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Other People's Money: External Debt, Disequilibrium Exchange Rate and Economic Growth, A Kenyan Case (1963-2015)

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Abstract: External debt is found to be a driver of economic growth if properly managed but its servicing rather than repayment is an inhibiting factor to economic growth. This paper examined the relationship between external debt and economic growth in Kenya. The paper also examines the control effect of exchange rate for the period between 1963 and 2015. Through Vector Error Correction model, Variance decomposition and causality, the findings reveal that economic growth and disequilibrium exchange rate is negatively and significantly related to economic growth. However, there is absence of bidirectional causality between the variables. The negative effect of exchange rate on economic growth is a signal to the central bank and Policy makers that they need to stabilize the local currencies for instance by improving exports. A reduction in borrowing will enable the country to use a greater proportion of their tax revenues for investments rather than repaying loans, thereby increasing economic growth. Furthermore, real exchange depreciation raises the debt burden and negatively relates to GDP. There is thus the need to ensure that exchange is not over-devalued in order to balance the two effects.

Key Words: *External Debt, Disequilibrium Exchange Rate, Economic Growth, Kenya*

Introduction

The effect of Public debt on economic growth remains a key area of interest. Every country is striving to have sustainable economic development. According to Reinhart and Rogoff, (2011), the greatest hindrance to sustainable development is fiscal deficits mainly driven by public debt servicing and widening current account deficits. In emerging market and developing economies, real gross domestic product (GDP) growth slowed slightly to 5¾ percent in 2012, from 6.2 percent in 2011(International Monetary Fund,2012) ,thanks to domestic vulnerabilities which had been gradually building for a decade supported by rapid credit growth. IMF (2011) reported that the debt crisis of sub Saharan and other developing countries increased rapidly following the global debt crisis that emerged in the early 1980s. The crisis led to over-borrowing by most developing African countries and increased lending by the international banks in the same period. The collapse of the world commodity prices especially petroleum also escalated the debt situation in those countries. The increase in foreign borrowing that followed the debt crisis was worsened by the oil price shocks of 1973 and 1979. The oil price shock resulted in acute current account deficits in most non-oil producing developing countries.

IMF (2012) report reflected the effects of the increased debts in developing countries showing in the 1980s per capita income of sub-Saharan Africa which declined at an annual average rate of 2.2% while per capita private consumption went down by 14.8%. During the same period, the volumes of export were 4.3% while terms of trade fell by 9.1%. Between 1981 and 1990 the GDP growth of these countries was 1.7% in average. The decline in growth rate of Sub-Saharan Africa to negative -0.9% is a sharp contrast with East Asia's real per capita GDP growth rate of 6.3% and China's impressive growth rate of 8.2% during the same period. With the build-up of external debt and poor economic performance of SSA economies, the debt problem has risen to significant levels and the burden has become even worse. According to the report published by IMF (2013), Tanzania is ranked third as the most indebted countries in Eastern Africa. It comes after Kenya and Burundi while Uganda is fourth. Rwanda has the lowest public debt among the five countries with 22%.Similarly Kenya is ranked second with 28.5% foreign debt service while Burundi is leading with 50%.

Statistics compiled by IMF (2013), places Kenya among the east African countries in the second position as the most indebted country with 53% of public debt against GDP, after Burundi which has 72.3% . In position three is Tanzania while Uganda is fourth with 34% and 27% respectively. Rwanda has the lowest public debt among the five countries with 22%. IMF (2013) also indicates that in terms of debt service, Burundi is ahead of Kenya with 50% while Kenya has 28.5% debt service (IMF, 2013). In Kenya, public debt is used to industrialize and also to develop infrastructure (Were, 2010). The assumption is that, if these conditions are improved, the economy will grow and be able to finance such debts. World Bank (2010) report indicates that difficulties in management and servicing of debts exists among the Highly Indebted Poor Countries (HIPCs) even though they have been servicing. External debt is found to be a driver of economic growth if properly managed but its servicing rather than repayment is an inhibiting factor to economic growth. This paper examined the relationship between external debt and economic growth in Kenya. The paper also examines the control effect of exchange rate for the period between 1963 and 2015.

Statement of the Problem

According to CBK (2012), Public debt in Kenya has been on upward trend especially for the last ten years. In 2010, the country's total public debt amounted to Kshs.1.2 trillion with a major shift towards the domestic debts (Maana, Owino & Mutai, 2008). High domestic debts affect both private investment and economic growth because it induces uncertainty and negatively affects investments via high interest rates which reduce investments and consequently slows down economic growth. Domestic borrowing in Kenya crowds out private sector (Maana, Owino & Mutai, 2008). Increased domestic debt also reduces the country's credit-worthiness hence scaring potential investors and foreign lenders (Maana, Owino & Mutai, 2008). The link between public debts and its effect on economic growth has not been explicitly brought out in the literature. Debates on this relationship between public debts and economic growth have continued to yield inconsistent results. Some studies present a negative effect of public debts on economic growth. For example studies by Ribeiro, Vaicekauskas and lakštutiene (2012**);** Shah and pervin (2010); Reinhart and Rogoff (2010); Kumar and Woo (2010); Chironga (2003). Other studies present a positive effect of public debts on economic growth. For example studies by Degefe (1992); Gikandu (2012). Other studies did not find any relationship between public debts and economic growth. For example studies by Were (2001) and Schclarek (2004). The recent increase in public debt across developing countries including Kenya, during and after the recent global crisis has made it a prominent policy issue of whether high debt levels have a negative impact on growth.

Furthermore, studies conducted on public debts and economic growth have presented contextual, conceptual and methodological research gaps. A study by Kumar and Woo (2010) using panel data regressed per capita GDP growth against lagged values of the debt – GDP ratio so as to establish the causality concept. The study however presented a conceptual research gap by using lagged values of debt. Further, the study presented contextual research gaps as it was conducted in a different context from the current study. In another study, Shah and Pervin (2010) used an Ordinary Least Squares regression method to investigate effects of external public debt on economic growth of Bangladesh economies. The study was conducted in Bangladesh economies thus presenting a contextual gap. The study also focused on external public debt only and that presents a conceptual research gap as the current study focused on both external and domestic debts. Furthermore, the use of OLS presents a methodological research gap as the current study used a VAR model. Furthermore a study by Ullah (2011) using cointegration technique to examine the impact of foreign aid on economic growth in Pakistan presented conceptual, contextual and methodological research gap. In Kenya, Gikandu (2012) did a study on the relationship between domestic debt and economic growth in Kenya. The study similarly presented a conceptual research gap as it focused on domestic debts only. These are the research gaps which motivated the current study to be conducted. Many of the past studies were done on developed and emerging economies. This study was conducted in a developing country, Kenya. It established what effect the external and internal debt levels in the Kenyan economy have on economic growth because as noted in the trends, the Kenyan Public debt trends have been rising at a rate different from economic growth.

Objective of the Study

1. To assess the effect of external (foreign) public debt on economic growth in Kenya.
2. To estimate the effect of exchange rate as a control variable on economic growth in Kenya.

Theoretical Literature Review

Dependency Theory

The interaction between the developing and developed nations is captured by the theory. According to the theory, poor states are impoverished and rich ones enriched by the way poor states are integrated into the "world system". The theory originates with two papers published in 1949 – one by Hans Singer and another one by Raúl Prebisch. Matias (2004) stated that theory has its roots from the Marxian perspective in what was seen as a direct challenge of the market economic policies adopted in the post-war era which advocated a free market. Although painful for a time, some of the methods of market liberalization will in the long run help these nations to establish their economies making them competitive at the global level. According to the theory, the developed world perpetuated dependence through various means which did not end when independence was attained. It has been posited that this involves media control, politics, banking and finance, education (which translates to all aspects of human resource development) and sport. Domination by the developed world has continued through the great influence of transnational companies. Supporters of the dependency theory propose that only through the delinking by the developing countries from the developed world would we have development seen in these countries. The wealthy nations counter attempts by dependent nations to resist influence and actively keep developing nations in a subservient position often through economic sanctions or by proscribing free trade policies attached to loans granted by the World Bank or International Monetary Fund. The dependency theory also suggests that dependency increases as the developed and developing world continue to interact in the world market system because of how they are integrated into the system. Wealthy countries use their wealth to influence the adoption of policies that increase wealth of the developed nations at the expense of the developing nations. This causes a situation where capital moves to the developed nations but not developing nations. This causes a situation where capital moves to the developed nations, which forces the latter to seek larger loans which further indebts them further.

Dynamic Theory of Public Spending, Taxation, and Debt

The theory builds on the well-known tax smoothing approach to fiscal policy pioneered by Barro (1979). The approach predicts that in order to sharp changes in tax rates, the government use budget surpluses. In times of high expenditure needs, the government runs deficits but runs surpluses in times of low expenditure needs. The theory however assumes fluctuations in government expenditure as well as a convex function between costs of income tax and tax rate. The theory further argues that issuance of bonds going for one period is what constitutes borrowing. Bonds can be purchased and the interest earned from them is used to finance government ex-

penditure. Pork-barrel spending can also be achieved when the provision of a public good which is of benefit to all citizens is financed by public revenues. The level of public debt acts as a state variable, creating a dynamic linkage across policy-making periods.

The Debt Overhang Theory

The debt overhang theory is based on the premise that if the total amount of debt exceeds the country's repayment ability in the future, then the expected debt service of that country will be an increasing function of its output level. This implies that part of the returns gained from investing in the domestic market is taken by the foreign creditors thus discouraging domestic investments (Claessens, 1996)**.** In such a situation the indebted country is left with a small proportion of any increases in output and exports because part of the proceeds is used to service external debt. The theory postulates that reducing debt obligation lead to a rise in investment and repayment capacity. When this happens, the outstanding debt is more likely to be repaid therefore reducing chances of debt default. Similarly when the effect is strong, the indebted country is said to be on the wrong side of the debt Laffer curve. Laffer describes the relationship between the level of debt and the country's repayment ability which implies that there is a maximum at which accumulation of debt promotes growth (Elbadawi, 1996). Therefore the debt overhang hypothesis predicts that, if there is likelihood that in future, debt will be larger than the country's repayment ability, then the cost of servicing the debt will depress further domestic and foreign investment (Krugman, 1988; Sachs, 1990). Baum, Anja, Cristina and Philipp (2013) states that there is a negative relationship between economic growth and public debt by arguing that high levels of indebtedness discourage investment and negatively affect growth as future tax revenues go to repay debt. Kenya has been experiencing rapid external debts growth over the years. Some of this debt is over 50 years old with less prospects of full service and to service, the government resorts to borrowing domestically to service the external debt thus worsening the case.

Empirical Literature Review

A study by Reinhart and Rogoff (2010 and 2012) showed that high levels of external public debt are negatively correlated with economic growth, but that there is no link between debt and growth when public debt is below 90% of GDP. Mustafa (2010) conducted a study to find out the impacts of public debt on economic growth in Pakistan economy. Both short run and long run effects were established using cointegration method. The findings showed both long run and short run significant effect of external debt on economic growth while labor force negatively affects GNP in both short and long run. Similarly; Ullah (2011) using Trace and Eigen statistics also established a long run relationship between aid and economic growth in Pakistan. In the Bangladeshian context, Shah and pervin (2010) conducted a study to find out whether there was a short and long run relationship between external public debt and economic growth using an OLS regression model and the findings revealed that in the long run, external debt service has a negative effect on GDP while in the short run external debt has a positive impact on GDP. Evidence of debt overhang was not established.

A study by Reinhart and Rogoff (2010) concluded that high levels of public debt in relation to GDP of over 90% is accompanied by a lower levels of economic growth in both developed and developing countries. Consequently, in the case of developing countries external debt levels of over 60% of GDP negatively affects economic growth Kumar and Woo (2010) concluded that there is an inverse relationship between initial debt and the sub-

sequent growth. They argued that an increase in 10% in the initial debt –GDP ratio leads to a decrease in annual real per capital GDP growth of 0.2% points per year. A study by Polodoo et al (2007) investigated the impact of exchange rate volatility on macroeconomic performance in small island developing states. He used yearly panel data spanning 1999 to 2010 and compute z-score to measure the exchange rate volatility. Plain panel ordinary least square regression was carried out with robust standard error to correct for heteroskedesticity. The result revealed that exchange rate volatility positively impacts on economic growth. Investigation of the impact of exchange rate volatility on economic growth on small open economies at the European Monetary Unity (EMU) periphery was conducted by Schnabl (2007). He estimated a panel data of 41 countries in the EMU periphery from 1994 to 2005. Volatility was captured as a yearly average of monthly percentage exchange rate. He performed both GLS and GMM and the result provided evidence that exchange rate volatility has negative impact on economic growth. The study concludes that macroeconomic stability is necessary to maintain the peg since stable exchange rate positively influences economic growth.

Panel estimations for more than 180 countries Edwards and Levy Yeyati (2003) found evidence that countries with more flexible exchange rate grow faster. Eichengreen and Lablang (2003) found strong negative relationship between exchange rate stability and growth for 12 countries over a period of 120 years. Azid et al (2005) studied the impact of exchange rate volatility on growth and economic performance for Pakistan for the period 1973 to 2003. The study used GARCH estimation for exchange rate volatility. Johansen's multivariate co integration technique was used to capture both the short and long run dynamics in the study. Even after treating the volatility measure as either a stationary or non-stationary variable in the VAR, they were not able to find evidence suggesting that economic growth is affected by exchange rate volatility. However, the result would have been biased. This is because the treatment of volatility as either stationary or non-stationary is not realistic since volatility is characterized by clustering of large shocks to conditional variance. Azee *et al* (2012) examined the effects of exchange rate volatility on macroeconomic performance in Nigeria for a period of 25 years ranging from 1986 to 2010. The study employed OLS and Johansen co integration estimation technique to test for the short and long run effect respectively. The ADF test reveals that all the variables were stationary. The result found that the RER volatility contributes positively to GDP in the long run. Mauna and Reza (2001) studies the effect of trade liberalization, real exchange rate and trade diversification on selected North Africa countries Morocco, Algeria and Tunisia. By decomposing in real exchange rate into fundamental and monetary determinants, and by using both standard statistical measures of exchange rate fluctuation and the measures of exchange rate risk developed by Puree and Steinher (1989), they reached the conclusion that exchange rate depreciation has a positive effect on the quantity or manufactured exports while exchange rate misalignment, volatility or fluctuation has a negative effect. According to them, the motivating result is that all manufacturing sub-sectors are responsive to exchange rate change but the degree of responsiveness differs across sectors.

Research Methodology

The study adopts an explanatory research design, similar to Mangeni (2018) and Abdulrehman and Nyamute (2018). Secondary time series data between 1963 and 2015 is collected. Descriptive statistics was conducted to establish the measures of central tendency (Mean, median), measures of variation (Standard deviation) normality of the variables using Jarque Bera test. Descriptive method reviewed descriptive statistics such as mean, medium, standard deviation and normality probability distributions carried out through skewness and kurtosis. The test combines both the Skewness and Kurtosis to test for normality. For a normally distributed variable the as-

ymptotic coefficient will be equal to zero, any JB test value that is not zero is thus a deviation from the normality assumption. Likewise Skewness coefficient for a normally distributed variable is zero while that of kurtosis is three. Deviations from normality assumption necessities transformation of all or some variables into logarithms, which has the effect of instilling normality (Agrawal *et al*., 2010). The null hypothesis under this test is that the data is not statistically different from a normal distribution. The study also used correlation analysis to investigate the association between the independent and the dependent variables as well as presence of Multicollinearity between the predictor variables. Multicollinearity occurs if two or more independent variables are highly correlated with one another. Multicollinearity is said to exist between two variables if they have a Pearson correlation value greater than 0.8 (Williams, 2008).

Preliminary Tests

Test for Stationarity

Non Stationarity has always been regarded as a problem in the analysis of time series data. Time series data is stationary if its mean, variance and covariance do not vary overtime. Non-stationary data leads to spurious regression due to non-constant mean and variance (Dimitrova, 2005). Differencing a series using differencing operators produces other set of observations. Data that is differenced once is given as:

$$\Delta X_t = X_t - X_{t-1.}$$

A series which is stationary without any differencing, is said to be I(0) or integrated of order 0. However, a series which is stationary after first-difference is said to be I(1) or integrated of order 1. After the stationarity of the series has been established, a test for the existence of a unit root if any (moment of the series: independence of mean, mode and kurtosis over time) in the variables is carried out by the use of Augmented Dickey-Fuller (ADF) test.

Lag length Selection Procedure

Before the Johansen cointegration test is performed, the optimal lag length for analysis should be identified (Simiyu, 2015). The lag length can be selected using the information selection criteria which include: Sequential Modified Likelihood Ratio (LR), Final Prediction Error (FPE), Akaike Information Criterion (AIC), Schwarz Bayesian Information Criterion (SBIC) and Hannan-Quinn Information Criterion (HQIC) and ensuring that the residuals are white noise as suggested by Ivanov et al (2005). According to Simiyu (2015), there is no clear rule of thumb on which criterion to use for optimal lag length selection among the above methods. However, the decision rule is to choose the model with lowest value of information criteria. The lag length for the VAR (p) model may be determined using model selection criteria. The general approach is to fit VAR (p) models with orders p = 0,...,p *max* and choose the value of p which minimizes some model selection criteria. Model selection criteria for VAR (p) models have the general form

IC (p) = ln |Σ ˜(p)| + c T · ϕ(n,p)

where Σ ˜(p) = T −1 PT t=1 ˆ εtˆ ε0 t is the residual covariance matrix without a degrees of freedom correction

from a VAR(p) model, cT is a sequence indexed by the sample size T, and ϕ(n,p) is a penalty function which penalizes large VAR(p) models

Cointegration Test

After establishing whether the series is stationary in levels or first-difference (and if the series are integrated of the same order), then Johansen's procedure is used to determine whether there exist a cointegrating vector among the variables (Johansen, 1988). The study establishes whether the non-stationary variables are cointegrated. Differencing of variables to achieve Stationarity leads to loss of long-run properties. The concept of cointegration implies that if there is a long-run relationship between two or more non-stationary variables, deviations from this long-run path are stationary. In testing for co integration the study used the Johansen co integration test (Maximum Eigenvalue statistic and Trace statistic). The Johansen cointegrating test is more accurate and superior to Engel granger test of cointegration because it gives the exact number of cointegrating equations in the model. The study hence used the Johansen cointegration test to perform the cointegration test. Johansen cointegration uses two tests to determine the number of cointegrating vectors which are: the Maximum Eigen value test and the Trace test. The null hypothesis for the Maximum Eigen value is to test r cointegrating relations against the alternative of r+1 cointegrating relations where r = 0, 1, 2, ..., n-1 and n is the number of variables in the system. The test statistic for Maximum Eigen value is computed as:

$$LRmax\ (r/n + 1) = -T * \log\ (1 - \omega)\hat{}(5)$$

Where ω is the Maximum Eigen value and T is the sample size.

The Trace statistics tests the null hypothesis of r cointegrating relations against the alternative of n cointegrating relations, where n is the number of variables in the system and r = 0, 1, 2, ..., n-1. The test statistic is computed using the following expression:

$$LR_{tr}\ (r/) = -T * \Sigma^{n}{}_{i\ =r\ +1} \log\ (1 - \omega\hat{\imath})$$

The Time Series Models Selection

Time series is a process observed in sequence over time, due to this sequential nature of time series, series in time y_t is not independent of series in timey_{t-1}. Time series can be separated into two main categories the univariate ($y_t \in R$is a scalar) and the multivariate ($y_t \in R^m$is a vector valued). The primary models for the univariate time series are the autoregressive models (ARs) while those of the multivariate time series are the vector autoregressive models (VARs) (Hansen, 2013).

Vector Autoregressive (VAR)

After performing the Johansen cointegration test, the study fit the appropriate time series model given the Johansen test results. Cointegration was established between the variables and VECM was applied to the series to determine the short run relationships. The VAR model is one of the most successful, flexible, and easy to use models for the analysis of time series. The VAR model has proven to be especially useful for describing the dynamic behavior of economic and financial time series and for forecasting. It often provides superior forecasts to those from univariate time series models and elaborate theory-based simultaneous equations models. Forecasts from VAR models are quite flexible because they can be made conditional on the potential future paths of specified variables in the model (Zivot & Wang, 2006). The model is used in structural analysis where certain as-

sumptions about the causal structure of the data under investigation are imposed, and the resulting causal impacts of unexpected shocks or innovations to specified variables on the variables in the model are summarized. These causal impacts are usually summarized with impulse response functions and forecast error variance decompositions (Zivot & Wang, 2006).

The general VAR (p) model has many parameters, and they may be difficult to interpret due to complex interactions and feedback between the variables in the model. As a result, the dynamic properties of a VAR (p) are often summarized using various types of structural analysis. The three main types of structural analysis summaries are (1) Granger causality tests; (2) impulse response functions; and (3) forecast error variance decompositions.

The basic p-lag vector autoregressive (VAR (p)) model has the following general form:

$Y_t = c + \Pi_1 Y_{t-1} + \Pi_2 Y_{t-2} + \cdots + \Pi_p Y_{t-p} + \varepsilon t,\ t = 1, \ldots..T,$

Where Π_i are (n× n) coefficient matrices and εt is an (n × 1) unobservable zero mean white noise vector process (serially uncorrelated or independent) with time invariant covariance matrix Σ.

A VAR model for this study took the following form:

$GRATE_t = ß_0 + ß_1 EDT_{t-1} + ß_2 REER_{t-1} + \mu t$

Where:

GRATE is the real GDP

EDT_{t-1} is the lag of stock of external debt

$REER_{t-1}$ is the lag of movements in real exchange rate

$ß_1$ and $ß_2$ are coefficients of lagged variables

μt model residual/ Error term

Vector Error correction (VECM) models

The short-run dynamics of the VAR model are captured with the Vector Error Correction Model which is similar to the short-run adjustment. The error correction term measures the speed of adjustment, or how much of disequilibria experienced in one period are corrected for in the subsequent period. Lütkepohl (2004) argues that if two *I* (1) series *x* and *y* are cointegrated, then there is exist unique α0 and α1 such that

$U_t \equiv yt - \alpha_0 - \alpha_1 x_t$ is *I*(0).

In the single-equation model of cointegration where *y i*s the dependent variable and *x* as an exogenous regressor, then a Vector error-correction model takes the following form:

$$\Delta y_t = ß y_0 + ß y_1 \Delta y_{t-1} + \ldots + ß y_p \Delta y_{t-p} + ¢ y_1 \Delta x_{t-1} + \ldots + ¢ y_p \Delta x_{t-p} - \lambda y(y_{t-1} - \alpha_0 - \alpha_1 x_{t-1}) + v^y{}_t$$

$$\Delta X_t = ß x_0 + ß x_1 \Delta y_{t-1} + \ldots + ß x_p \Delta y_{t-p} + ¢ x_1 \Delta x_{t-1} + \ldots + ¢ x_p \Delta x_{t-p} - \lambda x(y_{t-1} - \alpha_0 - \alpha_1 x_{t-1}) + v x_t$$

where

$y_t = \alpha_0 + \alpha_1 x_t$ is the long-run cointegrating relationship between two variables and λy and λ*x* are the error-correction parameters that measure how *y* and *x* react to deviations

from long-run equilibrium. Once the Vector error correction system has been estimated, we can proceed to calculate impulse response function and variance decompositions, or to generate forecasts as we would with a VAR (Lütkepohl , 2004).

A VECM for this took the following form:

$\Delta GRATE_t = ß_0 + ß_{1\Delta} EDT_{t-1} + ß_{2\Delta} REER_{t-1} + \xi_{t-1}$

$+ \mu t$

Where:

GRATE is the real GDP

EDT_{t-1} is the lag of stock of external debt

$REER_{t-1}$ is the lag of movements in real exchange rate

Δ is the differencing operator

ξ_{t-1} is the lagged value of the error correction term / component used to capture the short –run effects/dynamics .It shows the speed of adjustment of the variables towards a long run equilibrium after short run fluctuations of the variables

ß1 and $ß_2$ are coefficients of lagged and differenced variables

µt model residual/ Error term

Post Estimation Diagnostic Tests

The study used a VECM model after testing for cointegrating systems and established presence of four cointegrating systems. After running the VECM, post estimation diagnostic tests were also conducted.

Causality Test

Causality analysis is normally carried out to review the presence of casual relationship between the variables in a study. The Granger causality test was employed to determine the presence or otherwise of these relationships between the dependent variable and the explanatory variables. Causality tests review the causal relationship between variables in the model and the direction to which the relationships is running from or to but (Brooks, 2008). One way direction gives a uni-directional causality and two way direction gives bi-directional causality.

Variance Decomposition Test

Granger causality does not explain the proportion of the movements in the dependent variable that are due to their own shocks and shocks of the predictor variables. A shock on a variable affects its own course and is also transmitted to all other variables in the model. The study used variance decomposition to determine how much of the period steps ahead, a forecast error variance of the dependent variable are explained by the dependent variable. Variance decomposition determine how much of the S- steps ahead forecast error variance of a given variable is explained by innovations (error terms as it is called in time series) to each of the explanatory variables. S is 1, 2,…n. In variance decomposition an error term of one variable is introduced to a shock while holding all other error terms constant (Brooks, 2008).

VEC Residual Serial Correlation LM Tests

The study conducted autocorrelation tests after running VECM. Since the accepted lags were 4, the test was conducted at each lag. The null hypothesis is that there is no serial correlation at lag h.

Findings

The trends in figure 1 indicate that the levels of external debt has been rising steadily with years. The rate is faster rate as compared to GDP growth which has indicated unsteady increasing and decreasing trends over the years. There has been fluctuations in the exchange rate fluctuations over the study period.

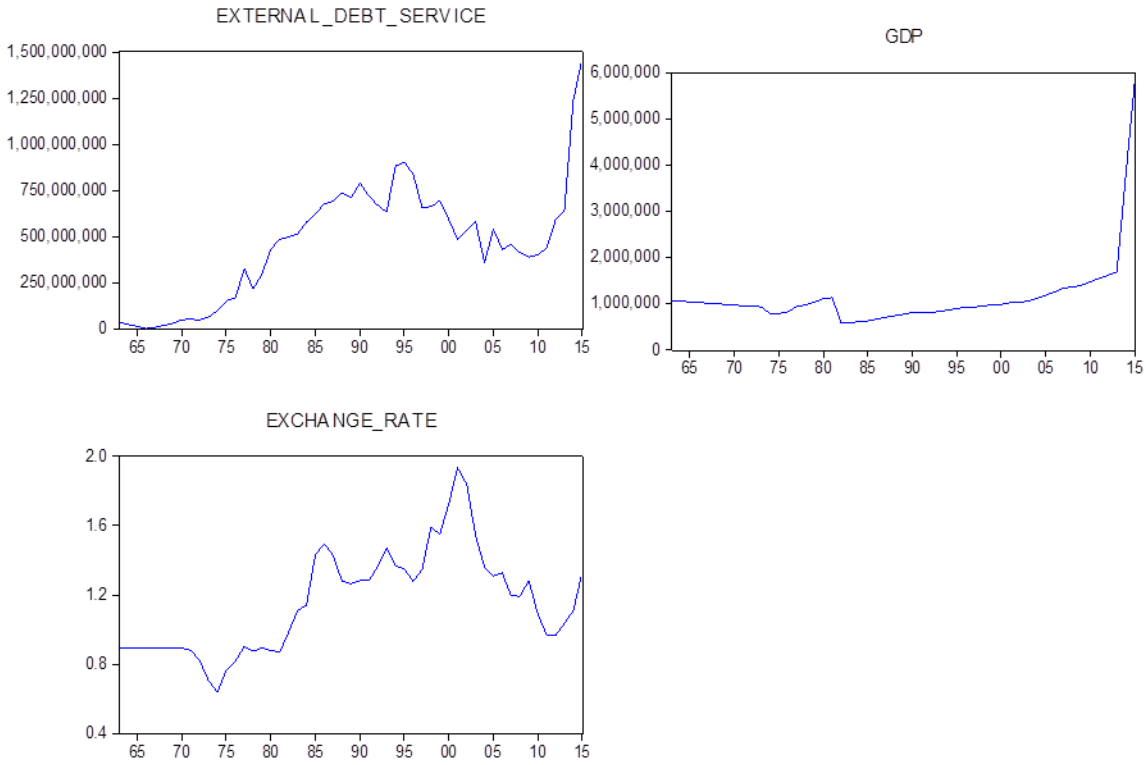

Figure 1 Trend Analysis

Descriptive Statistics

Descriptive analysis was conducted to indicate the mean, standard deviation, Skewness, Kurtosis and normality of the variables using the Jarque Bera statistic which is a combination of both Skeweness and Kurtosis. Under the null hypothesis of a normal distribution, the Jarque-Bera statistic is distributed with 2 degrees of freedom. The reported Probability is the probability that a Jarque-Bera statistic exceeds (in absolute value) the observed value under the null—a small probability value leads to the rejection of the null hypothesis of a normal distribution. The descriptive findings indicated that the variation in external as indicated by their standard deviation was

large. Exchange rate on the other hand also indicated large variations. GDP growth also indicated large variations over the study period.

Table 1 Descriptive Statistics

	EXCHANGE RATE	EXD	GDP
Mean	1.159	224,070.426	1,137,049.824
Median	1.140	54,348.200	975,477.255
Maximum	1.933	1,433,447.200	5,808,849.780
Minimum	0.638	1,244.000	577,770.054
Std. Dev.	0.298	308,143.336	795,256.633
Skewness	0.485	1.921	4.591
Kurtosis	2.615	6.991	25.662
Jarque-Bera	2	68	1,320
Probability	0.301	0.000	0.000

The descriptive statistics discussed above indicated that the data for the variables were not normally distributed apart from the data for exchange rate hence there was need to transform debt and GDP into their logs to base ten in order to normalize it. The results for density distribution together with normality line shown in Figure 2 confirm the descriptive findings of normality.

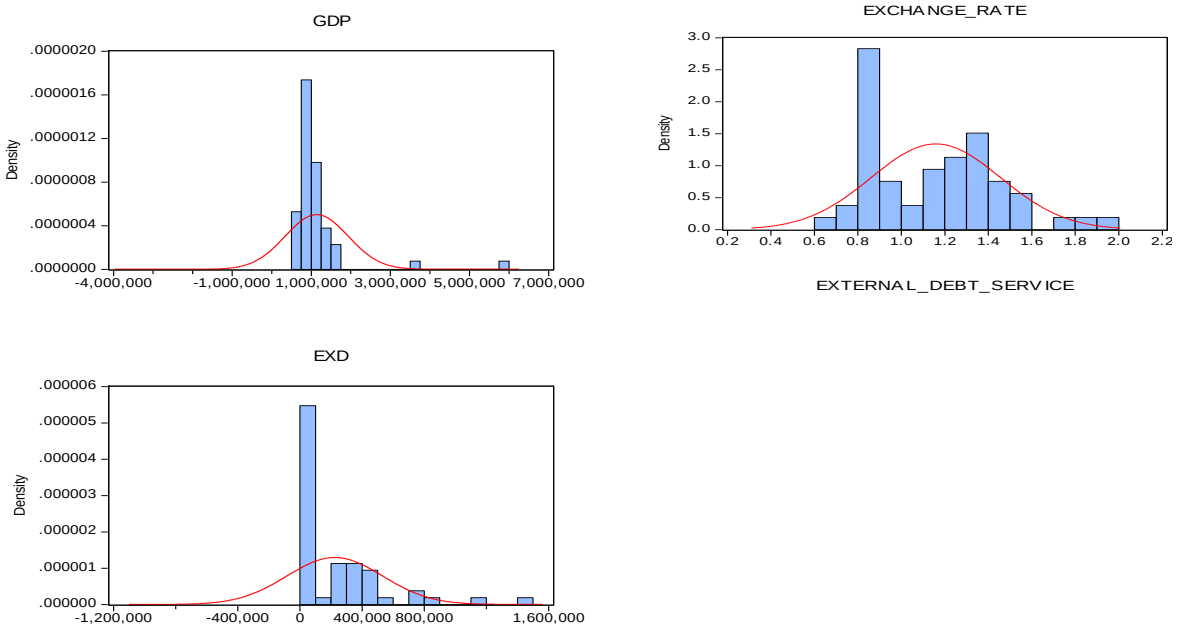

Figure 2 Graphical Normality Curve

After transformation into logs, the normality tests were also conducted using both Jarque Bera and graphical representation.

Table 2 Normality Test after transformation

	LOGEXD	**LOGGDP**
Jarque-Bera	5.219	169.707
Probability	0.074	0.052

The test for normality after transformation indicated that the null hypothesis of the data being normally distributed was not rejected at 5% level of significance indicating that log transformations normalized the data. The results are further presented graphically as shown in Figure 3.

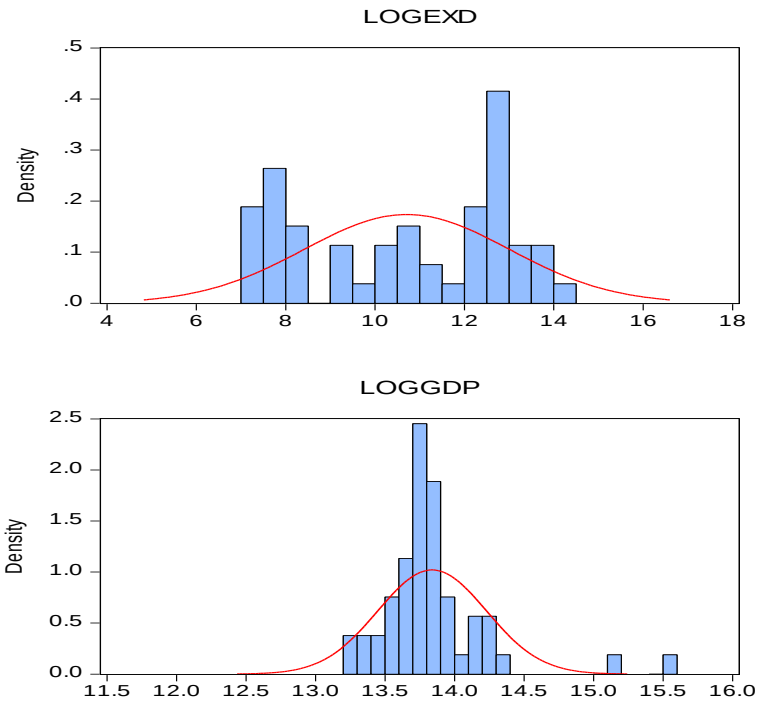

Figure 3 Graphical Normality Curve after Log Transformation

Correlation Matrix

According to William *et al.* (2013), Multicollinearity refers to the presence of correlations between the predictor

variables. In severe cases of perfect correlations between predictor variables, multicollinearity can imply that a unique least squares solution to a regression analysis cannot be computed (Field, 2009). Multicollinearity inflates the standard errors and confidence intervals leading to unstable estimates of the coefficients for individual predictors (Belsley *et al*., 1980). Multicollinearity was assessed in this study using a correlation matrix.

The Multicollinearity decision rule is that a high correlation coefficient between the regressors of absolute 0.8 and above implies the existence of Multicollinearity (Adam and Twenoboah, 2008). Williams (2008) argues that one of the ways of dealing with Multicollinearity may be that the best thing to do is simply to realize that Multicollinearity is present, and be aware of its consequences and ignore it. Since according to Williams (2008), it is sometimes suggested that you "drop" the offending variable but if the variable really belongs in the model, this can lead to specification error, which can be even worse than Multicollinearity. Hence even though there was a high. The results indicated significant associations between GDP and external debt while the association between GDP and exchange rate was positive but not significant. The association between external debt as well as exchange rate and GDP were negative.

Table 3 Correlation Matrix

	GDP	**EXD**	**EXCHANGE RATE**
GDP	1		
EXD	-0.8278*	1	
EXCHANGE RATE	-0.025	0.3095*	1

Unit Root Test

Most economic variables are usually non-stationary in nature and prior to running a regression analysis. Unit root tests were thus conducted using the ADF test to establish whether the variables were stationary or non-stationary. The purpose of this is to avoid spurious regression results being obtained by using non-stationary series. Augmented Dickey Fuller (ADF) test was employed to determine existence stationarity or otherwise. ADF was chosen because it takes care of autocorrelation in case it is present in the series (Brooks, 2008).

HO: $\alpha = 0$ (the series has a unit root).

H1: $\alpha \neq 0$ (the series has no unit root).

The decision criterion is through comparison of the absolute tau statistic value (tau calculated) and Dickey - Fuller critical table value and if the absolute tau statistic value is greater than the absolute Dickey - Fuller critical table value the null hypothesis that the series has a unit root is not rejected. The results indicated that all the variables were non stationary at level apart from exchange rate hence first differencing was conducted on the non stationary variables. The results indicated that all the variables became stationary at none after first differencing.

Table 4 Unit Root Tests

Variable name	ADF Statistic	1% Level	5% Level	10% Level	Comment
Unit Root test (None and Level)					
Exchange rate	-0.002	-2.611	-1.947	-1.613	Stationary
EXD	3.834	-2.611	-1.947	-1.613	Non Stationary
GDP	1.643	-2.611	-1.947	-1.613	Non Stationary
After Differencing (None and First Difference)					
EXD	-12.990	-2.612	-1.948	-1.613	Stationary
GDP	-11.169	-2.612	-1.948	-1.613	Stationary

Optimal Lag Length

Before the Cointegration test is performed, the optimal lag length for analysis should be identified (Simiyu, 2015). The lag length can be selected using the information selection criteria which include: Sequential Modified Likelihood Ratio (LR), Final Prediction Error (FPE), Akaike Information Criterion (AIC), Schwarz Bayesian Information Criterion (SBIC) and Hannan-Quinn Information Criterion (HQIC) and ensuring that the residuals are white noise as suggested by Ivanov et al (2005). According to Simiyu (2015), there is no clear rule of thumb on which criterion to use for optimal lag length selection among the above methods. However, the decision rule is to choose the model with lowest value of information criteria. In choosing the optimal lag length, this study used the information criterion such as Akaike Information Criterion (AIC), the Bayesian Information Criterion (BIC) and the Scharz Bayesian Information Criterion (SBIC). These criterion were preferred because they are more effective than graphical procedures which determine the number of lags by examining autocorrelation function (ACFs) and the partial autocorrelation function (PACFs) patterns. Although no criterion is superior to the others the study chose Akaike Information Criterion because of its efficiency property, thus the study chose four lag length to be used in this model as the optimal lag length. The optimal lag length decision is supported by likelihood ratio test and the final prediction error criterion results.

Table 5 Lag Order Selection Criteria

VAR Lag Order Selection Criteria						
Lag	LogL	LR	FPE	AIC	SC	HQ
0	-1150.252054092184	NA	2.07e+14	47.15315	47.34619	47.22639
1	-900.3226042542521	438.6517	2.15e+10	37.97235	39.13061*	38.41179*
2	-871.815434288006	44.21520	1.92e+10*	37.82920	39.95267	38.63484
3	-855.0971484186357	22.51851	2.93e+10	38.16723	41.25592	39.33907
4	-819.0170921889746	41.23435*	2.22e+10	37.71498*	41.76888	39.25303
* indicates 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						

Co integration

Cointegration reviews long run relationship between variables in a study and the conditions for cointegration are that the series must be non-stationary and integrated of order one, the unit root tests results from this study fulfill these conditions and thus cointegration analysis was performed to establish existence or non-existence of long term relationship between the variables in the study. The null hypothesis was that there is no cointegration against an alternative hypothesis that there is cointegration. The null hypothesis is rejected if the absolute statistics test value is greater than the absolute critical value for cointegration (Brooks, 2008).

HO: $\alpha = 0$ (The series does not have cointegration relationships).

H1: $\alpha \neq 0$ (The series has cointegration relationships).

The Johansen co integration test was conducted since its more accurate and superior to Engel granger test of cointegration. Johansen results indicate that the null hypothesis of at most 2 co integration equations for the model linking inflation to its determinants was rejected at 5% significance level. The trace statistic for the null hypothesis for the existence of at most 2 cointergration equations was larger than the set critical value at 5%. This implies that more than 2, that is 3 Cointegrating equations exists this further implies that all the variables in the model converge to an equilibrium in the longrun (i.e are co intergrated) as shown in Table 6.

Table 6 Johansen Cointegration

Series: LOGGDP LOGEXD EXCHANGE RATE				
Lags interval (in first differences): 1 to 4				
Unrestricted Cointegration Rank Test (Trace)				
Hypothesized		Trace	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.645	122.162	76.973	0.000
At most 1 *	0.489	72.509	54.079	0.001
At most 2 *	0.422	40.276	35.193	0.013
At most 3	0.167	14.003	20.262	0.289
At most 4	0.103	5.224	9.165	0.260
Trace test indicates 3 cointegrating eqn(s) at the 0.05 level				
* denotes rejection of the hypothesis at the 0.05 level				
**MacKinnon-Haug-Michelis (1999) p-values				

Cointegration establishes long run relationships between the variables in the study from equation in Table 7 above it was reviewed that external debt had a long run negative relationship with GDP and exchange rate had a negative long run relationship with GDP. The relationships are however not significant.

Table 7 The Cointegrating Equation

Cointegrating Equation(s):	Log likelihood	-816.6443239	
Normalized cointegrating coefficients (standard error in parentheses)			
LOGGDP	LOGEXD	EXCHANGE RATE	C
1	-9.627	-9.050	6.509
	1.590	3.564	4.012

The Time Series Fitted Model

Time series is a process observed in sequence over time, due to this sequential nature of time series, se-

ries in time y_t is not independent of series in time y_{t-1}. A univariate time series analysis involves only one explanatory variable while multivariable involves two or more explanatory variables, this study has four independent variables and therefore it uses multivariate models in its analysis.

Vector Error Correction Model

The short-run dynamics of the VAR model are captured with the Vector Error Correction Model which is similar to the short-run adjustment. The error correction term measures the speed of adjustment, or how much of disequilibria experienced in one period are corrected for in the subsequent period. VECM requires the variables to be cointegrated. VECM determines short term dynamics of variables by restricting for the long term relationships of variables through cointegrating relations while allowing for the short run adjustments back to the long run equilibrium whenever deviations occur (Brooks, 2008). The established VECM model is presented in Table 8.

Table 8 The Vector Error Correction Model

Standard errors in ( ) & t-statistics in [ ]			
Error Correction:	D(LOGGDP)	D(LOGEXD)	D(EXCHANGE_RATE)
D(LOGGDP(-1))	0.2962	-0.5800	-0.4582
	0.3285	0.2981	0.1336
	[0.90171]	[-1.94577]	[-3.42943]
D(LOGGDP(-2))	0.2502	-0.1976	-0.1194
	0.3211	0.2913	0.1306
	[0.77943]	[-0.67848]	[-0.91429]
D(LOGGDP(-3))	0.0361	0.1637	-0.6190
	0.2955	0.2681	0.1202
	[0.12222]	[0.61040]	[-5.14954]
D(LOGGDP(-4))	0.1442	0.0036	-0.3963
	0.4262	0.3867	0.1733
	[0.33836]	[0.00929]	[-2.28643]
D(LOGEXD(-1))	-0.0490	-0.0453	0.0132
	0.1592	0.1444	0.0647
	[-0.30795]	[-0.31390]	[0.20378]
D(LOGEXD(-2))	-0.1091	-0.0489	-0.0711
	0.1939	0.1759	0.0789
	[-0.56277]	[-0.27801]	[-0.90155]
D(LOGEXD(-3))	-0.4350	-0.1589	-0.0791

	0.2147	0.1948	0.0873
	[-2.02614]	[-0.81567]	[-0.90618]
D(LOGEXD(-4))	-0.1872	-0.2643	-0.1545
	0.2666	0.2419	0.1084
	[-0.70214]	[-1.09263]	[-1.42529]
D(EXCHANGE_RATE(-1))	0.2796	0.8814	-0.0711
	0.4882	0.4430	0.1986
	[0.57279]	[1.98963]	[-0.35816]
D(EXCHANGE_RATE(-2))	-0.1129	0.8563	-0.0827
	0.3525	0.3198	0.1433
	[-0.32029]	[2.67763]	[-0.57692]
D(EXCHANGE_RATE(-3))	-0.1089	0.4692	-0.1545
	0.3726	0.3380	0.1515
	[-0.29219]	[1.38792]	[-1.01955]
D(EXCHANGE_RATE(-4))	-0.2801	0.3982	-0.0488
	0.3215	0.2917	0.1308
	[-0.87116]	[1.36504]	[-0.37287]
C	0.0359	0.4039	0.0426
	0.0815	0.0739	0.0331
	[0.44061]	[5.46315]	[1.28426]
R-squared	0.3801	0.5947	0.7865
Adj. R-squared	-0.2140	0.2064	0.5819
Sum sq. resids	0.8209	0.6758	0.1358
S.E. equation	0.1849	0.1678	0.0752
F-statistic	0.6397	1.5314	3.8437
Log likelihood	29.5348	34.2030	72.7182

The coefficient estimate corresponding to the cointegrating equation (CointEq1) and the differenced dependent variable (D(GDP)) represent the model's adjustment speed back to the long run equilibrium, while those corresponding to the first raw and columns two, three and four represent adjustment speed back to long run equilibriums of each individual differenced regressors. According to Brooks, (2008) VECM allows for individual regressors to adjust back to their own long run equilibriums relations and also for collective adjustment of all explanatory variables working together to restore the model's long run equilibrium relationships. VECM yields an equal number of error correction term equations as the number of variables in the model. The first one relate to the whole model adjustment speed to its long run equilibrium in an event of deviations, the others relate to individual independent variables' adjustment speed to their own long run equilibrium relationships if they had deviated from them.

From the results, it was established that the independent variables individual adjustment speed rates back to their own long run equilibriums were found to be 39.51% and 35.65% for external debt and exchange rate re-

spectively. All the explanatory variables were found to have dropped below their own individual long run equilibriums, and the VECM results show that they are expected to increase at their respective adjustment speed rate to restore their own individual long run equilibrium. External debt was found to have no significant relationship with economic growth as indicated by a t-statistic less than 2 when related to all the four lags of GDP(t=-1.94577, -0.67848, 0.61040 and 0.00929) at lag 1, 2, 3 and 4 of the GDP respectively. The adjustment speed of external debt back to equilibrium was very fast to be felt in the short run.

Only exchange rate had a significant short run relationship with GDP as indicated by t-statistics of -3.42943, -0.91429, -5.14954 and -2.28643 at the 1, 2, 3 and 4 lag of GDP growth respectively. The speed of adjustment back to its equilibrium is slow to be noticed in the short run. The analysis of the cointegration and VECM indicates the long run and short run relationship respectively. VECM further indicates the speed of adjustment to equilibrium of the variables. The two however don't indicate the causal relationship between the variables hence the study established the granger causality of the variables on each other to establish the causal relationships.

Causality Test

Causality analysis is normally carried out to review the presence of casual relationship between the variables in a study. The Granger causality test was employed to determine the presence or otherwise of these relationships between the dependent variable and the explanatory variables. Causality tests review the causal relationship between variables in the model and the direction to which the relationships is running from or to but (Brooks, 2008). The null hypothesis is rejected if the F-statistic is significant. The findings in Table 4.13 indicate that there exists a uni-directional relationship between external debt and domestic debt as the null hypothesis of external debt not causing domestic debt is rejected. This implies that external debt causes domestic debt but domestic debt does not cause external debt. Further results indicated a lack of causality between the variables.

Table 9 Granger Causality Test

Null Hypothesis:	**F-Statistic**	**Prob.**
LOGEXD does not Granger Cause LOGGDP	1.291	0.285
LOGGDP does not Granger Cause LOGEXD	0.012	0.988
EXCHANGE_RATE does not Granger Cause LOGGDP	1.186	0.315
LOGGDP does not Granger Cause EXCHANGE_RATE	0.230	0.795
EXCHANGE_RATE does not Granger Cause LOGEXD	1.462	0.242
LOGEXD does not Granger Cause EXCHANGE_RATE	1.999	0.147

Variance Decomposition

Granger causality does not explain the proportion of the movements in the GDP growth that are due to their own shocks and shocks of the other variables. A shock on a variable affects its own course and is also transmit-

ted to all other variables in the model. The study used variance decomposition to determine how much of the period steps ahead, a forecast error variance of GDP are explained by innovations of exchange rate and external debt in five percentiles (each of 10 years) of the study period. The study findings indicated that in the first percentile, that is the first decade from independence, changes in GDP were largely due to its own variations which stood at 100% and the predictor variables (external debt and exchange rate) didn't contribute to the changes in GDP. The findings further indicate that in the second decade, the changes in GDP were still largely attributed to itself while external debt and exchange rate contributed less than 2% to GDP. The findings reveal that as the years progressed, the contribution of the predictor variables to GDP increased to more than 5%. In the final decade which is between the year 2005 and the year 2015, the results reveal that the changes in GDP were largely contributed by itself up to 79.19 % but external debt and exchange rate contribute the remainder.

Table 10 Variance Decomposition

Variance Decomposition of LOGGDP:				
Period	S.E.	GDP	EXD	EXCHANGE RATE
1	0.186	100	0	0
2	0.305	97.29	2.28	0.43
3	0.465	90.307	9.101	0.593
4	0.638	84.901	14.566	0.533
5	0.861	79.19	20.505	0.305

Conclusion

In the long run, the external debt had a long run negative insignificant relationship with GDP. In the short run, external debts were found to have no significant relationship with economic growth in the short run. The findings are not consistent with Mustafa (2010) who indicated that long run significant effect of external debt on economic growth. The findings however are consistent with Shah and Pervin (2010) who found that in the long run, debt service has a negative effect on GDP. Exchange had a negative and insignificant association with GDP. The findings are inconsistent with the study done by Polodoo et al (2007) which indicated a positive impact on economic growth. Multiple regression analysis indicated that economic growth is positively and significantly related to debt service. The findings are consistent with Azee et al (2012) that debt service contributes positively to economic growth. In the long run, exchange rate had a negative insignificant relationship with GDP but in the short run it had a significant short run relationship with GDP.

Recommendations

In light of the results and conclusions discussed in the foregoing paragraphs, the government and policymakers in Kenya should consider the following recommendations to improve public debt management. First, the governments should establish and adopt an optimal balance between external and domestic debt to maintain steady economic growth. Second, the negative effect of exchange rate on economic growth is a signal to the central bank and Policy makers that they need to stabilize the local currencies for instance by improving exports. The study also recommends that prudential fiscal management measures are required to avoid an unnecessary in-

crease in overall public debt. A reduction in borrowing will enable the country to use a greater proportion of their tax revenues for investments rather than repaying loans, thereby increasing economic growth.Furthermore, real exchange depreciation raises the debt burden and has a negative relationship with GDP. There is thus the need to ensure that exchange rate is not over-devalued in order to balance two effects.

Conflict of Interest

No potential confict of interest was reported by the authors

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