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Macroeconomic Effects of Budget Deficits in Uganda: A VAR-VECM Approach

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Abstract

This paper investigates the relationship between budget deficits and selected macroeconomic variables for Uganda between 1999 and 2011 using Vector Error Correction Model (VECM), pairwise granger causality test and variance decomposition techniques. Results indicate that the variables under study are cointegrated and thus have a long run relationship. VECM results reveal unidirectional causal relationships running from budget deficits (BD) to current account balance (CAB), inflation to BD, BD to lending interest rates, and no causal relationship between gross domestic product (GDP) and BD. The Pairwise Granger Causality test results reveal unidirectional causal relationships running from BD to CAB, BD to GDP, inflation to BD, and a bi-directional causal relationship between the CAB and GDP. Variance decomposition results show that, variances in CAB and GDP are mostly explained by BD followed by lending interests while variance in lending interest rates is mostly explained by inflation followed by GDP. Variances in the Inflation are mostly explained by variance in lending interest rates followed by CAB. The results from the study clearly show that budget deficits in Uganda are responsible for widening current account deficit and raising interest rates. Fiscal and monetary policy actions are therefore needed to contain and reduce the deficit in order to minimize its effect on the current account and lending interest rates.

JEL classification numbers: C5, E6, H5
Keywords: Budget Deficits, macroeconomic performance, VAR, Uganda

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1 Introduction

The relationship between budget deficits and other macroeconomic variables represents one of the most widely debated topics amongst economists and policy makers in both developed and developing countries (Aisen and Hauner, 2008, Georgantopoulos and Tsamis, 2011). It's widely believed that huge budget deficits have adverse macroeconomic effects such as high interest rates, current account deficits, inflation etc. (Bernheim, 1989).

In the last five years, the ratio of the budget deficit to GDP has risen from about 4.6 percent in 2007 to over 9.5 percent in 2011. This trend is also observed in the growth government debt. Total external debt has increased from about 1785 million US dollars in 2007 to over 3109 million US dollars in2011. This growth in budget deficit spending is worrying especially its effect on other macroeconomic variables. The continuously widening current account deficit, high interest rates and inflation are believed to be partly due to government's budget deficit spending (Mugume and Obwona, 1998). Despite this general knowledge, there is no recent empirical evidence about Uganda that links the budget deficits and other macroeconomic variables.

Thus, this study attempts to examine the relationship between the budget deficit and other macroeconomic variables using a VAR-VECM econometric approach. This is aimed at deriving substantive empirical evidence on the impact of budget deficits on key macroeconomic variables. The findings will inform both fiscal and monetary policy in Uganda. The findings will further enrich the existing literature on the relationship of budget deficit and other macroeconomic variables by providing new evidence from a least developed country. The importance of this study is paramount since it covers a period which includes some of the most important economic, political and social transformations that led to a more open and liberalised Ugandan economy.

We employ Vector Error Correction Model (VECM), pairwise granger causality test and variance decomposition techniques to examine the relationship between budget deficits and selected macroeconomic variables (Gross Domestic Product (GDP), Lending Interest Rates (LIR), Current Account Balance (CAB) and Inflation) using quarterly data from 1999 to 2011. VECM results reveal unidirectional causal relationships running from budget deficits to CAB, inflation to BD and BD to lending interest rates. But the results show no causal relationship between GDP and budget deficits in Uganda. The Pairwise Granger Causality test results reveal unidirectional causal relationships running from budget deficit to current account, BD to GDP, inflation to BD, and a bi-directional causal relationship between the current account balance and GDP. Variance decomposition results show that, variances in the current account balance and GDP are mostly explained by the budget deficit followed by lending interests while variance in lending interest rates is mostly explained by inflation followed by GDP, variance in the Inflation is mostly explained by variance in lending interest rates followed by the current account balance. The results from the study clearly show that budget deficits in Uganda are responsible for widening current account deficit and raising interest rates.

The paper is organised as follows. Section one provides the introduction and background of the study, section two presents both the theoretical and empirical literature while section three presents the theoretical framework, methodology and data. Section four presents the study results and discussions. The final section contains conclusions and policy recommendations.

1.1 Background of the Study

Like any other least developed country, Uganda faces budgetary constraints largely due to its low resource base in terms low incomes, low savings and a low tax base. In order to meet her development needs, the government requires more resources than it collects to finance its expenditure.

Available data shows that for the past two decades government expenditure has continuously exceeded government revenue. The ratio of government expenditure to GDP has risen from about 18 percent of GDP in 1992/93 to about 23 percent of GDP in 2010/11, while the ratio of government revenue to GDP has increased from about 8 percent to 13 percent during this period (Figure 1). This signifies a financing gap of about 10 percent of GDP in 2010/11 that has to be filled by other sources like borrowing and foreign aid.

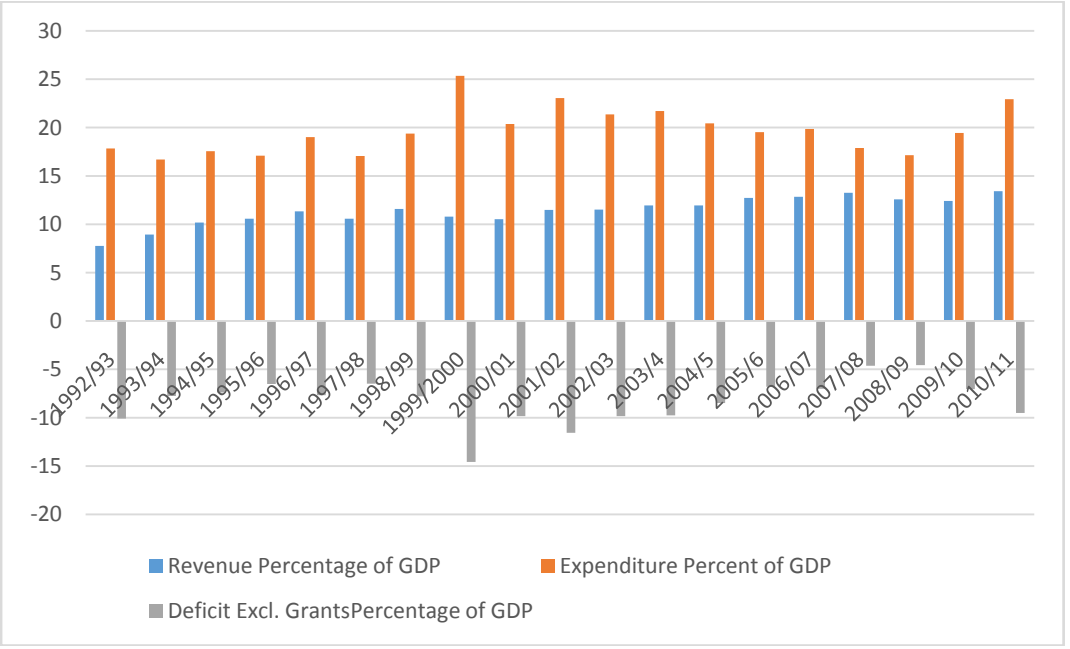

Figure 1: Government Revenue and Expenditure as % of GDP
Source: MoFPED[3] (2012)

Budget deficits can be financed through a number of ways which include government borrowing domestically (mainly used in countries with developed domestic financial systems), government borrowing from international sources, minting money by the central bank (monetary financing) and through foreign aid from donor governments and agencies. The effects of budgets deficits on the economy largely depend on the financing sources (Mugume and Obwona, 1998; Adam and Bevan, 2005; IMF, 1995). If the deficit is financed by borrowing from the domestic banking system, the likely adverse impacts will be an increase in the domestic interest rates and the crowding out of private borrowers (Easterly and Schmidt-Hebbel, 1993).

[3]MoFPED – Ministry of Finance Planning and Economic Development, Uganda

If the deficit is financed by direct borrowing from the central bank/ money creation from the central bank (monetary financing of the budget deficit), it is highly likely that a huge deficit financed this way may lead to inflation (IMF, 1995).

In the case of financing deficit using externally borrowed funds, the likely adverse effects will be the appreciation of the exchange rate resulting from the inflow of foreign exchange which will affect the performance of exports leading to the deterioration of the current account balance. It also leads to the growth in the country's external debt stock which could result into a debt crisis. (Easterly and Schmidt-Hebbel, 1993; IMF, 1995).

Financing the deficit through foreign aid could also have its own negative effects on other macroeconomic variables. This channel of financing could create effects similar to the Dutch disease[1]. This happens if windfall of resources denoted in foreign currency (foreign aid) lead to the appreciation of the exchange rate making the country's exports less competitive or lead to resources moving away from the production of tradables to the production of non-tradables. (Herr and Priewe, 2005; Brownbridge and Mutebile, 2007).

In Uganda the deficit is financed from both external and internal sources with external sources financing the largest proportion (figure 2). External financing is largely in form loans and grants. Grants come in form of budget or project support from bilateral and multilateral donor governments and agencies. Domestic sources include mainly bank financing and the sale of government securities.

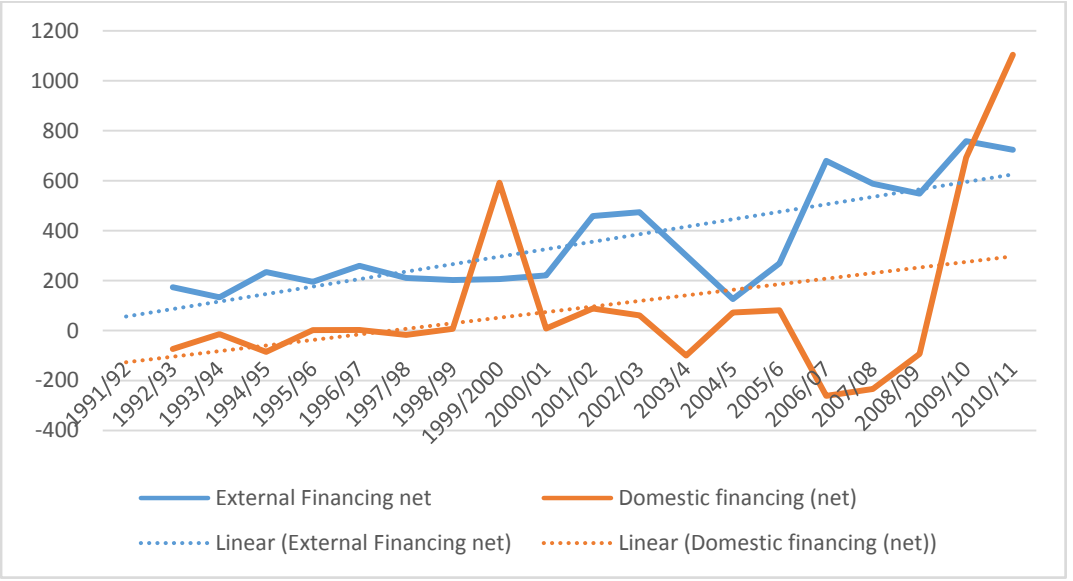

Figure 2: Comparing Domestic and External Deficit Financing (SHS Billions)
Source: MoFPED (2012)

The figure 2 shows that domestic financing of the deficit has generally been lower than foreign financing apart from the year 1999/2000 and after 2009/10. From 2008/9 domestic financing of the budget deficit surges and rises above the external financing. This surge in domestic financing may be explained by the increased spending resulting from international financial crisis and the financing of the 2010/11 parliamentary and presidential elections.

The result of the increasing budget deficit expenditure from the external financing

channel can be seen from the increase in Uganda's external debt stock which has more than doubled from about 1,280 million dollars in 2006/08 to about 3,109 million US dollars in 2011/12. (Figure 4).

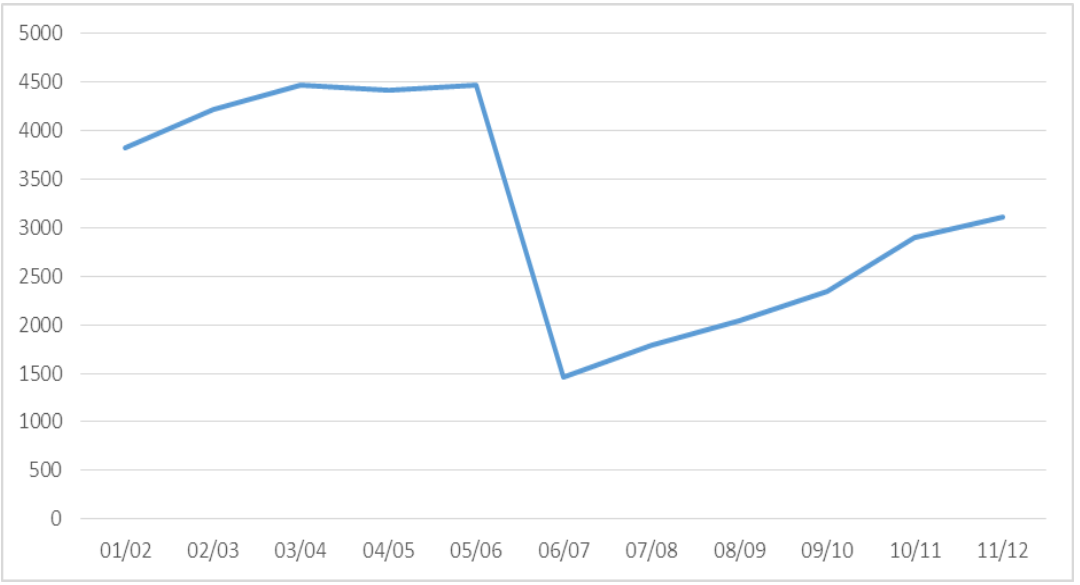

Figure 3: Total External Debt Stock (end of Period) Millions US Dollars
Source: Bank of Uganda (2012)

Figure 3 shows that Uganda carried a large stock of external debt of about 4,464 million US dollars up to 2006. Owing to debt forgiveness through the High Indebted Poor Countries initiative (HIPC) and the Multi-lateral Debt Relief Initiative (MDRI), Uganda's external debt stock was reduced to manageable levels of about 1,280 million US in 2006/07. However, due to increasing government expenditure, Uganda's external debt stock has steadily been rising ever since.

Effects of the budget deficit can also depend on the type of the sectors the government decides to spend on. For example, budget deficits can have positive macroeconomic effects in the long run if it is used to finance extra capital spending that leads to an increase in the stock of national assets. Increased spending on the transport and power infrastructure improves the supply-side capacity of the economy promoting long-run growth; for example, increased government investment in education and health can bring positive effects on labour productivity and employment. However, wasteful spending such as excessive government expenditure on official travels and conferences might not contribute much to economic growth and development.

In Uganda government expenditure can be broken down into; (1) Recurrent Expenditures which includes wages and salaries, interest payments, transfers to the Uganda Revenue Authority, (2) Development expenditure both external and domestic, (3) Lending and investment and; (4) Other expenditures which include, pensions, defence, other recurrent ministries and district recurrent expenditures.

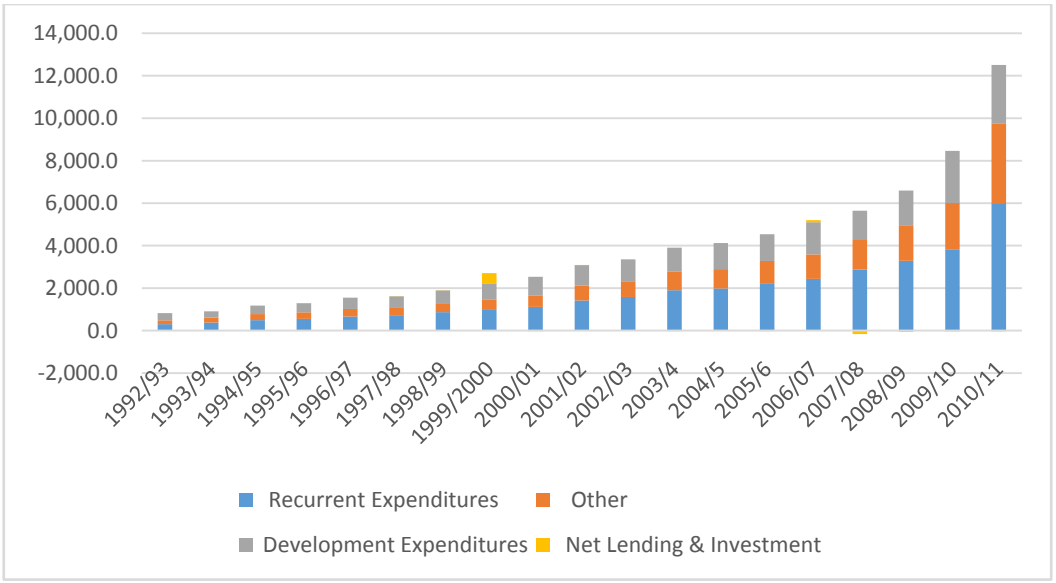

Figure 4: Government Expenditure (billions of Shillings) from 1992/93 to 2010/11
Source: MoFPED (2012)

From Figure 4 we see that the recurrent and development expenditures were almost equal from the early 1990s to 2000. However, the gap between the two has consistently been widening since 2001. The increase in recurrent expenditure above development expenditure is due to an increase in government wages and salary payment (figure 5) which may be attributed to government policies of Universal Primary and Secondary education which saw an increase in teacher recruitment by government. This increase may also be explained by government's policy of decentralisation which has seen the increase in the number of districts from about 56 in 2000 to 112 in 2011. This increase in the number of districts corresponds with an increase in the number of civil servants and hence a higher wage and salary bill as well an increase other administrative costs.

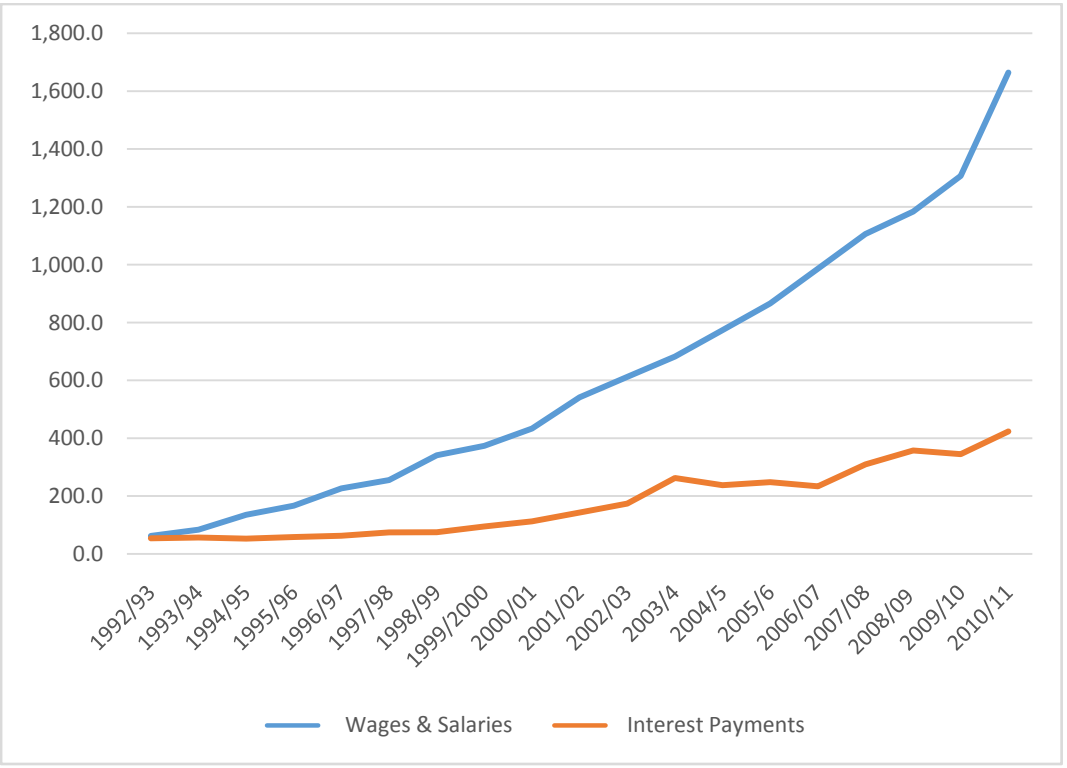

Figure 5: Recurrent Expenditure Trends (Billions of Shillings)
Source: MoFPED (2012)

2 Literature Review

2.1 Theoretical Literature

There are a number of approaches that attempt to explain the relationship between budget deficits and other major macroeconomic variables such as interest rates, GDP growth, current account balance, exchange rates, inflation etc. these include; the neoclassical theory, the Keynesian and the Ricardian theory.

The standard neoclassical model, first assumes that the consumption of each individual is determined as the solution to an inter-temporal optimization problem, where both borrowing and lending are permitted at the market rate of interest. Secondly, it assumes that each consumer belongs to a specific cohort or generation, and the lifespans of successive generations overlap. Thirdly the market is assumed to clear in all periods (Bernheim, 1989). This set-up implies that budget deficits will raise current expenditure and for the case of a closed economy under full employment, increased expenditure will translate into high interest rates, reduced national savings and a reduction in future investment. Consequently budget deficits crowd out investment leading to reduced future capital formation. In the case of a small open economy, the increased consumption expenditure has no effect on interest rates in the world markets but may lead to increased foreign borrowing resulting into the appreciation of the local currency and consequently a reduction in export and an increase in imports. This leads to a deterioration of the current

account position (Bernheim 1989; Yellen 1989). According to this theory therefore budget deficits have adverse effects on the economy and thus it advocates for a balanced budget at all times.

The Keynesian paradigm differs from the neoclassical paradigm in that, it assumes the existence of unemployed resources and the existence of credit constrained individuals in the economy (Bernheim, 1989). The Keynesians theory indicates that, an increase in government spending leads to an increase in aggregate demand, which leads to the employment of the redundant resources which subsequently leads to an increase in output (Bernheim, 1989). This paradigm therefore asserts that budget deficits don't necessarily have a detrimental effect to economic growth. Budget deficits can be used to stimulate aggregate demand during periods of economic downturns thereby shortening the recovery period. The Keynesian view recommends that budget management should follow anti cyclical economic conditions. This implies that during periods of recession, the government should run a deficit to stimulate aggregate demand whereas during periods of economic boom government should pursue a surplus budgetary policy.

Lastly, the Ricardian view asserts that budget deficits have no impact on economic growth and development. According to this theory, an increase in government debt as a result of the deficit will imply future taxes with a present value equal to the value of the debt. Therefore, rational agents should recognize this equivalence and proceed as if the debt did not exist, resulting in the debt having no effects on economic activity (Seater, 1993; Bernheim, 1989).

2.2 Empirical Literature

In the empirical literature, the popular exposition is that budget deficits are inflationary. Various studies have explored the causal relationship between budget deficits and inflation. The results have been invariably mixed. Catão and Terrones (2005) find a strong link between fiscal deficits and inflation using a sample of 107 countries over the period 1960 to 2001. Their results show that, a 1 percent reduction in the ratio of the budget deficit to GDP is associated with an 8.75 percent lower inflation rate. Lin and Chu (2013) employ a dynamic panel quantile regression (DPQR) regression models following the ARDL regime to examine the extent to which fiscal deficits are inflationary in 91 countries between 1960 and 2006. Their findings show that fiscal deficits are inflationary only in high inflation countries. This finding is consistent with earlier work by De Haan and Zelhosrt (1990). Easterly and Schmidt-Hebbel (1993), analyse data from a sample of 10 countries and find strong evidence that over the medium term, money financing of the deficit leads to higher inflation, while debt financing leads to higher real interest rates or increased repression of financial markets. Makochekanwa (2008), finds a significant positive impact of budget deficit on inflation in Zimbabwe for the period 1980 to 2005. He also finds a stable long run relationship between the budget deficit, exchange rate, GDP and inflation.

On the other hand, Ndashau (2012) uses Granger causality techniques, augmented by vector error correction modelling, to highlight the existence of a causality effect from inflation to budget deficits scaled by the money base. However, the effect of budget deficits on inflation was not statistically significant. Georgantopoulos and Tsamis, (2011), investigate the casual link between budget deficit and other macroeconomic variables (Consumer Price Index (CPI), Gross Domestic Product (GDP) and Nominal Effective Exchange Rate) for Greece during the period 1980-2009. Their findings reveal no link

between the budget deficit and CPI but they find casual links between budget deficit and GDP and Nominal Effective Exchange Rate.

Mugume and Obwona (1998) examined the interaction between fiscal deficits and other macro-level variables for Uganda in the post reform period. Their results show that the unsustainability of the budget deficit has implications for public, external and monetary sectors. In particular, they found a negative relationship between fiscal deficits and economic growth. Also they reveal that fiscal deficit is linked to inflation, exchange rate depreciation and the widening of current account deficit. On the other, Odhiambo et al. (2013), find a positive relationship between budget deficits and economic growth in Kenya for the period 1970 to 2007. Buscemi and Yallwe, (2012) using GMM technique, find that fiscal deficit results are significant and positively correlated to economic growth and saving in China, India and South Africa. However, the authors reveal that real interest rates are negatively and significantly correlated with economic growth and saving. The main conclusion by the authors is that, fiscal deficit affects the economic growth and saving through the means financing the deficit. Additionally, Keho (2010), investigates the causal relationship between budget deficits and economic growth for seven West African countries over the period 1980-2005. The author finds mixed results[4] with three out of the seven countries showing no evidence of causality, one showing a unidirectional causality running from deficit to growth and the rest showing two-way causality between budget deficits and economic growth.

Basu and Datta (2005), studied the impact of the fiscal deficit on India's external accounts since the mid-1980s. They find no evidence to support neither the twin deficit nor the Ricardian hypothesis. The twin deficit hypothesis asserts that a budget deficit causes a trade deficit/current account deficit and the Ricardian Equivalence Hypothesis (REH) that rejects any possible relationship between these two deficits. They find no cointegration between the two deficits hence disqualifying the twin deficit hypothesis and no cointegration between the savings rate and the fiscal deficit-GDP ratio which negates the REH in Indian circumstances. Also their findings show that ratios of trade deficit, fiscal deficit and net savings randomly maintain the national income identity and that a high fiscal deficit for the case of India has been sustained by a simultaneous and independent increase in the savings ratio.

On the other hand, Akbostancı and Tunç (2002), confirm the twin deficit hypothesis using an error correction model on data from Turkey for the period 1987 to 2001. They conclude that budget deficit do affect the trade deficit. This is consisted with findings from Baharumshah, etal. (2006) who confirm the twin deficits hypothesis for 4 ASEAN countries (Indonesia, Malaysia, the Philippines and Thailand). Baharumshah, etal. (2006) discover an indirect causal relationship running from budget deficit to higher interest rates, and higher interest rates lead to the appreciation of the exchange rate and this leads to the widening of current account deficit. Brownbridge and Mutebile (2007) analyse the impact of an increase in the fiscal deficit on macroeconomic policy management and the fiscal sustainability. They argue that aid funded deficits may have effects akin to the Dutch disease through the appreciation of the exchange rate with adverse effects for export

[4]Benin, Burkina Faso and Mali showed no evidence of causality between deficit and growth, Niger showed a unidirectional causality running from deficit to growth while Benin, Burkina Faso and Mali showed a two-way causality between deficit and growth.

sector competitiveness. Vuyyuri and Seshaiah (2004), study the interaction of budget deficit with other macroeconomic variables (Nominal effective exchange rate, GDP, Consumer Price Index and money supply) for India, using Cointegration approach and Variance Error Correction Models (VECM) for the period 1970-2002. They find the variables to be cointegrated. Also they find a bi-directional causality between budget deficit and nominal effective exchange rates. But they find no significant relationship between budget deficit and GDP, Money supply & consumer price index. They also observe that the GDP Granger causes budget deficit.

Aisen and Hauner (2008), find a significant and positive relationship between budget deficits and interest rates using a panel dataset of 60 advanced and emerging economies. They also find that the effects of budget deficits on interest rates varied by country group and period. Their findings show that the effects were larger and more robust in the emerging markets and in later periods than in the advanced economies and in earlier periods. They further found that the effect of budget deficits on interest rates depends on interaction terms and is only significant under one of several conditions such as if one size of the deficits, source of deficit financing (mostly domestically financed), or interact with high domestic debt; financial openness is low; interest rates are liberalized; or financial depth is low. Uwilingiye and Gupta, (2007), investigate the direction of temporal causality between budget deficit and interest rate for South Africa using quarterly and annual data for the period of 1961 to 2005, find that budget deficit Granger causes interest rate in the quarterly data. However, for the annual data, they find no causal relationship between the budget deficit and the Treasury bill rate. The two variables are positively cointegrated for both data frequency. Similarly Bonga-Bonga (2011), investigates the extent of the effects of the systematic and surprise changes in budget deficits on the long-term interest rate in South Africa using vector autoregressive (VAR) techniques. He finds a positive relationship between the budget deficits and long-term interest rates. On the other hand, Akinboade (2004), using the LSE approach and Granger-causality methods, finds no relationship between the budget deficit and interest rates in South Africa.

In conclusion, the review of empirical literature on the relationship between budget/fiscal deficits and other macroeconomic variables gives quite mixed results with some studies showing no relationship between budget deficits and other macroeconomic variable, some confirming that indeed budget deficits affect all or some macroeconomic variable and not others. This emphasizes the discussion in section 1 which pointed out that the effects of budget deficits on the economy depend on the financing source and the expenditure patterns. This implies that the relationship between budget deficits and other macroeconomic variables is case/country specific and depends on a number of conditions like source of deficit financing and expenditure pattern, size of the deficit etc.

3 Methodology, Data and Empirical Model

3.1 Methodology

In modelling the relationship between budget deficits and the macro - economy, we follow the seminal work of Bernheim (1989) who considered and critiqued three theories, namely: the neoclassical theory, the Keynesian and the Ricardian theory noted earlier. Generally, economic theory provides two alternative hypotheses that can explain the

relationship between budget deficits and the economy. First, the twin deficit hypothesis that asserts that a budget deficit causes a trade deficit/current account deficit. Secondly the Ricardian Equivalence Hypothesis (REH), which rejects any possible relation between these two deficits (Suparna and Debabrata, 2005).
The twin deficit hypothesis can be derived from the National accounting identity of an open economy given by the following expression.

$$Y = C + I + G + (X - M) \tag{1}$$

From equation 1, Y represents National Income or GDP, I is investment, C is private consumption, G is government spending and X-M stands for net exports (exports minus imports). In the case of a closed economy the National accounting model is defined by the following expression.

$$Y = C + S + T \tag{2}$$

From equation 2, Y represents National Income or GDP, C is private consumption, S is savings, and T is taxes.
To model the relationship between budget deficits and selected macroeconomic variable, we proceed by subtracting equation 1 from 2, which yields equation 3 given as;

$$(S - I) + (T - G) = (X - M) \tag{3}$$

From equation 3, assuming an economy is already at optimum output where Y is fixed, this implies that if the deficit (T-G) increases, and savings (S) remains the same, then either investment (I) must fall (crowding out effect), or net exports (X-M) must fall, which will cause a trade deficit. From equation 3 it can be observed that that effect of the deficit will depend on the source of financing i.e., if the deficit is financed by external sources, the current account balance will deteriorate and if its financed domestically it may cause a crowding out effect in an economy at or near full employment.
Following the Keynesian theory, an increase in budget deficit could lead to an increase in output and, therefore, an increase in income. Increased incomes could increase the demand for imports thereby creating or widening the trade balance. Further still, the deterioration of the current account balance could manifest from an increase in interest rates resulting to fiscal deficit by raising the level of aggregate demand. An increase in domestic interest could induce an increase in capital inflow resulting into the appreciation of the domestic currency. The appreciation of the exchange rate will have adverse effect on the exports thereby affecting the current account balance. On the other hand, the Ricardian equivalence Hypothesis (REH) rejects the twin deficit hypothesis and asserts that there is no causal link between fiscal deficit and the current account deficits.
Following Catão and Terrones (2005) we posit that government spending, G, is financed by the extent of domestic tax collection, T, such that

$$G_t = T_t \tag{4}$$

Equation 4 assumes that Governments run balanced budgets. In reality, however, government tax revenues quite often may not be sufficient to finance Government

expenditure as is the case in Uganda. In such circumstances, government expenditure may be financed by issuance of bonds (B), reduction of international asset holdings (A) or by printing money (M). Governments also receive grants, but these are excluded from our discussion because they are usually not reliable as they are granted on the basis of donor discretion.

$$G_t - T_t = B_t + A_t + M_t \tag{5}$$

Equation 5 can be modified, following the work of Catão and Terrones (2005) who modelled the Government budget deficit as

$$\frac{B_{t+1}^G}{R_t^*} = T_t + B_t^G - G_t + \frac{M_{t+1} - M_t}{P_t} + A_t \tag{6}$$

In Equation 5 above, B_t^G is Government net assets at time t, M_t is the currency in circulation, T_t is tax revenue, G_t is Government expenditure and R^* is the international real Interest rate.
Re-arranging the equation above yields the budget deficit defined by equation 7 below

$$G_t - T_t + \frac{B_{t+1}^G}{R_t^*} = B_t^G + \frac{M_{t+1} - M_t}{P_t} + A_t \tag{7}$$

The left hand side of Equation 7 is the total government deficit and it includes the budget deficit $G_t - T_t$ and the real net Government assets. The right hand side comprises the means of financing the budget deficit that include Government debt instruments such as bonds

B_t^G, real money supply, $\frac{M_{t+1} - M_t}{P_t}$ and reserves, A_t.

Equation 7 above can be expressed as a general equation in 8 below:

$$G_t - T_t = f(B_t^G, M_t, A_t) \tag{8}$$

If we express equation 8 above in a VAR framework we can allow budget deficits to influence and be influenced by other macroeconomic variables. This study expands this theoretical framework using a VECM approach to investigate the relationship between fiscal deficits, inflation, lending rates, current account balance and Gross Domestic Product, and investigate the general relationship using the following expression.

$$(G_t - T_t) = f(INF_t, LR_t, CAB_t, GDP_t) \tag{9}$$

3.2 The Empirical Model

We adopt an econometric methodology (Vector Error Model (VECM)), similar to one used by Georgantopoulos and Tsamis (2011) and Vuyyuri and Sesahiah (2004) when investigating the Macroeconomic Effects of Budget Deficits in Greece and India respectively. We are interested in finding out whether a long-run relationship exists between budget deficits the macroeconomic variables.
The VAR model is specified below,

$$LBD = \beta_0 + \sum_{j=1}^{n} \beta_{1j} LBD_{t-j} + \sum_{j=1}^{n} \beta_{2j} LLIR_{t-j} + \sum_{j=1}^{n} \beta_{3j} INFLATION_{t-j} + \sum_{j=1}^{n} \beta_{4j} LCAB_{t-j} + \sum_{j=1}^{n} \beta_{5j} LGDP_{t-j} + \varepsilon_{1t} \quad (10)$$

From Equation 10, LBD is the natural log of Budget Deficit, LCAB is the natural log of Current Account Balance, LLIR is the natural log of Lending Interest Rates, INFLATION represents Inflation and LGDP is the natural log of Gross Domestic Product.
We then estimate the Vector Error Correction Model (VECM) for all the endogenous variables in the model and use it to carry out tests such as Granger causality tests over the short and long run.
The VECM estimated equation is as follows,

$$\Delta LBD = \sum_{j=1}^{n} \beta_{1j} \Delta LBD_{t-j} + \sum_{j=1}^{n} \beta_{2j} \Delta lLIR_{t-j} + \sum_{j=1}^{n} \beta_{3j} \Delta INFLATION_{t-j} + \sum_{j=1}^{n} \beta_{4j} \Delta lCAB + \sum_{j=1}^{n} \beta_{5j} \Delta LGDP_{t-j} + \beta_8 D_t + \alpha_1(\delta_0 LBD_{t-j} + \delta_1 LLIR_{t-j} + \delta_2 INFLATION_{t-j} + \delta_3 LCAB_{t-j} + \delta_4 LGDP_{t-j} + \varepsilon_{1t} \quad (11)$$

From Equation 11, $\beta_8 D_t$ is a vector of exogenous variable (intercept).

3.2 Empirical Strategy

We start by determining the stationarity properties of the univariate time series to avoid spurious regressions. We use the Augmented Dickey-Fuller (ADF) (Dickey and Fuller, 1979) and the Phillip Perron (PP) tests to test for unit roots of the time series variables.
Once we have determined that the variables are non-stationary and are integrated of order 1 {I(1)} we then examine the time series for co-integration using the Johansen (1988) cointegration test. Cointegration analysis helps to identify long-run economic relationships between the variables. We then use the FPE: Final prediction error, AIC: Akaike information criterion, SC: Schwarz information criterion and the HQ: Hannan-Quinn information criterion criteria to determine the number of lags in the cointegration test (order of VAR) and then use the trace and maximal eigenvalue tests to determine the number of cointegrating vectors present. We then estimate the Vector Error Correction Model (VECM) for all the endogenous variables in the model and use it to carry out tests such as Granger causality tests over the short and long run.
Furthermore, we carry out pairwise granger causality and variance decomposition tests to further understand the interactions of the variables.

3.3 Data and Time Series Properties

This study employs quarterly data for the period 1999 to 2011. Fiscal Deficit (BD) data is obtained from the Ministry of Finance Planning and Economic Development (MoFPED). Current account deficit (CAB), Inflation (INFLATION), Lending Interest Rates (LIR) statistics are obtained from the Bank of Uganda and Gross Domestic Product (GDP) figures are obtained from the Uganda Bureau of Statistics (Annex 1). The data in converted into natural logarithms.

From the summary statistics we note that the means of the variables are close to one another and the differences between the minimum and maximum values also appear to be very small affirming these small variations. Most of the variables are not normally distributed, with Skewness below 1 and Kurtosis is less than 3 (Annex 2).

Time series plots of level variables, reveal that over time the fiscal deficit has been widening, INFLATION, and LGDP generally exhibits upward trends, lending interest rates are generally stable, while the current account has been widening. LBD exhibits a widening trend implying that over time government expenditure has been increasingly exceeding government revenue (Annex 3). Annex 4 shows the correlation matrix between the variables with LBD being negatively correlated with LLIR and positively correlated with INFLATION, LCAB and GDP.

4 Results and Discussion

This section presents both the descriptive and empirical findings of the study. Table 1 presents the estimates of the Augmented Dickey – Fuller (ADF) and the Phillip-Perron (PP) tests in levels and in first differences of the data without an intercept or trend, with an intercept and trend, and with an intercept. The tests have been performed on the basis of 5 percent significance level, using the McKinnon Critical Values. Results show that at 1st differences all series are consistently stationary but at levels there a mixed pattern arises.

Table 1: Unit root test results for variables in level and 1st difference

	Phillip-Perron (PP) tests						Augmented Dickey-Fuller (ADF)					
	Exogenous: None		Exogenous: Constant, Linear Trend		Exogenous: Constant		Exogenous: None		Exogenous: Constant, Linear Trend		Exogenous: Constant	
Variable	t-Stat.	Order	t-Stat.	Order	t-Stat.	Order	t-Stat.	Order	t-Stat.	Order	t-Stat.	Order
LBD(-1)	-1.6	I(1)	-7.0	I(0)	-5.6	I(0)	0.0	I(1)	-5.7	I(0)	-5.6	I(0)
LCAB(-1)	-0.3	I(1)	-5.6	I(0)	-3.7	I(0)	1.5	I(1)	-1.6	I(1)	0.4	I(1)
LGDP(-1)	3.2	I(0)	-5.8	I(0)	-1.2	I(1)	5.0	I(0)	-4.1	I(0)	-1.6	I(1)
LLIR(-1)	-0.3	I(1)	-2.8	I(0)	-2.8	I(0)	-0.4	I(1)	-2.8	I(0)	-2.8	I(0)
INFLATION(-1)	-0.6	I(1)	-2.6	I(0)	-2.2	I(0)	1.0	I(1)	-5.5	I(0)	-0.6	I(1)
1ST DIFFERNCES												
D(LBD(-1))	-9.9	I(1)	-9.7	I(1)	-9.8	I(1)	-6.7	I(1)	-6.5	I(1)	-6.6	I(1)
D(LCAB(-1))	-11.6	I(1)	-11.5	I(1)	-11.5	I(1)	-10.9	I(1)	-11.5	I(1)	-11.1	I(1)
D(LGDP(-1))	-8.7	I(1)	-12.0	I(1)	-11.9	I(1)	-1.5	I(1)	-12.0	I(1)	-11.9	I(1)
D(LLIR(-1))	-8.6	I(1)	-8.5	I(1)	-8.6	I(1)	-8.6	I(1)	-8.6	I(1)	-8.6	I(1)
D(INFLATION(-1))	-3.7	I(1)	-3.6	I(1)	-3.6	I(1)	-5.9	I(1)	-5.7	I(1)	-4.9	I(1)

We estimate a VAR with an arbitrary lag length, and then check for appropriate lag length. Based on the LR: sequential modified LR test statistic (each test at 5% level), FPE: Final prediction error, SC: Schwarz information criterion and the AIC: Akaike information

criterion, the appropriate lag length is 2 (Annex: 5).
We then estimate the VAR with the appropriate lag length of 2 and test to see if the VAR that we worked with so far fulfils the diagnostic tests for normality, serial correlation, stability etc.
The VAR fulfils the stability condition since no root lies outside the unit circle (Annex 6). Diagnosis of residual terms results in Annex 7 confirm that residual are normally distributed and from the LM test, the probability values allow us to accept the null hypothesis that there is no serial correlation in the model (Annex 8).

Table 2: Johansen Cointegration Test, Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value
None *	0.482634	88.90314	88.80380	0.482634	30.97326	38.33101
At most 1	0.443237	57.92989	63.87610	0.443237	27.52396	32.11832
At most 2	0.293402	30.40592	42.91525	0.293402	16.32280	25.82321
At most 3	0.183179	14.08312	25.87211	0.183179	9.509735	19.38704
At most 4	0.092722	4.573386	12.51798	0.092722	4.573386	12.51798

* denotes rejection of the hypothesis at the 0.05 level

From the Johansen cointegration test above, the number of cointegrating relationships implied by trace test and maximum eigenvalue test are different. Trace test indicates the presence of one cointegrating equation while maximum eigenvalue test indicates none. However, because of the high power of trace test over maximum eigenvalue test, the existence of one cointegrating relationships is accepted.

4.1 Estimated Results

VECM results show that budget deficits in Uganda depend on the inflation both in the short and long-run. Results from Table 3 reveal that there is a unidirectional causal relationship between the current account deficit and budget deficits running from budget deficits to CAB. This implies that budget deficits in Uganda cause current account deficit confirming the twin deficit hypothesis discussed in the literature. Table 3 results further show a unidirectional causal relationship between budget deficits and lending interest rates running from BD to lending interest rates. This implies that government deficit spending leads to higher lending interests in Uganda. The results also show a unidirectional causal relationship between budget deficits and inflation running from Inflation to BD. This implies that an increase in inflation reduces the deficit. Note that this finding is contrary to theory. As we noted earlier, literature asserts that budget deficits cause inflation and not the other way round. This observed relationship could imply that in the short-run inflation increases government revenue through the inflation tax thereby reducing the deficit.
However, the Table 3 results show no causal relationship between GDP and budget deficits in Uganda. We note from Table 3 that the error correction term for the budget

deficit is -0.71 and is statistically significant, implying that 71 percent of the deviation from the long-term equilibrium is corrected in every period.

Table 3: Granger Causality using VECM

Error Correction:	D(LBD)	D(LCAB)	D(LGDP)	D(LLIR)	D(INFLATION)
CointEq1	-0.713319	-0.070835	0.001759	-0.009941	1.299624
	(0.16661)	(0.11054)	(0.00633)	(0.00791)	(0.34835)
	[-4.28128]	[-0.64078]	[0.27806]	[-1.25603]	[3.73084]
D(LBD(-1))	-0.173629	0.381752	-0.006235	0.019481	-0.623383
	(0.16603)	(0.11016)	(0.00630)	(0.00789)	(0.34713)
	[-1.04575]	[3.46548]	[-0.98918]	[2.47001]	[-1.79582]
D(LCAB(-1))	-0.012370	-0.300233	0.002945	-0.000775	-0.552483
	(0.18735)	(0.12430)	(0.00711)	(0.00890)	(0.39170)
	[-0.06603]	[-2.41536]	[0.41403]	[-0.08714]	[-1.41049]
D(LGDP(-1))	-0.300248	-0.074566	-0.193179	-0.299613	-5.625732
	(4.19980)	(2.78648)	(0.15945)	(0.19950)	(8.78071)
	[-0.07149]	[-0.02676]	[-1.21151]	[-1.50180]	[-0.64069]
D(LLIR(-1))	2.436549	-3.217515	-0.060137	-0.207972	3.282516
	(2.96024)	(1.96406)	(0.11239)	(0.14062)	(6.18910)
	[0.82309]	[-1.63820]	[-0.53507]	[-1.47897]	[0.53037]
D(INFLATION(-1))	-0.215353	0.022853	0.001842	-0.000569	0.645494
	(0.06165)	(0.04090)	(0.00234)	(0.00293)	(0.12890)
	[-3.49307]	[0.55869]	[0.78698]	[-0.19439]	[5.00780]

4.2 Pairwise Granger Causality Test Results

Pairwise Granger causality tests are employed to further analyze the causal relationships between the selected macroeconomic variable. Results in table 4, show a unidirectional causal relationship from budget deficits to current account balance. This finding implies that budget deficits granger cause the current account deficit in Uganda. The results also show a unidirectional causal relationship between BD and GDP. This finding implies that GDP granger affect causes budget deficits in Uganda. In addition the Table 4 results show a unidirectional causal relationship between inflation and BD, from inflation to BD. Finally the results also show a bi-directional causal relationship between the current account balance and GDP and a unidirectional causal relationship between GDP and Inflation.

Table 4: Pairwise Granger Causality Tests

Null Hypothesis:	Obs	F-Statistic	Prob.	
LCAB does not Granger Cause LBD	46	1.19354	0.3298	Accept
LBD does not Granger Cause LCAB		2.56682	0.0541	Reject
LGDP does not Granger Cause LBD	46	3.85110	0.0103	Reject
LBD does not Granger Cause LGDP		0.32775	0.8575	Accept
LLIR does not Granger Cause LBD	46	1.24394	0.3094	Accept
LBD does not Granger Cause LLIR		1.61447	0.1912	Accept
INFLATION does not Granger Cause LBD	46	2.44783	0.0633	Reject
LBD does not Granger Cause INFLATION		2.01715	0.1121	Accept
LGDP does not Granger Cause LCAB	46	3.22833	0.0228	Reject
LCAB does not Granger Cause LGDP		3.05505	0.0285	Reject
LLIR does not Granger Cause LCAB	46	1.50479	0.2207	Accept
LCAB does not Granger Cause LLIR		1.13961	0.3531	Accept
INFLATION does not Granger Cause LCAB	46	1.63281	0.1866	Accept
LCAB does not Granger Cause INFLATION		1.35740	0.2674	Accept
LLIR does not Granger Cause LGDP	46	0.36402	0.8326	Accept
LGDP does not Granger Cause LLIR		0.67121	0.6161	Accept
INFLATION does not Granger Cause LGDP	46	0.84341	0.5067	Accept
LGDP does not Granger Cause INFLATION		6.33844	0.0005	Reject
INFLATION does not Granger Cause LLIR	46	0.39399	0.8116	Accept
LLIR does not Granger Cause INFLATION		1.36381	0.2652	Accept

4.3 Variance Decomposition Analysis

Tables 5 to 9 present the variance decomposition results. This analysis is employed as additional evidence presenting more detailed information regarding the variance relations between the budget deficits and selected macroeconomic variables. Variance decomposition results (Table 5) show that by the fourth lag period, (which is equivalent to one year since we are using quarterly data), 79.94 percent variance in fiscal deficit is explained by 9.40 percent variance in lending interest rates, 5.01 percent in inflation, 4.03 percent in GDP and by 1.62 percent change in the current account balance. In the tenth period (two and half years), 79.46 percent of the variance in fiscal deficit is explained by 7.52 percent variance in lending interest rates 6.27 percent in inflation, 2.51 percent in the current account balance and 4.25 percent in GDP. This implies that with time, the effect of lending interest rates on fiscal deficit reduces while the effect from inflation, current balance and GDP increases.

Table 5: Variance Decomposition of LBD:

Period	S.E.	LBD	LCAB	LGDP	LLIR	INFLATION
1	1.16	100.00	0.00	0.00	0.00	0.00
2	1.25	92.05	0.45	3.36	0.55	3.59
3	1.42	79.04	1.24	3.70	11.30	4.71
4	1.57	79.94	1.62	4.03	9.40	5.01
5	1.70	79.92	1.43	4.34	9.15	5.16
6	1.78	77.33	2.64	4.95	8.38	6.71
7	1.89	77.84	2.45	4.51	7.83	7.38
8	1.98	78.95	2.23	4.39	7.52	6.91
9	2.05	78.99	2.52	4.40	7.56	6.53
10	2.12	79.46	2.51	4.25	7.52	6.27

Table 6 results show that in the fourth period, 74.24 percentage variance in the current account balance is explained by 16.82 percent variance in fiscal deficit, 6.32 percent of the variance in lending interest rates and 1.65 percent variance in inflation. In the tenth lag period, 80.93 percent variance in the current account balance is explained by 12.75 percent variance in budget deficit and 4.44 percent of the variance in lending interest rates. We note that variance in the current account is more explained by the budget deficit followed by lending interests.

Table 6: Variance Decomposition of LCAB

Period	S.E.	LBD	LCAB	LGDP	LLIR	INFLATION
1	0.66	0.08	99.92	0.00	0.00	0.00
2	0.85	15.17	81.14	0.00	3.38	0.31
3	0.92	18.77	72.80	0.94	6.99	0.51
4	0.99	16.82	74.24	0.98	6.32	1.65
5	1.11	15.66	76.81	0.82	5.26	1.44
6	1.14	14.74	77.10	1.55	5.06	1.55
7	1.18	14.02	77.93	1.55	5.01	1.49
8	1.25	13.61	79.24	1.38	4.44	1.33
9	1.31	12.75	80.24	1.45	4.11	1.45
10	1.33	12.21	80.93	1.54	3.94	1.39

Table 7 results show that in the fourth period 77.38 percent variance in GDP is explained by 14.06 percent variance in fiscal deficit, and 4.74 percent of the variance in lending interest rates. In the tenth lag period, 81.07 percent variance in GDP is explained by 12.37 percent variance in budget deficit and 3.39 percent of the variance in lending interest rates. This shows the variance in GDP is more explained by the variance in budget deficit followed by lending interests.

Table 7: Variance Decomposition of LGDP:

Period	S.E.	LBD	LCAB	LGDP	LLIR	INFLATION
1	0.03	18.42	0.25	81.33	0.00	0.00
2	0.03	16.49	1.43	81.78	0.12	0.18
3	0.03	14.16	2.35	78.19	3.14	2.17
4	0.04	14.06	1.92	77.38	4.74	1.91
5	0.04	14.50	1.77	77.49	4.49	1.75
6	0.04	13.72	1.77	78.43	4.37	1.71
7	0.05	13.10	1.58	79.44	4.03	1.85
8	0.05	13.02	1.48	79.80	3.70	2.00
9	0.05	12.73	1.35	80.38	3.49	2.04
10	0.05	12.37	1.25	81.07	3.39	1.92

Table 8 results show that in the fourth lag period 75.36 percent variance in lending interest rates is explained by 12.21 percent variance in inflation, 9.00 percent variance in GDP, 2.88 percent variance in fiscal deficit, and only 0.55 percent variance in the current account balance. In the tenth lag period, 70.11 percent variance in lending interest rate is explained by 16.64 percent variance in inflation, 9.78 percent variance in GDP, 2.13 percent variance in budget deficit and 1.33 percent of the variance in current account balance. We note that variance in lending interest rates is mostly explained by inflation followed by GDP and less by budget deficits and the current account balance.

Table 8: Variance Decomposition of LLIR

Period	S.E.	LBD	LCAB	LGDP	LLIR	INFLATION
1	0.05	0.03	0.39	0.02	99.56	0.00
2	0.07	3.78	0.53	6.43	88.11	1.15
3	0.08	2.71	0.46	9.49	82.08	5.26
4	0.09	2.88	0.55	9.00	75.36	12.21
5	0.11	2.38	0.54	8.55	72.51	16.02
6	0.12	2.29	0.92	8.90	69.88	18.02
7	0.13	2.09	1.18	9.20	69.40	18.14
8	0.14	2.14	1.27	9.51	69.24	17.83
9	0.15	2.14	1.31	9.67	69.73	17.16
10	0.15	2.13	1.33	9.78	70.11	16.64

In addition, Table 9 results show that in the fourth lag period 59.34 percent variance in inflation is explained by 25.54 percent variance in lending interest rates, 11.72 percent variance in current account, 3.26 percent variance in GDP and only 0.13 variance in fiscal deficit. In the tenth lag period, 56.18 percent variance in inflation is explained by 24.54 percent variance in lending interest rates, 15.88 percent variance in current account balance, 3.26 percent variance in GDP and only budget deficit and 0.14 percent of the variance in fiscal deficit. Note that, variance in the Inflation is mostly explained by variance in lending interest rates followed by the current account balance, GDP and lastly by the budget deficit.

Table 9: Variance Decomposition of INFLATION

Period	S.E.	LBD	LCAB	LGDP	LLIR	INFLATION
1	2.23	0.06	1.52	0.14	6.95	91.33
2	3.74	0.10	4.77	0.84	16.61	77.68
3	4.83	0.08	8.45	2.45	22.81	66.21
4	5.29	0.13	11.72	3.26	25.54	59.34
5	5.42	0.16	13.93	3.43	26.04	56.43
6	5.53	0.15	14.92	3.31	25.23	56.40
7	5.62	0.15	15.09	3.29	24.40	57.07
8	5.66	0.15	15.26	3.37	24.11	57.12
9	5.68	0.15	15.60	3.36	24.23	56.68
10	5.78	0.14	15.88	3.26	24.54	56.18

5 Conclusion and Policy Implications

The study has provided evidence on the causal relationships between budget deficits and other macroeconomic variables (inflation, GDP, lending interest rates and the current account balance) using the Vector Error Correction Model (VECM), Variance Decomposition and Granger Causality techniques on quarterly data for the period 1999 to 2011 for Uganda. The VECM results reveal a unidirectional causal relationship between the current account deficit and budget deficits running from budget deficits to CAB, a unidirectional causal relationship between budget deficits and inflation running from Inflation to BD, and unidirectional causal relationship between budget deficits and lending interest rates running from BD to lending interest rates. However, the VECM results show no causal relationship between GDP and budget deficits in Uganda.

In addition, results from the Pairwise Granger Causality test reveal a unidirectional causal relationship from budget deficits to current account balance affirming the twin deficit hypothesis and rejecting the Ricardian Equivalence Hypothesis. Also, the results also show a unidirectional causal relationship between BD and GDP, running from GDP to budget deficit. The results also indicate a unidirectional causal relationship between inflation and BD, from inflation to BD; and a bi-directional causal relationship between the current account balance and GDP. Finally the results show a unidirectional causal relationship between GDP and Inflation.

Variance decomposition results show that in a period of one year, 79.94 percent variance in fiscal deficit is explained by 9.40 percent lending interest rates, 5.01 percent inflation, 4.03 percent GDP and only 1.62 percent by the current account balance. And in two and half years, 79.46 percent of the variance in fiscal deficit is explained by 7.52 percent variance in lending interest rates 6.27 percent inflation, 2.51 percent current account balance and 4.25 percent GDP. The results further show that, variances in the current account balance and GDP are mostly explained by the budget deficit followed by lending interests while variance in lending interest rates is mostly explained by inflation followed by GDP, variance in the Inflation is mostly explained by variance in lending interest rates followed by the current account balance.

5.1 Policy Considerations

The results from the study clearly show that budget deficits in Uganda are responsible for widening the current account deficit and rising interest rates. An ever widening current account deficit is not desirable and it could be recipe for disaster if it reaches unsustainable levels. A current account deficit is unsustainable if it cannot be financed on a lasting basis with market-based capital inflows, it's not consistent with adequate growth, price stability and the country's ability to service fully its external debt obligations, (IMF, 1995). Similarly, high interest rates crowd out the private sector and thus negatively affect national savings and investment. It is therefore necessary for the government to reduce the size of the budget deficit to a level that won't affect other macroeconomic variables through fiscal consolidation and boosting domestic production.

Fiscal consolidation is a policy aimed at reducing government deficits and debt accumulation. For Uganda the policy should focus on both short term and long term measures. In the short term the government should aim at gradually reducing the budget deficit (especially after the recent indications from donors to suspend development aid), by raising domestic revenue mobilization. Uganda's tax to GDP ratio has stagnated between 11 and 13 percent since 1996 yet government spending has continued to grow. Financing of the growing expenditure has therefore been through foreign aid and government borrowing both externally and internally. This as we have noted, has had negative consequences. In order to mitigate the above consequences, government should institute actions that increase its revenue collection. Such actions should aim at increasing Uganda's tax revenue collection by adopting efficient and effective methods of tax collection. Such measures include but are not limited to the following;

1. Reducing the size of the informal sector which has proved hard to tax.
2. Reducing unproductive tax exemptions.
3. Government should improve and heighten its efforts in combating tax evasion.
4. Combating corruption which undermines tax collection efforts.

On the expenditure side, government should reduce its overall recurrent expenditure bill, this could be done by revising the administrative structures created under its decentralization plan. **Decentralization;** in order improve service delivery, the Ugandan government undertook an aggressive decentralization plan which has seen the creation of number of new districts as noted in section 1. This rapid growth in the number of districts has seen increase in administrative costs. Government should revisit this plan reduce the number of districts to manageable levels. A reduction of the number of districts should be complimented by a reduction in the size parliament and cabinet.

Revisiting the funding of Universal primary and secondary school; the abolition of tuition in UPE and USE programs has increased governments wage bill in form of salary payments to teachers. (Note that, although the total wage bill is huge, individual teacher's salaries are very small and thus a constant cause for strikes). To ensure future sustainability of these programmes therefore, government needs to revise the funding paradigm to include a component of parents' contribution to the education of their children.

Boosting production and export base; there is also need for government to pursue policies that will boost the production goods for both domestic consumption and export in the long run. A combination of import substitution and export promotion strategies will reduce the reliance on consumption of imported goods as well as boost Uganda's export base and revenues thereby lowering the current account deficit. In this respect, Uganda

should endeavor to increase agricultural production where it has a competitive advantage as well as value addition through agro processing in the short and medium term. In the long term however, government should focus on policies that increase industrial output especially the production of manufactured goods. Statistics show that share of manufacturing to GDP in Uganda has remained static at less than 10 percent since the 1960s. This has left Uganda reliant on the imports and thus a widening current account deficit.

Uganda should position itself and take advantage of the widening regional and international market resulting from regional integration initiatives as well as international partnerships. This means that Uganda should endeavor to produce quality products at lower costs compared to her neighbours. Lowering the cost of production will make Uganda's exports more competitive. This requires among other things, investing in infrastructure such as roads, railway, energy etc. which would require increased government spending. This means therefore that government should set its priorities right and spend on activities and projects that will result into high economic devidends. In addition, government should engage the private sector through public private partnerships to smoothen the financing of infrastructural projects.

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Appendices

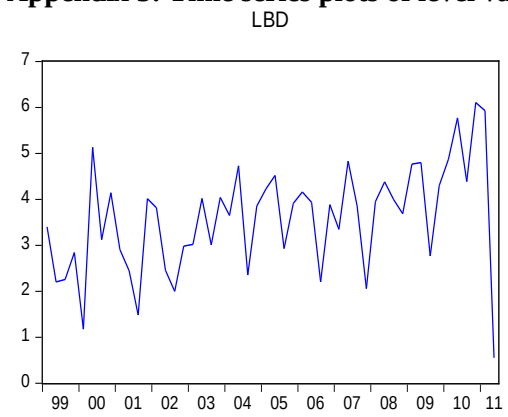
Appendix 1: Data Description and Sources

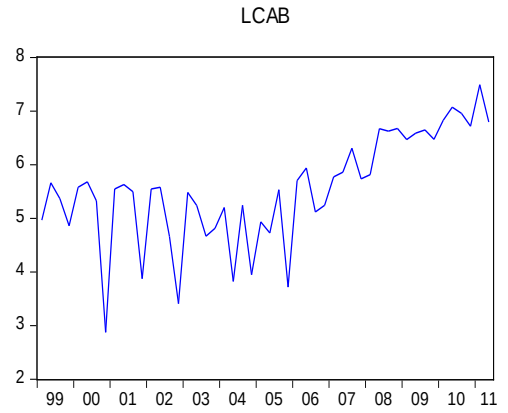
Variable Name	Abbreviation	Description	Data source
Fiscal Deficit	BD	This is the difference between the government expenditure and revenue excluding grants	Ministry of Finance Planning and Economic Development
Current Account Balance	CAB	The sum of the goods account (trade balance), the services account (services net), the income account (income net) and the net current transfers excluding grants.	Balance of Payments Statement - Bank of Uganda
Lending Interest Rates	LIR	Weighted Average commercial bank lending interest rates.	Bank of Uganda
Inflation	INFLATION	Annual headline inflation.	Bank of Uganda
Gross Domestic Product	GDP	This GDP at constant prices.	Uganda Bureau of Statistics

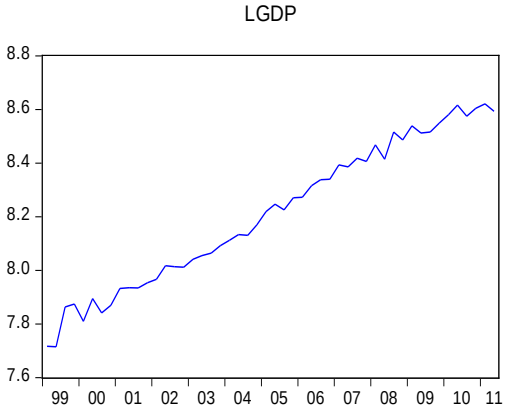
Appendix 2: Summary Statistics, using the observations 1999:1 - 2011:2

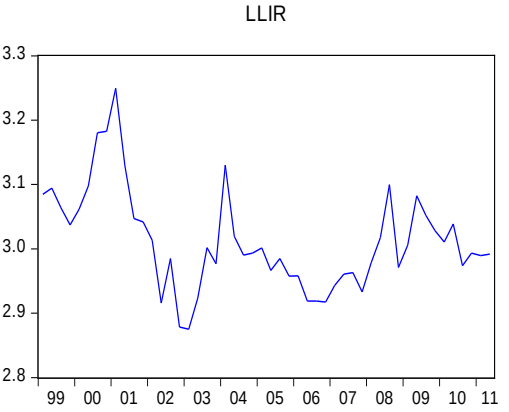
	LBD	LCAB	LGDP	LLIR	INFLATION
Mean	3.582	5.537	8.211	3.013	6.405
Median	3.851	5.562	8.222	2.998	6.329
Maximum	6.105	7.489	8.620	3.249	15.265
Minimum	0.549	2.871	7.715	2.875	-4.281
Std. Dev.	1.186	1.005	0.271	0.078	4.640
Skewness	-0.219	-0.465	-0.061	0.791	-0.092
Kurtosis	2.944	3.024	1.742	3.706	2.712
Jarque-Bera	0.404	1.800	3.326	6.251	0.243
Probability	0.817	0.407	0.190	0.044	0.885
Sum	179.112	276.852	410.561	150.629	320.264
Sum Sq. Dev.	68.962	49.453	3.605	0.297	1054.945
Observations	50.000	50.000	50.000	50.000	50.000

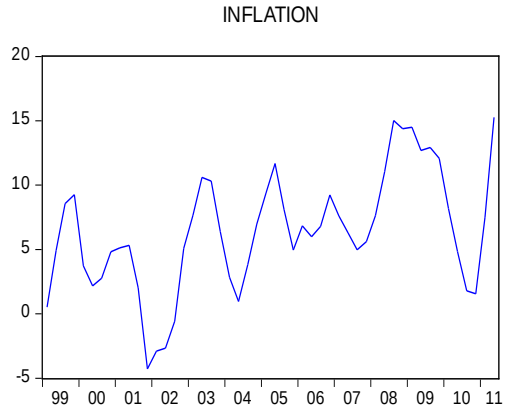
Appendix 3: Time series plots of level variables











Apendix 4: Correlation coefficients, using the observations 1999:1 - 2011:2, 5% critical value (two-tailed) = 0.2787 for n = 50

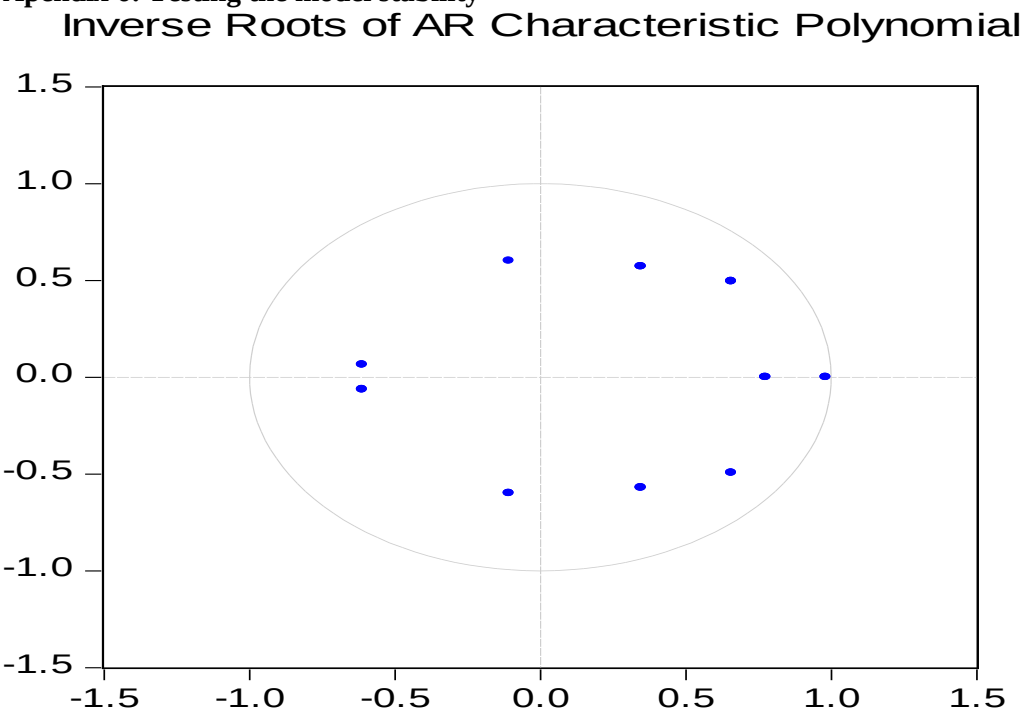
	LBD	LCAB	LGDP	LLIR	INFLATION
LBD	1.00	0.21	0.45	-0.03	0.04
LCAB	0.21	1.00	0.65	-0.02	0.36
LGDP	0.45	0.65	1.00	-0.36	0.50
LLIR	-0.03	-0.02	-0.36	1.00	-0.10
INFLATION	0.04	0.36	0.50	-0.10	1.00

Appendix 5: VAR Lag Order Selection Criteria, Endogenous variables: LBD LCAB LGDP LLIR INFLATION

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-189.93150	NA	0.003299	8.475281	8.674047	8.549740
1	-54.23641	235.9914	2.70e-05	3.662453	4.855045	4.109205
2	-3.55103	77.12993*	9.20e-06*	2.545697	4.732116*	3.364743*
3	17.76260	27.80039	1.20e-05	2.705974	5.886220	3.897313
4	51.39008	36.55160	1.02e-05	2.330866*	6.504939	3.894499

* indicates lag order selected by the criterion

Apendix 6: Testing the model stability



Appendix 7: VAR Residual Normality Tests, Orthogonalization: Cholesky (Lutkepohl), Null Hypothesis: residuals are multivariate normal

Component	Skewness	Chi-sq	Prob.	Kurtosis	Chi-sq	Prob.	Jarque-Bera	Prob.
1	-0.295323	0.697726	0.4035	3.083273	0.013869	0.9063	0.711595	0.7006
2	-0.263272	0.554497	0.4565	2.962720	0.002780	0.9580	0.557276	0.7568
3	0.173025	0.239501	0.6246	3.960556	1.845337	0.1743	2.084838	0.3526
4	0.623262	3.107643	0.0779	2.871388	0.033082	0.8557	3.140725	0.2080
5	0.061052	0.029819	0.8629	2.164489	1.396157	0.2374	1.425976	0.4902
Joint		4.629187	0.4628		3.291224	0.6552	7.920411	0.6366

Appendix 8: VAR Residual Serial Correlation LM Tests, Null Hypothesis: no serial correlation at lag order h

Lags	LM-Stat	Prob
1	23.45295	0.5511
2	26.86551	0.3626
3	14.45678	0.9532
4	50.13278	0.0021
5	15.67656	0.9241
6	19.57938	0.7685
7	23.61780	0.5415
8	18.37909	0.8259
9	19.16106	0.7893
10	18.50280	0.8203
11	27.60323	0.3264
12	19.63313	0.7658

Probs from chi-square with 25 df.