211	0.6782	1.8814
	(0.5378)	(0.4933)	(1.5313)	(0.2168)	(0.0740)	(1.0294)	(0.3195)	(0.3908)	(0.9920)	(1.2961)
FD(-2)	0.2616	0.4123	-1.0254	0.0780	0.0091	0.8753	0.3989	0.0463	-0.2737	-0.0522
	(0.6095)	(0.5591)	(1.7356)	(0.2457)	(0.0838)	(1.1667)	(0.3621)	(0.4429)	(1.1243)	(1.4690)
FDI(-1)	-1.0439	1.1981	-2.6932	0.7845	-0.4342	1.6949	-0.7208	-1.3923	2.3124	2.7692
	(2.1847)	(2.0039)	(6.2204)	(0.8806)	(0.3004)	(4.1816)	(1.2978)	(1.5874)	(4.0297)	(5.2649)
FDI(-2)	-1.4531	-2.6603	-5.2032	-0.5155	-0.7254	-1.7376	0.5748	-0.4266	-5.7972	-4.9230
	(1.7811)	(1.6337)	(5.0714)	(0.7180)	(0.2449)	(3.4092)	(1.0581)	(1.2942)	(3.2853)	(4.2924)
FX(-1)	0.2008	0.1510	0.1318	-0.0819	0.0100	0.7284	-0.0021	-0.0076	0.2030	0.1692
	(0.1632)	(0.1497)	(0.4646)	(0.0658)	(0.0224)	(0.3123)	(0.0969)	(0.1186)	(0.3010)	(0.3932)
FX(-2)	-0.2513	-0.0698	-0.2889	0.0931	-0.0305	0.1586	-0.0009	-0.1985	-0.3498	-0.7586
	(0.1584)	(0.1453)	(0.4510)	(0.0638)	(0.0218)	(0.3032)	(0.0941)	(0.1151)	(0.2921)	(0.3817)
GDP(-1)	-0.3528	0.0642	0.5984	0.1409	0.0294	-0.3933	0.4095	0.3668	-0.5580	-0.8074
	(0.3428)	(0.3144)	(0.9759)	(0.1382)	(0.0471)	(0.6561)	(0.2036)	(0.2491)	(0.6322)	(0.8260)
GDP(-2)	-0.1210	-0.0764	-0.0066	-0.0177	-0.0266	-0.5403	-0.2057	-0.0402	-0.4196	-0.7489
	(0.2174)	(0.1994)	(0.6191)	(0.0876)	(0.0299)	(0.4162)	(0.1292)	(0.1580)	(0.4010)	(0.5240)
GDS(-1)	0.4275	0.6541	-0.6557	-0.0788	0.0028	0.5476	0.0269	-0.0473	0.9029	0.8519
	(0.4187)	(0.3841)	(1.1923)	(0.1688)	(0.0576)	(0.8015)	(0.2488)	(0.3043)	(0.7724)	(1.0091)
GDS(-2)	-0.0331	-0.2214	-0.1779	-0.1111	-0.0637	-0.1168	-0.0183	-0.5167	-0.2130	-1.5428
	(0.3827)	(0.3510)	(1.0895)	(0.1543)	(0.0526)	(0.7324)	(0.2273)	(0.2780)	(0.7058)	(0.9222)
INF(-1)	-0.1671**	0.1575	0.7809	0.0794	0.0402	0.2033	-0.0472	0.1206	0.3854	-0.0755
	(0.0682)	(0.1543)	(0.4789)	(0.0678)	(0.0231)	(0.3219)	(0.0999)	(0.1222)	(0.3102)	(0.4053)
INF(-2)	0.1069	-0.0305	-0.0828	0.0284	0.0029	-0.2348	0.0577	0.0486	-0.6510	0.3268
	(0.1776)	(0.1629)	(0.5056)	(0.0716)	(0.0244)	(0.3399)	(0.1055)	(0.1290)	(0.3275)	(0.4279)
TOT(-1)	-0.2774**	-0.0131	-0.0585	-0.0164	-0.0082	-0.2115	0.0450	0.04544	-0.0457	0.0681
	(0.1065)	(0.0977)	(0.3033)	(0.0429)	(0.0147)	(0.2039)	(0.0633)	(0.0774)	(0.1965)	(0.2568)
TOT(-2)	0.1821	-0.0416	0.0109	0.0501	0.0175	-0.0181	-0.0014	0.0378	-0.1589	0.5338
	(0.1042)	(0.0956)	(0.2967)	(0.0420)	(0.0143)	(0.1994)	(0.0619)	(0.0757)	(0.1922)	(0.2511)
C	11.9716	9.5404	46.4598	-2.2297	-0.3596	15.8286	11.0569	18.0419	-15.2911	23.9072
	(14.0245)	(12.864)	(39.9318)	(5.6532)	(1.9284)	(26.8439)	(8.3312)	(10.1901)	(25.8686)	(33.7982)
OIL	0.0253**	0.0149	-0.1051	-0.0362	0.0077	-0.0340	0.0194	-0.0084	0.1498	-0.3541
	(0.0110)	(0.0587)	(0.1822)	(0.0258)	(0.0088)	(0.1225)	(0.0380)	(0.0465)	(0.1180)	(0.1542)
Summary of the statistics of the VAR models										
	CA	**DOP**	**EDS**	**FD**	**FDI**	**FX**	**GDP**	**GDS**	**INF**	**TOT**
R-squared	0.9363	0.9501	0.8870	0.7493	0.5635	0.9676	0.7271	0.8851	0.6205	0.8980
Adj. R-squared	0.7581	0.8918	0.7551	0.4568	0.0543	0.9298	0.4086	0.7511	0.1779	0.7789
Sum sq. resids	305.1155	256.7024	2473.592	49.5766	5.7688	1117.844	107.6711	161.0821	1038.0910	1772.0570
S.E. equation	4.1171	3.7764	11.7227	1.6596	0.5661	7.8805	2.4458	2.9915	7.5942	9.9221
F-statistic	1.9318	16.3118	6.7259	2.5618	1.1066	25.5983	2.28320	6.6043	1.4018	7.5431
Log likelihood	-97.3937	-93.9383	-139.2485	-61.0503	-18.0293	-123.3631	-76.5616	-84.6182	-121.8827	-132.5779
Akaike AIC	5.9697	5.7969	8.0624	4.1525	2.0015	7.26816	4.9281	5.3309	7.1941	7.7289
Schwarz SC	6.8986	6.7258	8.9913	5.0814	2.9303	8.1970	5.8570	6.2598	8.1230	8.6578
Mean dependent	-5.7255	53.3826	54.4354	-4.234	0.6098	40.7446	4.1360	14.7327	13.1441	99.0827
S.D. dependent	5.0454	11.4823	23.6879	2.2518	0.5821	29.7433	3.1804	5.9962	8.3754	21.1021

Table 6: Vector Autoregression Estimates

Notes: Standard errors in (), Oil variables has been treated as an exogenous variable, all other variables have been treated as endogenous variables, all figures are in 4 decimal places

4.4.1.2. Diagnostic Test and Model Checking

Unrestricted VAR models usually involve a substantial number of parameters which in turn results in rather imprecise estimators. It is therefore desirable to impose restrictions that reduce the dimensionality of the parameter space. Such restrictions may be based on economic theory or other non-sample information and on statistical procedures.

Once a VAR has been estimated, it is of pivotal interest to see whether the model is stable and the residuals obey the model's assumptions. In order to confirm the validity and stability of our estimates, post-estimations tests were carried out for the models. The tests and their results are discussed in the following subsections.

4.4.1.2.1. Stability Test

As earlier stated in chapter three, one important characteristic of $VAR(p)$ –process is its stability. This means that VAR generates stationary time series with time-invariant means, variances and covariance structure. The study evaluated the reverse roots of characteristic polynomial by conducting VAR stability condition Check test. The results in Table 7 indicate that the moduli of the eigenvalues are less than one. Figure 1 confirms the results that no root lies outside the unit circle, therefore VAR satisfies the stability condition.

Root	**Modulus**
0.952200 + 0.036361i	0.952894
0.952200 - 0.036361i	0.952894
0.844485 + 0.298686i	0.895750
0.844485 - 0.298686i	0.895750
-0.064903 + 0.834665i	0.837185
-0.064903 - 0.834665i	0.837185
-0.509607 + 0.590025i	0.779633
-0.509607 - 0.590025i	0.779633
0.225488 - 0.631767i	0.670801
0.225488 + 0.631767i	0.670801
0.048730 - 0.623513i	0.625414
0.048730 + 0.623513i	0.625414
-0.382105 + 0.312464i	0.493597
-0.382105 - 0.312464i	0.493597
0.265107 + 0.395232i	0.475909
0.265107 - 0.395232i	0.475909
-0.468208	0.468208
0.428568 + 0.173125i	0.462215
0.428568 - 0.173125i	0.462215
-0.141454	0.141454

Table 7: VAR Stability Condition Check

VAR satisfies the stability condition; No root lies outside the unit circle.

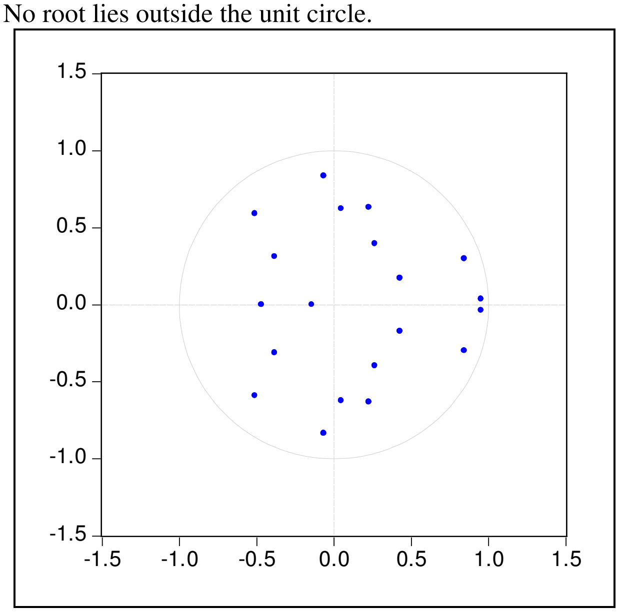

Figure 1: Inverse Roots of AR Characteristic Polynomial

4.4.1.2.2. Normality Test

Although normality is not a necessary condition for the validity of many of the statistical procedures related to VAR models, deviations from the normality assumption may indicate that model improvements are possible. However, normal distribution of errors is very important especially when we want to make interpretation according to the estimated econometrical equation. To test for the normality of the VAR models, the study plotted the residuals for the ten (10) models. The objective is to determine whether the residuals are stationary or not. Figure 2 shows that the residuals are indeed stationary. The stationarity of the residuals therefore implies that the estimated parameters are valid.

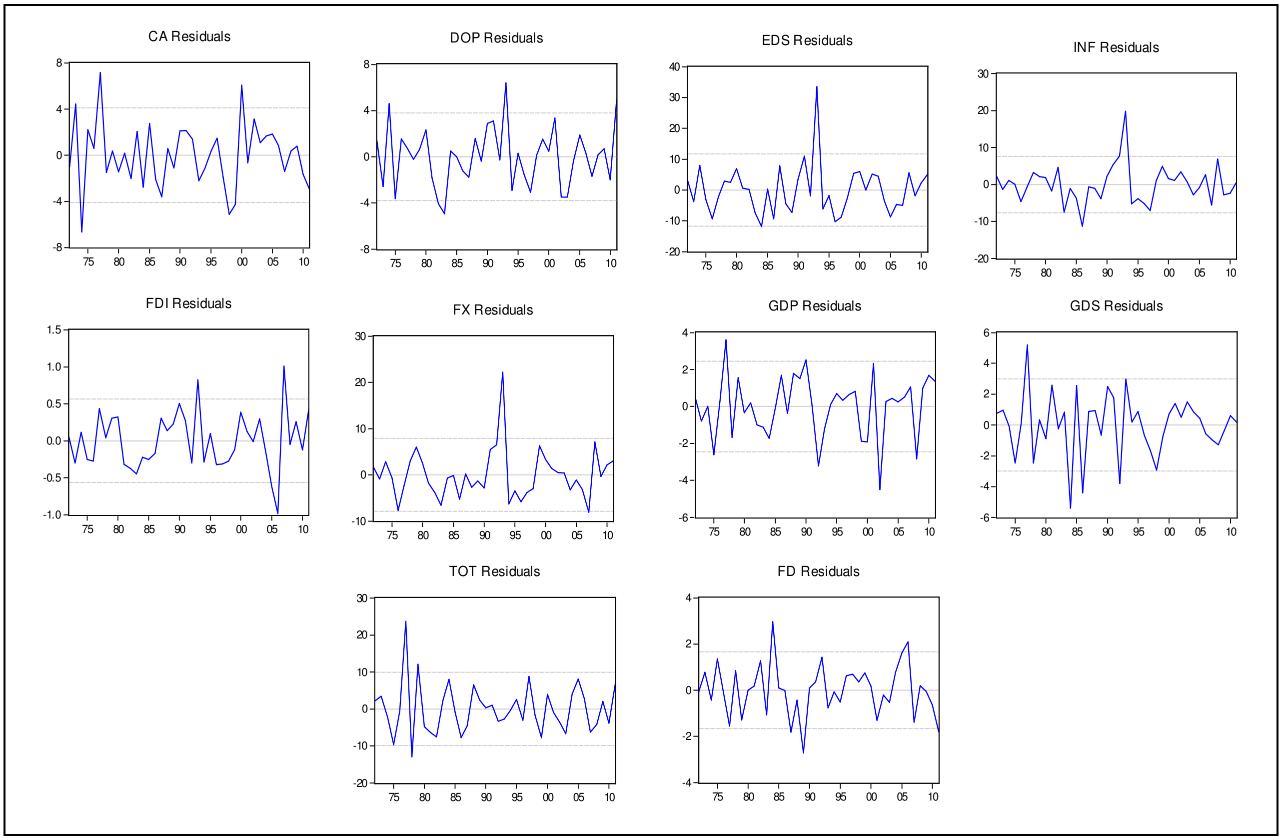

Figure 2: Residuals for VAR

To confirm the above results, a Jarque-Bera test for normality was conducted on the residuals of the VAR models. A multivariate version of this test was conducted using the residuals that are standardized by a Cholesky decomposition of the variance-covariance matrix for the centered residuals. The test statistics for the multivariate case is defined as;

$$JB_{mv} = s_3^2 + s_4^2 \qquad (4.3)$$

Whereby s_3^2 and s_4^2 are computed according to;

$$s_3^2 = Tb_1^T b_1 / 6 \qquad (4.4a)$$

$$s_4^2 = T(b_2 - 3_K)^T (b_2 - 3_k) / 24 \qquad (4.4b)$$

with b_1 and b_2 being the third and fourth non central moment vectors of the standardized residuals $\hat{u}_t^s = \tilde{P}^-(\hat{u}_t - \bar{\hat{u}}_t)$ and $\tilde{P}$ is a lower triangular matrix with positive diagonal such that $\tilde{P}\tilde{P}^T = \tilde{\Sigma}_u$, i.e. the cholesky decomposition of the residual covariance matrix. The test statistic JB_{mv} is distributed as $\chi^2(2K)$. The results of the Jarque-Bera test are presented in Table 8 The results fail to reject the null hypothesis that the errors in our models are normally distributed.

Jarque-Bera test		
Joint		
Chi-Square	d.f	Prob.
86.71488	20	0.078

Table 8: VAR Residual Normality Test

Orthogonalization: Cholesky (Lutkepohl); Null Hypothesis: residuals are multivariate normal

4.4.1.2.3. Serial Correlation Test

For testing the lack of serial correlation in the residual of the $VAR(2)$, a portmanteau test and the Breusch-Godfrey LM test were conducted. The portmanteau statistics is defined as

$$Q_h^* = T\sum_{j=1}^{h} tr(\hat{C}_j^{'}\hat{C}_0^{-1}\hat{C}_j\hat{C}_0^{-1}) \quad (4.5)$$

with $\hat{C}_i = \frac{1}{T}\sum_{t=i+1}^{T}\hat{u}_t\hat{u}_{t-i}^{'}$ .The test statistics has an approximate $\chi^2(K^2h - n^*)$ distribution and n^* is the number of coefficients excluding deterministic terms of $VAR(p)$ model. The limiting distribution is only valid for h tending to infinity at a suitable rate with growing sample size. On the other hand, Breusch-Godfrey LM-statistics is based upon the following auxiliary regressions:

$$\hat{u}_t = A_1 y_{t-1} + \cdots + A_p y_{t-p} + CD_t + B_1\hat{u}_{t-1} + \cdots + B_h\hat{u}_{t-h} + \varepsilon_t \quad (4.6)$$

The Null hypothesis is $H_0 : B_1 = \cdots = B_h = 0$, and correspondingly the alternative hypothesis is of the form $H_1 : \exists B_i \neq 0$ for $i = 1,2,\cdots,h$ .The test statistics is defined as:

$$LM_h = T(K - tr(\tilde{\sum}_R^{-1}\tilde{\sum}_e)) \quad (4.7)$$

where $\tilde{\sum}_R$ and $\tilde{\sum}_e$ assign the residual covariance matrix of the restricted and unrestricted models respectively. The test statistics LM_h is distributed as $\chi^2(hK^2)$

The presence of serial correlation in the models was tested by use of the Lagrange-Multiplier (LM) test and Portmanteau Tests for Autocorrelations. From the outcome, we fail to reject the null hypothesis of no presence of autocorrelation in the models (see Table 9 and 10).

Lags	Q-Stat	Prob.	Adj Q-Stat	Prob.	Df
1	98.67730	NA*	101.2075	NA*	NA*
2	192.5461	NA*	200.0167	NA*	NA*
3	307.0673	0.2124	323.8235	0.3436	100
4	396.5213	0.0931	423.2168	0.4781	200
5	504.8270	0.3561	546.9948	0.2217	300
6	596.8211	0.4531	655.2231	0.6175	400
7	699.4912	0.6712	779.6717	0.2476	500
8	805.4983	0.2341	912.1805	0.7143	600
9	893.8720	0.4103	1026.211	0.3490	700
10	992.2637	0.2456	1157.400	0.6175	800
*The test is valid only for lags larger than the VAR lag order.					
df is degrees of freedom for (approximate) chi-square distribution					
Null Hypothesis: no residual autocorrelations up to lag h					

Table 9: VAR Residual Portmanteau Tests for Autocorrelations

Lags	LM-Stat	Prob
1	415.787	0.064
2	383.342	0.981
3	NA	NA
4	414.213	0.091
5	385.574	0.770
6	369.326	0.758
7	NA	NA
8	NA	NA
9	376.808	0.672
10	405.292	0.991
Probs from chi-square with 100 df.		
Null Hypothesis: no serial correlation at lag order h		

Table 10: VAR Residual Serial Correlation LM Tests

4.4.1.2.4. Heteroskedasticity Test

The LM test for heteroskedasticity also shows that the null hypothesis of no heteroskedasticity is not rejected in the 10 models. Table 11 presents the results.

VAR residual heteroskedasticy Test: Include cross terms		
Joint		
Chi-Square	d.f	Prob.
99.8287	20	0.095

Table 11: VAR heteroskedasticity test with cross terms

4.4.1.2.5. Lag Exclusion Wald Test

One can easily test the null hypothesis about (non) significance of particular lag in the model.

For each lag the Wald statistic together with a p-value for the joint significance is reported – separately for each equation and jointly for the whole model (in the last column). In our case, all lags are significant, as outlined in Table 12.

	CA	DOP	EDS	FD	FDI	FX	GDP	GDS	INF	TOT	Joint
Lag 1	16.0964	25.6716	11.7695	10.0716	13.1086	14.2777	14.8704	14.8913	12.5101	14.7134	323.6720
	[0.0969]	[0.0042]	[0.3008]	[0.4342]	[0.2177]	[0.1607]	[0.1369]	[0.1361]	[0.2524]	[0.1429]	[0.0000]
Lag 2	12.3172	18.22293	2.5097	14.5644	13.8979	12.9893	14.2055	12.7027	12.7654	10.0548	388.6016
	[0.2644]	[0.0513]	[0.9907]	[0.1488]	[0.1777]	[0.2243]	[0.1638]	[0.2408]	[0.2371]	[0.4357]	[0.0000]
df	10	10	10	10	10	10	10	10	10	10	100

Table 12: VAR Lag Exclusion Wald Test

Chi-squared test statistics for lag exclusion: Numbers in [] are p-value

After testing the stability and validity of the VAR model, it is vital to discuss estimates of model 1, which has CA as a dependent variable. Considering the VAR estimates, the study finds substantial persistence in the current account deficit. The coefficient on the lagged current account is 0.7890 and significantly different from zero. This result is line with the findings of the literature, such as Chinn and Prasad (2003). It captures the partial adjustment of the current account and can be rationalized by habit formation in the behaviour of private agents. As the current account represents net saving decisions and is thus complementary to consumption decisions, the current account inherits the sluggishness of consumption changes which are due to habit formation. As a result, the current account does not fully respond to changes in fundamentals instantaneously.

Countries that are more open to international trade can be expected to have larger export sectors enabling them to service external debt more easily and sustaining a higher level of current account deficit. In the current study the findings indicate a positive (0.1144) and significant relationship between the degree of openness and current account deficit. Thus, this indicates that openness, can make adjustment to CA to a sudden stop and less painful (Calvo *et al*., 2003 and Edwards, 2004). However, Calderon *et al.* (2002), notes that he nets effect of openness on CAD appears to be ambiguous.

The results indicate that external debt stock has a significant effect on the CA with a coefficient of -0.0417. These results are consistent with Kwalingana and Nkuna (2009) who examine the short run and long run determinants of current account deficit in Malawi over a period of 1980 to 2006. Their results indicate that the trade openness, terms of trade and external debt are the factors that determine current account deficit in Malawi.

In theory, the exchange rate has an impact on the current account, however the finding from this study reveals that the exchange rate is not a significant factor in determining the current account deficit. These results contradict studies of Chinn and Ito (2006), Lee and Chinn (2006), Arghyrou and Chortareas (2008), and Arratibel, Furceri, Martin, and Zdzienicka (2011), however they are consistent with studies of Cheung, Chinn, and Fujii, (2009), Devkota (2004) and Hermann (2009). In his study, while examining Nepal's economics Hermann (2009) proves that the exchange rate devaluation may not be necessary a way to improve the trade balance. The fiscal tools such as increase the efficiency of tax administration and establishing the import substitution type of industries can help to reduce imports.

The GDP growth can be perceived as an indicator of internal macroeconomic performance reflecting macroeconomic policy stance and could hence be used to investigate consistency between internal and external policies. The higher a country's GDP growth rate, the greater the current account imbalance it can sustain without increasing its external debt to GDP ratio. Economic growth then becomes an important variable in assessing the external position of a country's economy (Adedeji, 2001; Chinn and Prasad, 2000; 2003). The results in our study indicate that the GDP growth is not significant. This confirms the earlier results of GDP being stationary at levels and thus not stable.

TOT is introduced as a proxy of external non-policy factors that affect the current account balance. An adverse transitory term of trade shock can induce either deterioration or improvement in the current account balance. The Harberger-Laursen-Metzler (1950) model suggests that it deteriorates because deterioration in the terms of trade will decrease real income and savings. The coefficient of TOT at lag of 1 is -0.2774 and significant. The change in terms of trade lagged one year is one of the most important factors affecting the current account balance in the short-run. The negative sign means that TOT has an adverse impact on the current account balance, but after a time lag due to some rigidity in the economy. Developing economies tend to suffer even in the presence of favorable TOT. Pinto (1987), Murphy (1983), Gelb (1988), Robinson and Ragnar (2005) and others emphasize that the windfall gains from an improvement in TOT can be squandered on white elephant projects in developing countries.

This study uses inflation as a proxy for monetary policy credibility. A credible monetary policy framework promotes stable inflation; reduces the volatility of exchange rate, reduces the degree of exchange rate misalignment thereby, addressing adverse changes in current account balance. Credible monetary frameworks reduce the tendency of aggregate demand to deviate substantially from the level consistent with inflation target. It therefore follows that inflation can act as a discipline device on CA by responding appropriately to aggregate demand shocks. The a priori expectation between INF and CA is ambiguous. It can be positive or negative since it can result in higher domestic and foreign investment and savings through reducing the level of uncertainty and inefficiency in resource management (Ozman, 2004). In this study, the coefficient of INF was found to be -0.1671 and considered significant.

Since Kenya is an Oil importing economy, the variable OIL was included in the model as a determinant of CA. Higher oil prices does not improve the current account balance of oil importing economies, (International Monetary Fund, 2006). The coefficient of OIL is -0.0253 and significant. This shows that OIL prices have had a significant negative impact on the Kenyan Current account deficit. This result is consistent with studies of Gruber and Kamin, (2007) and Barnes, Lawson and Radziwill, (2010), who reported that oil price has impact on the current account.

4.5.3. Granger Causality

The basic principle of Granger causality analysis is to test whether past values of macro variables help to explain current values of current account deficit. The causality tests were performed in a vector autoregression (VAR) model. The reported F-statistics are the Wald statistics for the joint null hypothesis. The study estimated the VAR [2,2] since this is satisfies the stability condition and has the appropriate/optimal lag order as indicated. The results are reported in Table 13 below.

The empirical results portrayed in Table 13, suggest that the Null hypothesis that CA does not Granger because DOP is rejected at 5% significance level, therefore it appears that there DOP causes CA. From the statistics, the null hypothesis of EDS does not Granger because CA is rejected at 5% level of significance thus indicating that CA is a cause of EDS, this confirms the economic theory that EDS is as a result of CA. The relation between EDS and CA indicate that Kenya's current account deficit has largely been financed by external borrowings, resulting in the substantial level of external debt and international accumulation.

The findings also indicate that the null hypothesis that CA does not Granger because FD is rejected, thus FD causes CA, this finding is inconsistent with the findings of Nyongesa and Onyango, (2009,2012). This might be because of the increase in the number of observation in the current study. The results also indicate that CA granger causes FDI. The findings also indicate that granger causality runs one way from each of the variables GDP, OIL and TOT to CA individually. On the other hand, from the results we fail to reject the null hypothesis, thus there is no bivariate causality between each of the variables FX, GDS, INF and CA.

Sn.	Null Hypothesis:	Obs	F-Statistic	Prob.	Conclusion	Inference
1.	DOP does not Granger Cause CA	40	0.14763	0.8633	*Do not Reject H_0*	
	CA does not Granger Cause DOP		4.21519	0.0229	*Reject H_0*	*DOP $\rightarrow$ CA*
2.	EDS does not Granger Cause CA	40	3.28279	0.0494	*Reject H_0*	*CA $\rightarrow$ EDS*
	CA does not Granger Cause EDS		0.49500	0.6138	*Do not Reject H_0*	
3.	FD does not Granger Cause CA	40	0.00824	0.9918	*Do not Reject H_0*	
	CA does not Granger Cause FD		3.39675	0.0449	*Reject H_0*	*FD $\rightarrow$ CA*
4.	FDI does not Granger Cause CA	40	3.62601	0.0371	*Reject H_0*	*CA $\rightarrow$ FDI*
	CA does not Granger Cause FDI		0.31741	0.7301	*Do not Reject H_0*	
5.	FX does not Granger Cause CA	40	1.83086	0.1753	*Do not Reject H_0*	*No causality*
	CA does not Granger Cause FX		1.46831	0.2442	*Do not Reject H_0*	
6.	GDP does not Granger Cause CA	40	0.00552	0.9945	*Do not Reject H_0*	
	CA does not Granger Cause GDP		1.88217	0.0167	*Reject H_0*	*GDP $\rightarrow$ CA*
7.	GDS does not Granger Cause CA	40	0.14209	0.8680	*Do not Reject H_0*	*No causality*
	CA does not Granger Cause GDS		0.74715	0.4811	*Do not Reject H_0*	
8.	INF does not Granger Cause CA	40	1.29429	0.2869	*Do not Reject H_0*	*No causality*
	CA does not Granger Cause INF		0.29898	0.7435	*Do not Reject H_0*	
9.	OIL does not Granger Cause CA	40	0.08725	0.9166	*Do not Reject H_0*	
	CA does not Granger Cause OIL		0.28051	0.0471	*Reject H_0*	*OIL $\rightarrow$ CA*
10.	TOT does not Granger Cause CA	40	0.23344	0.7930	*Do not Reject H_0*	
	CA does not Granger Cause TOT		4.80552	0.0143	*Reject H_0*	*TOT $\rightarrow$ CA*

Table 13: Granger Causality Test

Notes: Lags: 2; the sign $\rightarrow$ indicates the direction of causality; Test at 5% significance level.

4.6. Dynamic Interactions among Various Macroeconomic Variables and the Current Account Deficit in Kenya

In VAR methodology, the estimated coefficient values in these models do not constitute the strength of these models. The better use of VAR models is made through granger causality, variance decompositions and impulse response functions. Since our aim was to specify the variables which contribute to the current account balance, using this analysis was more gainful. What VAR does is to invert the system and then innovations are generated after decomposition, which have direct economic interpretations.

In order to understand the dynamics of responses, both the impulse response functions (IRFs) and variance decomposition (VD) are used in a vector autoregressive (VAR) framework. While the impulse response functions track the responsiveness of the regressands in the VAR to shocks to each of the other variables, the variance decompositions provide information on the proportion of the movements in the dependent variables accounted for by their own shocks vis-à-vis the shocks to other factors.

4.6.1. Variance Decomposition

Variance decomposition shows the contribution of each shock to the variance of *n*-period-ahead forecast error of the variable. In other words, variance decomposition typically shows the proportion of the forecast error variance of a variable which can be attributed to its own shocks and the innovations of the other variables.

The results of variance decompositions for current account are reported in Table 14. It is observed that CA is completely explained (100 percent) by its innovations in the first period, but its explanatory power declines over time. CA is explained by the innovations of DOP in the portion of approximately 16%, and by the innovations of EDS, FD, TOT in the portion of approximate mean of 7%, 10%, 8% for each series respectively. CA is explained by the innovation of FDI, GDP, and INF in the portion of approximately 2% for each of the series. On the other hand, FX and GDS have a weak significant influence of less than 1% over the ten-period time.

Period	S.E.	CA	DOP	EDS	FD	FDI	FX	GDP	GDS	INF	TOT
1	4.117142	100.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
2	5.829651	71.17550	1.146412	4.698215	8.887086	1.058768	0.044816	2.197937	0.050771	1.131638	9.608860
3	6.450273	60.82858	9.275100	5.034874	10.42974	2.290581	0.316623	2.119401	0.087633	0.957520	8.659948
4	6.504628	59.93424	9.834195	5.010373	10.39405	2.585770	0.347459	2.140689	0.111180	1.124993	8.517057
5	6.820530	54.56951	13.45820	7.003395	10.56376	2.733456	0.340723	2.328858	0.102545	1.031502	7.868049
6	7.040869	51.23335	15.20890	8.929382	9.973574	2.601541	0.379170	2.282319	0.117139	0.974721	8.299899
7	7.182818	49.22860	16.16189	9.272391	9.871839	3.523346	0.368344	2.275770	0.138165	1.119302	8.040359
8	7.271752	48.04007	16.63318	10.30096	9.667831	3.524720	0.426371	2.222330	0.139029	1.120963	7.924546
9	7.317018	47.45316	16.51968	10.66761	9.556839	3.486610	0.496314	2.196951	0.183243	1.112077	8.327512
10	7.334078	47.23908	16.45261	10.82478	9.543164	3.567547	0.494206	2.202557	0.198805	1.125942	8.351307

Table 14: Variance Decomposition of Current Account

Cholesky Ordering: CA CPI DOP EDS FDI FX GDP GDS TOT

From Table 14, since CA is largely determined by its own values, there is an indication that there is persistence in the current account deficit which also explains the structural conditions of the Kenyan economy. Through the variance decomposition, there is a noticeable very weak contribution of the GDP shock on CA. This contribution is approximately about 2% both in the short and long term since the economic growth does not last long. Finally, considering the importance of the degree of openness in the Kenyan economy, it would be interesting to highlight how the external shocks impact on the CA. This contribution is approximately about 16% in the long term and less than 10% in the short term.

4.6.2. Impulse Response

These impulses are derived using a recursive VAR model, in which Cholesky one-standard deviation shocks are applied and the response is estimated over a period of ten years, following the initial occurrence of the shocks. The impulse response function of VAR is to analyze dynamic effects of the system when the model received the impulse. In our 10 dimensional -$VAR(2)$ model, the study worked out the response between these variables. Results of the impulse response analysis are presented in Figure 3, which illustrates the response of current account deficit to one standard deviation innovation in each of the macro variables and also the response macro variables to one standard deviation innovation in Current account.

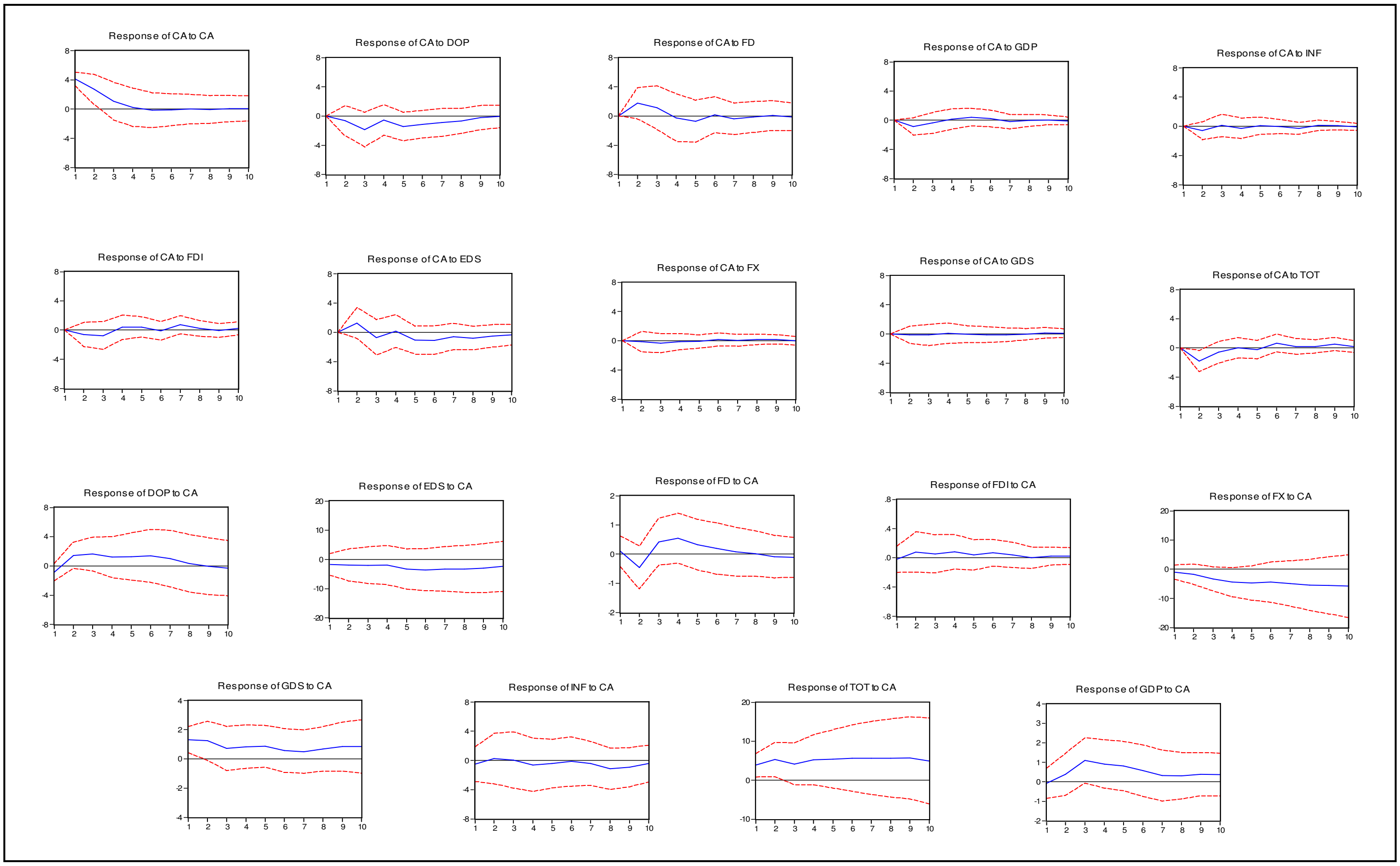

Figure 3: Response Cholesky One S.D Innovations $\pm 2SE$

Response of CA to CA; Panel 1 of Figure 3 shows the response of CA due to one standard deviation of unanticipated positive shock to itself—a gradual decline in Kenya's CA. The dashed line becomes parallel to equilibrium after the fourth year. This shows that the positive shock to CA is transmitted completely to CA itself. There is a continuous decline in CA. Asymptotically, it will converge to equilibrium in the long run, which verifies the stability of the model.

Response of CA to DOP; In Panel 2, Initially CA was at zero, then the deficit starts (going down) it reaches its lowest at the third year and reduces again in the fourth year and remains negative in response to the exogenous shock to DOP, and then converges with equilibrium in the ninth year.

Response of CA to FD; Panel 3 Initially, CA starts rising in response to the exogenous shock of FD. It remains positive until the third year, and then goes to negative a little bit comes to zero in the sixth year and converges with equilibrium in the eighth year.

Response of CA to GDP and INF: Panel 4 and 5, show the dynamic response of CA to one standard deviation of shock to GDP and INF respectively. The CA goes negative and later converges to equilibrium.

Response of CA to FDI; In panel 6, it can be observed that the responses of CA to FDI is in an oscillation way and converges at equilibrium in year eight.

Response of CA to EDS; In panel 7, it can be observed that the responses of CA to EDS is in an oscillation way in the first years up to the 5^{th} year and deviates further from equilibrium in subsequent years and remains negative to the end.

Response of CA to FX and GDS; In panel 8 and 9, it can be observed that there is very little or even no first response (at the 1st lag) of CA to the shocks of FX and GDS series.

Response of CA to TOT; From panel 10, it can be seen that the CA moves to negative and returns to zero in the fourth year and moves to positive and oscillates above the zero mark up to the end of the period under study. This result is not consistent with Otto's (2003) and Tayyaba and Saira (2012) study, where the current account's response to positive TOT shocks is not significant. This is because TOT is considered a key driver of fluctuations in real income and the current account in developing countries (Khan & Knight, 1983).

The study also sought to investigate the response of the other macro variables (DOP, EDS, FD, FDI, FX, GDS, INF, TOT and GDP) to a shock on CA. The results are shown from panel 11-19. The results indicate there is a great impact on the series. The time paths resulting from the response coefficients do not generally converge to zero. This implies that a positive shock from the current account deficit brings about an immediate significant impact on the macro economic variables in question. This reveals that Kenya's CA balance showed a negligible transitory shock to the macro variables in the economy.

5. Conclusions, Policy Implications and Recommendations

5.1. Conclusions

Based on the findings the following conclusions are made; concerning the determinants of current account deficit; Granger causality test indicate that, causality runs one way individually from DOP, FD, GDP, OIL and TOT to CA. Thus, these variables are determinants of CA. On the other hand, CA causes EDS and FDI thus these are as a result of the current account deficit. The findings also indicate that there is no causality between individual variables FX, GDS, INF on CA. The findings from VAR estimates indicate that Current Account is determined by its own past values, Degree of Openness of the economy, External Debt stock, Inflation, Oil price and Terms of Trade.

On the dynamic interactions among various macroeconomic variables and the current account deficit in Kenya, the results from the variance decomposition and impulse indicate that CA is completely explained by its on innovations, but its explanatory power declines over time.CA is explained by the innovations of DOP in the portion of approximately 16%, and by the innovations of EDS, FD, TOT in the portion of approximately mean of 7%, 10%, 8% for each series respectively. CA is explained by the innovation of FDI, GDP, and INF in the portion of approximately 2% for each of the series. On the other hand, FX and GDS have a weak significant influence of less than 1% over the ten period times. This result confirms the previous findings from the determinants of the CA.

5.2. Policy Implications

The key policy implication of the findings about the determinants of the current account deficit is that given the oil variables having an effect on Current account, prudent management of energy resources must be pursued in order to substitute oil. This will help reduce the volatility often associated with oil prices on the world market. There is need to focus on the terms of trade in order to have a positive impact on the current account balance. On the other hand, inflation should be contained to levels that are productive without affecting the economic growth and current account deficit.

5.3. Recommendations

From the conclusions on the major determinants of Current account, there is need for the government to take advantage of the degree of openness of the economy and not the other countries to take advantage of our openness. Secondly, there is need for the government to evaluate our terms of trade with our partners and ensure that there is mutual benefit between the partners. Thirdly, there is need to check our fiscal deficit and ensure that it is developmental. Fourthly, the government should encourage the use of other sources of energy to substitute oil. On the other hand, the government should provide an enabling environment and invest in the extraction of the commercially viable oil and coal in the country. These would change the country from being an oil importing to oil exporting economy hence reduce the negative external effect of the oil price on the current account and the economy at large.

From the findings, GDP growth is also a determinant of Current account deficit. Theoretically, GDP growth is an indicator of internal macroeconomic performance that reflects macroeconomic policy stance and thus the higher a country's GDP growth rate, the greater the current account imbalance it can sustain without increasing its external debt to GDP ratio. Therefore, there is need for the government to provide an enabling environment for the sustained growth and stability of GDP in order to have a significant effect on the exports and ultimately have an impact on the current account deficit.

On the dynamic interactions among various macroeconomic variables and the current account deficit in Kenya, the results indicate that CA is completely explained by its on innovations, thus there is need for the Kenyan economy to focus on the appropriate policy mix that has a direct impact on the current account in order to reduce its persistence which can lead to significant economic costs in terms of severe adjustment processes, difficulties in funding external debts or even a default.

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