

Forson, Cassiel Ato Baah

**Article**

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# DEBT, DEBT SUSTAINABILITY AND ECONOMIC GROWTH IN GHANA

Cassiel Ato Baah Forson<sup>1</sup>

## **Abstract**

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*The purpose of the study is to test for debt sustainability as well as assess the impact of public debt on economic growth in Ghana using annual time series data spanning from 1970 to 2014. The study employed the fiscal reaction function suggested by Bohn (1998) to test for the sustainability of Ghana's debt. The neoclassical growth model was used to determine the relationship between debt and economic growth after controlling for other determinants of growth such as labour, capital, trade openness, government expenditure, inflation, and democracy. Findings from the Fully Modified OLS (FMOLS) estimates reveal that Ghana's debt is unsustainable although the evidence is weak. Results from the Autoregressive Distributed Lag (ARDL) estimates reveal that debt exerts a negative impact on economic growth in Ghana in both the long and short-run, however, the long-run impact of debt on economic growth is greater. The study recommends that government must make some efforts to direct borrowed funds into productive economic activities to enable the Ghanaian economy to grow itself out of debt.*

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**KEYWORDS:** Debt, Economic Growth, Debt Sustainability, Fiscal Reaction Function.

**JEL Classification:** H30, H60, H63, O40

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<sup>1</sup> Member of Parliament, Ajumako Enyan Essiam Constituency and Ranking Member of the Finance Committee of Parliament, Parliament of Ghana, Accra. Email: cassielforson@yahoo.co.uk; cassielforson@gmail.com

## 1.0 INTRODUCTION

The growth potential of most countries in Africa is unremittingly over burdened with increasing debt levels. The International Monetary Fund in 2016 described the debt situation in Sub-Saharan African countries as one that is triggered mainly by weak growth and elevated deficits. According to Chauvin & Golitin (2010), despite the significant role of positive developments such as the Multilateral Debt Relief Initiative (MDRI) and the Heavily Indebted Poor Countries (HIPC) initiative to bring down the debt levels of Sub-Sahara Africa countries, most of them still can't find their way back to the path of perpetual debt sustainability. Debt, on its own is not the problem but unsustainable debt levels deteriorate the macroeconomic stability of a country, especially when it breaches certain thresholds. Under the EU treaties of fiscal convergence on stability and growth pact, public debt is sustainable if indebtedness does not exceed 60 percent of GDP and the budget deficit is not in excess of 3 percent of GDP. Empirically, Reinhart and Rogoff (2010, 2012) showed that debt level that exceeds 90 percent of GDP negatively affect economic growth. Caner *et al.* (2010) showed that a debt level that is below 77 percent of GDP followed by quality in infrastructure asset drives economic growth through investment. This perhaps, suggest that the exact threshold effects of public debt on growth has not been well established in the literature given the EU treaties suggests a threshold of 60 percent debt to GDP ratio.

According to Teică (2012), debt levels become unsustainable when it has been accumulated over time and government finds it difficult to service it at any given time. Ncube & Brixiová (2015) pointed out that interest rates-growth differentials and inadequate primary balances were the main drivers of unsustainable debt levels in most African countries. Studies have identified the continuous widening of the gap between the growth rate of developing countries and interest rates of debt facilities as the main cause of unsustainable debt levels (Munir *et al.*, 2016; Berg *et al.*, 2012; Kwakye, 2012; El-Mahdy & Torayeh, 2009; and Elbadawi *et al.*, 1997).

Ghana's fiscal position for the first time improved in 2015 after it was unable to consistently maximize the gains from the Multilateral Debt Relief Initiative (MDRI). It however, benefitted from the Heavily Indebted Poor Countries (HIPC) initiative in 2006 and 2004 respectively that saw its debt level reduced drastically to a sustainable level of 26 percent of GDP. Scholars who have written on the subject matter attributed Ghana's debt levels to persistent government fiscal deficits. A plethora of literature has consistently associated Ghana's rising debt level to persistent revenue shortfalls or to the perennial government expenditure overruns (IFS, 2015; Amo-Yartey, 2014; and Kwakye, 2014). Shocks to revenue targets or expenditure forecast often force government to finance its budget deficits through borrowing from the domestic or international capital market. The upsurge in the issuance of foreign and domestic debt instruments, coupled with immense borrowing from the private sector and other official creditors have either crowded out the private sector or worsened Ghana's accumulated debt stock.

Putting Ghana's debt levels within the context of the prescriptions of the sustainability threshold established by the IMF together with the World Bank using debt-to-GDP ratios shows some interesting findings. In 2012, Ghana attained a middle-income status with a very strong Country Policy and Institutional Assessment (CIPA) score with a 75 percent favorable debt sustainability framework threshold. This was matched with the strong assumption that Ghana had a probability of 10 percent of becoming debt distressed country with a threshold of 60 percent (IMF, 2012). However, the IMF in

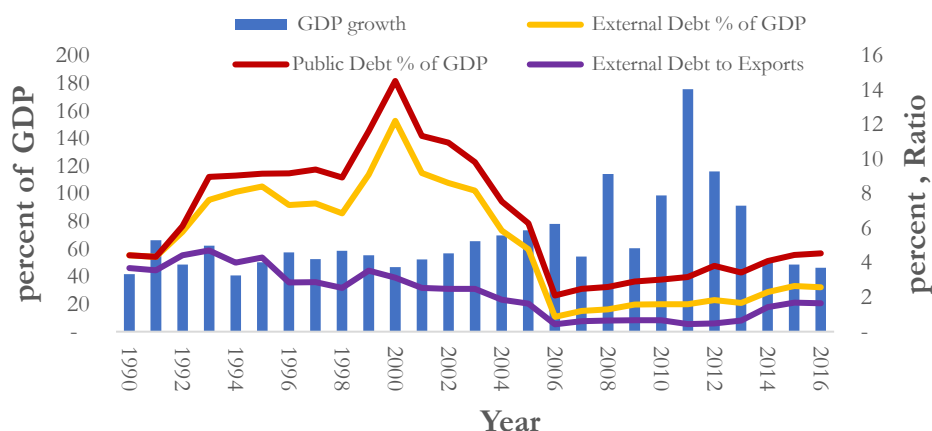
(2016) showed that the Ghanaian economy ended the 2016 fiscal year with a debt-to-GDP ratio of 73.1 percent. Data available at the Ministry of Finance showed that the overall budget deficit stood at 8.7 percent of GDP and 10.3 percent on commitment basis for the 2016 fiscal year. The overall deficit for the 2017 fiscal year was predicted at 6.5 percent of GDP.

A matter of this great sensitivity has not received the needed attention. A number of studies have attempted to analyze the effect of debt on economic growth in Ghana and in the sub-Saharan Africa. These studies have either examined the effect of external or domestic debt on economic growth. With regards to Ghana, specific case studies include: Anning *et al.* (2016); Asiamah and Owusu-Afriyie (2014); and Frimpong and Oteng-Abayie (2006). Despite their differences in methodology and approach, there has not been an established consensus on the exact effect of debt on growth as some of the effect of debt on growth were either found to be negative or positive. Frimpong and Oteng-Abayie (2006) who only examined the effect of external debt on growth in Ghana, found that external debt has a positive impact on economic growth. Anning *et al.* (2016) on the other hand found a negative relationship between public debt and growth. These studies failed to test for the sustainability of Ghana's debt and as well as examine the short and long-run effects of debt on growth after controlling for political factors.

It is worth acknowledging that the findings from these studies are in-depth and comprehensive but there exists unanswered questions, including the sustainability of Ghana's debt, the exact long and short run effects of debt on growth. It is based on these that the study seeks to test for sustainability Ghana's debt; and to examine the long and short run effect of debt on economic growth in Ghana. To best of my knowledge, the study and its approach is first of its kind in Ghana and is therefore expected to contribute to knowledge in the area of applied research and also influence policy. The subsequent parts of the study consist of literature review, methodology and data analysis and presentation of findings. The study concludes with empirical findings and offers policy recommendations.

### 1.1 Stylized facts on Ghana's debt dynamics

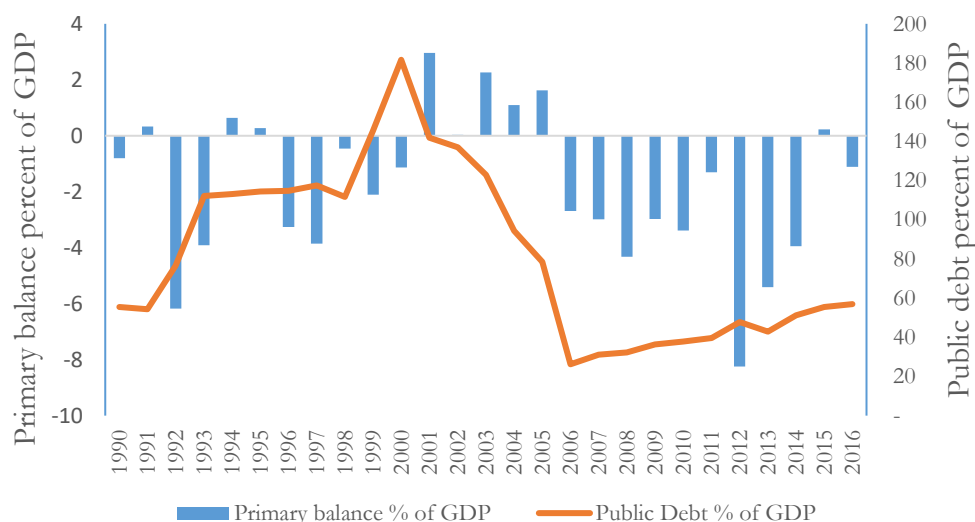
**Fig. 1: Debt ratios and GDP growth (1990-2016)**



*Source: Ministry of Finance (2016)*

Figure 1 explains the dynamics of public and external debt as a percentage of GDP. Figure 1 also explain the path of Ghana's external debt as ratio of export and the trend in GDP growth from the period 1990 to 2016. It can be observed that Ghana's external debt as a ratio of GDP has kept pace with total public debt as share of GDP since they have both consistently followed the same pattern. Between 1990 and 2005, public and external debt as a share of GDP assumed an increasing trend while economic growth witnessed a relatively stable growth averaging 5 percent. A decline in public and external debt to GDP from 2006 to 2016, was accompanied with a rise in GDP growth rate and a relatively stable external debt to exports ratio. The average growth rate over the period 2006 to 2016 was 7 percent. Ghana's external debt to export ratio over the period 1990 to 2006 witnessed a decline however, being to rise gradually from 2007 and rapidly from 2013 to date however, the value of external debt is in excess of the value of exports.

**Fig. 2: Primary Balance and Debt Dynamics in Ghana (1990 – 2016)**



**Source:** Ministry of Finance (2016)

Primary balance which basically excludes interest expenditure is a key driver of debt dynamics. Technically speaking, stabilizing debt to GDP ratio and keeping public debt on a declining path requires maintaining significant amount of primary surplus over a period of time. This has not been the case of Ghana in most years. From the Fig. 2 above, periods of higher primary deficits are associated with rising public debt to GDP ratio except between the year 2000 to 2006 where consecutive positive primary surpluses recorded over the period brought about a decline in the debt to GDP ratio.

## 2.0 LITERATURE

### 2.1 Debt, debt Sustainability and Economic Growth

The fiscal approach to debt sustainability takes its underlying assumption from the government budget constraint which postulates that primary fiscal deficit not financed by printing new currency will

automatically feed into higher public debt (Guzman & Heymann, 2015). According to Marieta (2014), the growth in debt-to-GDP ratio that is driven by interest rate-growth differential plays a critical role in assessing the sustainability of countries debt. A negative interest rate-growth differential is a welcoming relief for debt sustainability in low income countries and emerging markets, while a positive interest rate-growth differential is not friendly to advanced economies given the fact that they are much interested in running primary surpluses to enhance debt stabilization (IMF, 2011). The fundamental identity that explains the baseline determinants of debt sustainability in continuous terms given that government will not finance its budget by printing currency is written as;

$$\dot{d} = b + (r - y)b \quad (1)$$

Where,  $\dot{d}$  is the growth rate of debt-to-GDP ratio,  $b$  is the primary surplus/deficit-to-GDP ratio,  $y$  is the real growth rate,  $r$  is the real interest rate on debt servicing. Government expenditure component of primary deficit/surplus excludes interest payment expenditure. The equation above states that, a mixture of fiscal and budgetary policies is required to enhance debt sustainability. To achieve this, governments should aim at reducing budget deficits and increase primary surpluses (Teică, 2012).

The theory of inter-temporal budget constraint, also known as the present value of borrowing constraint is the work of Hamilton and Flavin (1986). The theory says that if government runs a deficit in the current period it means that government is determined to run a surplus in the future period so that any accumulated debt and interest will be repaid, hence the discounted present and future obligations must not be greater than the discounted revenues including that which is received from seignorage. When this hypothesis is tested using relevant data and the claim is violated it means fiscal policy and government debt are unsustainable. Chalk & Hemming (2000) argued that, the inter-temporal budget constraint in theory and practice is a standardized measure that does at least one of the following: serves as a yardstick against which solvency is examined; used to test for the sustainability of various debt indicators; and it serves as bench mark for measuring debt uncertainty. The strength of fiscal reaction function relevant is its ability to utilize macroeconomic approach to assessing public debt sustainability (D'Erasmus *et al.*, 2016).

Based on inference from the above, we conclude that the channels that is often used to explain the theoretical relationship between debt and economic growth are: the debt-service effect otherwise known as the crowding out effect and the debt overhang effect otherwise known as the debt stock accumulation effect. According to Krugman (1988), the overhang effect is condition where the accumulated debt stock is so large that it renders investment significantly low, hence depressing economic growth. Sachs (1989) explain that countries that find themselves in a debt overhang situation can only reduce their debt accumulation by increasing investment. The crowding out channel according to Cohen (1993) argues that economic growth is depressed due to falls in investment resulting from surge in debt servicing. This theory basically emphasizes how the productive sectors of an economy are crowded out due to an increase in debt servicing.

## 2.2 Empirical Literature

Munir *et al.* (2016) applied a threshold regression method to estimate the relationship between debt and economic growth in Malaysia. The study found a negative relationship between debt and growth in Malaysia, after controlling for the determinants of growth. Antonakakis (2014) used a panel of twelve (12) Euro area countries debt ratio thresholds on economic growth for a period of 44 years. The study revealed that sustainable debt ratios above a threshold of 90 percent had a positive effect on growth in the short-run. Using the threshold regression technique by Hansen (2000), they again found an inverse relationship between debt and economic growth. El-Mahdy & Torayeh (2009) used annual frequency data from 1981 to 2006 utilizing the cointegration estimation techniques along with some algebra found that public debt in Egypt had a robust negative effect on growth. They also confirmed that the debt path in Egypt in recent times were also sustainable.

Herath (2016) estimates the relationship between economic growth and debt in developed and developing countries while controlling for the size of their public sector and as well their per capital income. The study revealed that in the developed countries, higher levels of debt became a stimulant for economic growth and an expansion in the public sector. The results further showed that in developing countries, higher levels of debt also increase the growth of the public sector. Using a probability approach, Gardner & Di Giovanni (2008) found that debt-to-GDP ratio in a medium-term threshold leads to shocks in GDP and interest rates growth.

Wright & Grenade (2014) examine debt-growth nexus in thirteen (13) Caribbean countries using panel threshold dynamics and dynamic ordinary least squares estimates. The study found a universal peaking point for debt-to-GDP ratio of sixty-one (61) percent. A debt-to-GDP ratio beyond this point has an adverse effect on growth. The study also showed that there is a non-linear relationship between economic growth and debt level. Reinhart & Rogoff (2010) showed that debt had a diminishing effect on economic growth. Based on empirical estimates, their study proved that countries with a debt-to-GDP ratio greater than a threshold of 90 had their growth rates declining from 3 to -0.1.

The findings on the impact of debt and economic growth in Ghana are mixed. Using the inter-temporal budget constraint, Asiama *et al.* (2014) found that fiscal sustainability is a basic requirement for debt sustainability in Ghana after testing for the consistency of government fiscal behaviour with debt sustainability in Ghana. Owusu-Nantwi and Erickson (2016) examine the relationship between public debt and economic growth in Ghana from 1970 to 2012 using vector error correction model and cointegration. The study reported a positive relationship between economic growth and public debt in the long-run, and a bidirectional relationship between public debt and growth in the short-run. Frimpong and Oteng-Abayie (2006) used annual time series data from 1970 to 1999 and also found that inflows of external debt have a positive impact on the economic growth of Ghana on the short-run. Estimates via the VECM techniques revealed that debt servicing has a negative impact on economic growth. Anning *et al.* (2016) in a separate study showed that public debt has a negative effect on economic growth in Ghana.

According to D'Erasmus *et al.*, (2016), debt sustainability must be anchored on fiscal solvency which is driven by prudent fiscal adjustments. The only motivating factor that drives debt-to-GDP ratio from

an unsustainable level to a sustainable level is enhanced fiscal policy (Blanchard *et al.*, 1991). In any case it is expected that in the long and infinite horizon, government must become solvent enough in order to be able to pay its debt by generating future primary surpluses without engaging in ponzi game financing. Collignon (2012) viewed public debt as an event of the interaction of fiscal policy and the macroeconomic environment. To ensure that debt does not explode over time, policy makers need to consistently adjust fiscal balances in response to changes in the macroeconomic environment.

Using a non-linearity approach, Reinhart *et al.* (2003) and Reinhart & Rogoff (2010), show that debt has a particular threshold effect on growth. Results from a non-linear economic model showed that countries with debt above 90 percent of GDP are mostly lower growth performers. Mencinger *et al.* (2014) employed an inverted U-shaped approach to determine the turning points effects of debt on economic growth in sovereign EU states. After controlling for heterogeneity and endogeneity problems, the study showed that public debt-to-GDP ratio have non-linear impact on GDP per capita growth. The study further showed that the point at which the effects of debt on GDP turns from positive to negative is around 80 and 94 per cent.

Agénor & Montiel (1996; 2008) provide the background for understanding the dynamic role of fiscal balances in the sustainability of public debt. They proposed that whenever primary surplus and seigniorage to GDP ratio is constant, the present value of debt obligations would be inestimable if the rate of growth in real GDP is greater than the interest rates in real terms. This will guarantee solvency because the gains from issuing new debt is greater than that which is required to service existing debt without causing a rise in debt-to-GDP ratio. Any deviation from this premise will put the country permanently in indebtedness since it will have to generate its own resources through seigniorage.

In recent times, Fiscal imbalances of most countries, especially in the Sub-Saharan Africa has been chiefly occasioned by unfavourable terms of trade which has led to unsustainable debt levels (Chauvin & Golitin, 2010). Chaudia & Javid (2013) use the fiscal reaction function to test for debt sustainability in Pakistan. The study revealed that there was a positive relationship between surplus-to-GDP ratio and lag of debt-to-GDP ratio. The study also found weak form of debt sustainability as indicated by the small size of the coefficient of debt-to-GDP ratio. Cottarelli & Moghadam (2011) argue that public debt sustainability is larger function of fiscal policies. They posit further that debt sustainability and fiscal sustainability are both inter-related, such that sound fiscal adjustment generate sufficient primary balances that is required to service public debt. At the extreme, if primary balances turn out to be politically motivated, debt level becomes unsustainable.

Proponents of fiscal rules argue that in most cases, swings in business cycles may render fiscal policy ineffective, hence the need for automatic stabilizers to capture the effects of swings in business cycles. The effect of these automatic stabilizers would impact on an economy only if the government balance their budgets particularly when they set the structural budget deficit to zero over the medium term (Artis & Buti, 2000; Bean & Gerlach, 1998; Bayoumi & Eichengreen, 1995; and Afonso, 2005). The common proposition is that when the growth rate of an economy is lower than the rate of interest, stabilizing the growth rate of debt-to-GDP will demand that government runs a primary budget surplus. Using a VAR



approach, Chan *et al.* (2014) showed that fiscal consolidation does not play significant role in leveraging the debt of a country.

Claessens *et al.* (1997) outline three channels through which debt affects economic growth and these are; the effect of cash flow, the disincentive effect and the moral hazard effect. These channels define the link between macroeconomic performance and debt level. The cash flow effect explains the impact of an increase in indebtedness on capital and private investment. According to the cash flow effect, an increase in public debt promotes capital flight which in turn constrain private investment. The disincentive effect explains how higher level of indebtedness results in higher taxes. It states that when the debt burden is too high, servicing the debt becomes inevitably a positive function of GDP, leading to a shrink in investment and higher taxes in order to pay the creditors. The moral hazard effect explains the impact of debt relief on the economic performance. With debt relief, an indebted country will be relieved of its debt which provides an incentive for additional borrowing. Using your new debt position to undertake additional borrowing after benefiting from debt relief inevitably hurts economic growth as found in Ghana.

Various studies have also examined the impact of institutional factors such as good governance and democracy on economic growth. Using a cross section of 144 countries from 1980 to 2014, Heshmati and Kim (2017) found that democracy has a robust positive impact on economic growth. Gerring *et al.* (2005) argued that the effects of democracy on economic growth are not direct but indirect. Democratic is expected to promote the course of good governance which makes it easier for resources to be allocated into productive use, hence driving economic growth. The International Monetary Fund (IMF) during the article (IV) consultations and the fourth review found Ghana's economy at high-risk distress and vulnerable to exchange rate shocks due to upsurge in external debt. Najib *et al.* (2016) in a related study found that external debt have a positive impact on economic growth in Ghana by using annual frequency data from 1970 to 2014 and applying the ARDL estimation techniques. The estimates showed evidence of crowding out effect as debt service was found to have a negative impact on growth. It follows from the above literature that the findings in the directional relationship between debt and economic growth are mixed. In the case of debt sustainability, Bohn (1998) predicts that for a country's debt to be sustainable, there must be a positive relationship between primary surplus-to-GDP ratio and lag of debt-to-GDP ratio. Conversely, a negative relationship must exist between primary deficit-to-GDP ratio and debt-GDP ratio. In the case of changes in government spending, Bohn (1998) suggest that primary-surplus-to-GDP should have a negative relationship with changes in government expenditure same as primary deficit-to-GDP having a positive relationship with changes in government expenditure.

We conclude that the findings on debt and economic growth dynamics vary among countries. In some instances, debt has been found to have a negative impact on debt and some instances debt has been found to have a positive impact on growth. The impact of debt on economic growth is not the same for developed and developing countries. In the case of developing countries, economic growth has been found to staggering while public debt is on the ascendency. This explained partly by the differences in the structural and institutional that exist among these countries.

### 3.0 METHODOLOGY

#### 3.1 The Models

The fundamental baseline assumption for studying debt sustainability is to first determine whether government fiscal policies are taking the economy to soundness or to insolvency. Based on this assumption, it means that sustainability requires that government fiscal policies must be implemented in way that satisfies the conditions of the theory of the inter-temporal budget constraint. Following Chandia & Javid (2013), and given that government will not use high powered money to mobilize resource, the inter-temporal budget constraint of government equation may be written as:

$$R_t D_{t-1} + G_t = Rev_t + \Delta D_t \quad (2)$$

From equation 2,  $R_t D_{t-1}$  represents government debt servicing obligations,  $G_t$  represents government expenditure,  $Rev_t$  represent government tax revenue,  $\Delta D_t$  represent government liabilities acquired through the issue of bonds called debt stock, and  $R_t$  is the interest rate on public debt (public liabilities). Thus, the left-hand side of the equation represents the use of government revenue while the right-hand side represents the sources of government revenue. The element of money finance is ignored because government may not have the authority to finance its budget by printing new currency. Rearranging the terms in equation 2 become;

$$G_t - Rev_t = \Delta D_t + R_t D_{t-1} \quad (3)$$

From equation 3, the left-hand side represent government primary budget surplus/deficit and the left-hand side constitutes government total stock of liabilities (debt). Government capacity to meet debt obligation depends on the level of income measured by the size of nominal GDP. Using the nominal GDP to adjust equation 3, we derive Bohn (1998) fiscal reaction function or policy rule which is consistent with the rational behaviour of government. This results in equation 4 below;

$$pb_t = \delta_0 + \delta_1 d_{t-1} + \mu_t \quad (4)$$

Bohn (1998) used the above fiscal reaction function to test for debt sustainability. Where,  $pb_t$  represents the primary balance (surplus/deficit)-to-GDP ratio at time t, and  $d_{t-1}$  represents the debt-to-GDP ratio at time t-1 while  $\mu_t$  is the stochastic disturbance term. The condition for debt sustainability mandates us to impose a certain parametric restriction on the coefficient of debt-to-GDP ratio ( $\delta_1$ ). In countries with historical levels of budget deficits, the coefficient is expected to be positive ( $\delta_1 > 0$ ), on the other hand, in countries with historical levels of budget surpluses, the coefficient would be negative ( $\delta_1 < 0$ ). As stated in equation 5, the model is extended to include other determinants of government primary balance (surplus/deficit) as proposed earlier by Barro (1986) and Barro (1979). The general form of fiscal reaction function is written as;

$$pb_t = \delta_0 + \delta_1 d_{t-1} + \delta_2 pb_{t-1} + \delta_3 G_t + \delta_4 OUTG_t + \mu_t \quad (5)$$

Also,  $G_t$  and  $OUTG_t$  represent government and output gap respectively. Output gap shows how deviations in the actual output from the potential output will cause shocks to primary balance (Izák, 2009). Chandia & Javid (2013) referred to equation 5 as an extended fiscal reaction function. They argued that the choice of the fiscal reaction function in measuring debt sustainability is justified given that it can be extended to capture the effects of key drivers of debt sustainability such as output deviations and other macroeconomic variables.

Following the empirical work of Elbadawi *et al.* (1997) adopted by Frimpong, and Oteng-Abayie (2006), the paper adopts the following functional form specification to examine the nexus between economic growth and debt.

$$Q_t = F(INVT_t, DEBT_t, INF_t, G_t, Demo_t, FDI_t, DServ_t) \quad (6)$$

Where  $Q_t$  represents the growth rate in aggregate output,  $INVT_t$  signifies gross domestic investment,  $DEBT_t$  symbolizes debt stock,  $INF_t$  denotes inflation (general macroeconomic stability). The symbol  $G_t$  represents government consumption expenditure,  $Demo_t$  signifies democracy,  $DServ_t$  represents debt service, and  $FDI_t$  denotes foreign direct investment. The evolution of capital and labour in growth is captured by gross domestic investment. All independent variables are expressed as a ratio of GDP. Using a log-linear specification, equation 6 is re-written as;

$$\ln Q_t = \alpha_0 + \alpha_1 \ln INVT_t + \alpha_2 \ln DEBT_t + \alpha_3 \ln INF_t + \alpha_4 G_t + \alpha_5 Demo_t + \alpha_6 \ln FDI_t + \alpha_6 \ln DServ_t + \varepsilon_t \quad (7)$$

Equation 7 is considered as a log-linear expression; hence all estimates would be interpreted as elasticities. Where  $\alpha_s$  are the parameters to be estimated,  $\varepsilon_t$  represents the stochastic error term.

### 3.2 Data

The study utilize data spanning the period of 1970 to 2014 from the following sources: The International Monetary Fund (IMF), World Bank-World Development Indicators (WB-WDI), Ministry of Finance (MoF), and Bank of Ghana while Policy (II) data was extracted from policy (IV) project. The variables measure and used in the research are: debt-to-GDP ratios, real interest rates, government expenditure, government revenue, real exchange rates and primary budget deficit/surpluses, gross domestic investment, interest payment on debt service and Foreign Direct Investment.

**Table 1: Measurement of variable, sources of data, and the prior expectations**

Variable	Measurement	Data source	A priori Sign
Primary balance	Primary budget surplus/deficit to GDP ratio	MoF	
GDP growth	GDP growth rate	GSS	
Output gap	The deviation of actual output from potential output	Generated	+/-
Debt	Debt as a share of GDP	MoF	+/-
Inflation	percent Change in the CPI	GSS	+/-
Government expenditure	Final government consumption expenditure	MoF	+
Gross Domestic Investment	Accumulation in physical in physical and human capital expressed as ratio of GDP (percent of GDP). It excludes foreign direct investment.	GSS	+
Debt Service	Measured as the amount of money used to settle the principal and interest on debt.	MoF	-
Foreign Direct Investment	Measured as the net inflow of investment made by non-residents expressed as a ratio of GDP	BOG	+, -
Democracy	Measured using polity two (2)	Polity IV project	+

Researcher's construct

### 3.3 Estimation Techniques

#### 3.3.1 ADF and KPSS unit root test

The ADF unit root process is an augmented version of the original Dickey Fuller unit root test procedure. The ADF unit root test augments the Dickey Fuller procedure by including a lagged value of the dependent variable. According to Dimitrios & Hall (2011), the ADF test is more useful in macroeconomic time series. The ADF procedure is expressed in an equation form as;

$$\Delta Z_t = \rho_1 + \rho_2 t + \rho_3 Z_{t-1} + \sum_{i=1}^p \alpha_i \Delta Z_{t-i} + \mu_t \quad (8)$$

Where  $Z_t$  represents the time series variable,  $t$  is the trend variable,  $\rho_s$  are the estimated parameters,  $\Delta$  is the first difference operator,  $\alpha_1$  denotes the coefficient of the lagged value of the dependent variable.

$\varepsilon_t$  is the white noise error term. The baseline notation for the KPSS test is used in this study. The KPSS model used to determine the stationarity properties of the variables is written as;

$$Y_t = \alpha_1 + \varphi_2 t + b \sum_{i=1}^p \varepsilon_t + \mu_t \quad (9)$$

The model assumption is that both  $\varepsilon_t$  and  $\mu_t$  are covariance stationary having a zero mean and a unit standard deviation expressed as  $d \in (0, 1)$ . The KPSS test statistic is considered as the process sum of the residual with the null hypothesis of  $H_0: \alpha + \varphi_t + e_t$ .

### 3.3.2 Fully Modified Ordinary Least Squares (FM-OLS)

Equation 5 is estimated using the Phillips and Hansen (1990) Fully Modified Ordinary Least Square (FM-OLS). This approach is selected over the normal OLS procedure because of its robustness in resolving endogeneity problem. The rationale for adopting this approach is due to the implied assumption that some the independent variables in the above equations may be endogenous and/or correlated arbitrarily. According Phillips and Hansen (1990), the FM-OLS is a semi-parametric correction procedure that is able to correct any problem that is caused by correlation between shocks in stochastic regressors and cointegrating equations. Again, the small sample performance of FM-OLS is proven to be very reliable and the estimates are also very efficient and consistent (Cappuccio and Lubian, 2001; Hargreaves, 1994). This makes it more suitable than other related techniques.

### 3.3.3 ARDL

This study applied the ARDL process in two stages. In the first stage, the bounds test is used to test for the presence of cointegration and to examine whether there is any long-run equilibrium relationship among the variables in the model. In the second stage, the study estimate the long run and short run parameters using ARDL. Theoretically, the ARDL process enable the researcher to estimate the model even if the variables exhibit mixed order of integration or stationarity after first difference (Pesaran *et al.*, 2001). From equation 7, the ARDL process of estimation using an unrestricted error correction model is written as;

$$\begin{aligned} \Delta \ln Q_t = & \gamma_0 + \sum_{i=1}^n \gamma_1 \Delta \ln Q_{t-i} + \sum_{i=0}^n \gamma_2 \Delta \ln INVT_{t-i} + \sum_{i=0}^n \gamma_3 \Delta \ln DServ_{t-i} + \sum_{i=0}^n \gamma_4 \Delta \ln DEBT_{t-i} \\ & + \sum_{i=0}^n \gamma_5 \Delta \ln INF_{t-i} + \sum_{i=0}^n \gamma_6 \Delta \ln G_{t-i} + \sum_{i=0}^n \gamma_7 \Delta \ln Demo_{t-i} + \sum_{i=0}^n \gamma_8 \Delta \ln FDI_{t-i} \\ & + \alpha_1 \ln Q_{t-i} + \alpha_2 \ln INVT_{t-i} + \alpha_3 \ln DServ_{t-i} + \alpha_4 \ln DEBT_{t-i} + \alpha_5 \ln INF_{t-i} \\ & + \alpha_6 \ln G_{t-i} + \alpha_7 \ln Demo_{t-i} + \alpha_8 \ln FDI_{t-i} + \varphi ECM_{t-i} + \mu_t \end{aligned} \quad (10)$$

$\Delta$  is the difference operator and  $\gamma_1, \gamma_2, \gamma_3, \gamma_4, \gamma_5, \gamma_6, \gamma_7, \gamma_8$  are the short-run coefficients while  $\alpha_1, \alpha_2, \alpha_3, \alpha_4, \alpha_5, \alpha_6, \alpha_7, \alpha_8$  are the long-run elasticities.  $ECM_{t-i}$  is the error correction term which is a measure of the speed of adjustment to long run equilibrium whenever shocks occur in the system and  $\mu_t$  is the stochastic term. From the above, the null and alternative hypothesis for the test of cointegration among the variables is specified as;

$$H_0: \alpha_1 = \alpha_2 = \alpha_3 = \alpha_4 = \alpha_5 = \alpha_6 = 0$$

$$H_1: \alpha_1 \neq \alpha_2 \neq \alpha_3 \neq \alpha_4 \neq \alpha_5 \neq \alpha_6 \neq 0$$

This study utilizes the F-test statistic as decision criteria for the null and alternate hypothesis on the absence of cointegration stated in the null hypothesis. According to Pesaran *et al.* (2001), when the F-statistic exceeds the lower and upper bound from the bounds test results, then we reject the null hypothesis of no cointegration and accept the alternative hypothesis.

## 4.0 PRESENTATION AND DISCUSSION OF RESULTS

### 4.1 ADF and KPSS unit root test

The unit root test results for the ADF and the KPSS are reported at level and at the first difference. When a series is stationary at the levels, its integrating order is zero I (0). However, when a series is stationary after first differencing, it is said to have an integrating order of one I (1). Table 2 reports the constant with trend results for each of the variables employed in the study. We can conclude from the ADF and KPSS results reported in Table 2 that all the variables are strictly stationary after the first difference.

**Table 2: ADF and KPSS unit root test**

Variable	ADF		KPSS		Decision
	Levels	1 <sup>st</sup> Difference	Levels	1 <sup>st</sup> Difference	
	Cons+T	Cons+T	Cons+T	Cons+T	
Pb	-1.416	-3.281***	0.048	0.170***	I(1)
lnGDP	0.561	2.413***	0.078***	0.145***	I(1)
lnOutG	-1.278	-3.536***	0.463	0.134***	I(1)
lnDebt	1.196	-2.629***	0.151	0.118***	I(1)
lnfl	1.457	-2.982***	0.152	0.055***	I(1)
lnG	1.038	2.906***	0.191	0.138***	I(1)
lnInvt	0.388	-6.17***	0.500	0.114***	I(1)
lnDServ	0.180	2.616***	0.110***	0.127***	I(1)
Demo	-0.231	2.307***	0.106***	0.068***	I(1)
lnFDI	-1.602	-3.778***	0.160	0.132***	I(1)

Only constant + trend results are reported

\*\*\*Significance at 5percent significance level

A null hypothesis of non-stationarity

Newey-West Bandwidth lag selection criteria for KPSS and the 5percent and 10percent critical values for stationarity around the level and deterministic linear trend are 0.146 and 0.119

Researcher's estimates

### 4.2 Bounds test

The study further applied the bounds test technique by Pesaran *et al.* (2001) to check for the long-run relationship among the variables after ascertaining the integrating orders of the variables. The estimated results is reported in Table 3 below. The estimated F-statistic of 9.826151 is greater than both the lower bound and upper bound critical values at 5percent, 10percent, 1percent level of significance. This suggest that cointegration exist among the variables, and hence a long-run relationship is said to exist among the variables.

**Table 3: Bounds Test for Cointegration**

Test Statistic	Value	k
F-statistic	9.826***	7
Critical Value Bounds	Lower bound	Upper bound
10percent	2.03	3.13
5percent	2.32	3.5
2.5percent	2.6	3.84
1percent	2.96	4.26

Researcher's estimates

#### 4.3 Fully Modified OLS results

The use of the Fully Modified OLS is also based on the fact that cointegration exist among the variables. The Newey-West Bandwidth lag selection criteria was adopted.

**Table 4: Estimated Fully modified OLS results**

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Debt(-1)	0.021	0.003	5.759	0.016
pb (-1)	-0.569	0.130	-4.375	0.000
G	-0.895	0.129	-6.920	0.000
OUTG	0.152	0.030	5.050	0.000
C	-3.51E+08	3.97E+08	-0.882744	0.389

Researcher's estimates

Findings from the estimation of the fiscal reaction function in equation 4 using Fully Modified Ordinary Least Squares (FMOLS) is presented in Table 4. The results revealed that the coefficient of lag of debt-to-GDP ratio (debt), lag of primary balance-to-GDP ratio (pb), change in government expenditure (G) and output gap (OutG) were all statistically significant at 5percent confidence level. The coefficient of lag of debt-to-GDP ratio is positive and statistically significant. The coefficient of 0.021 for lag of debt-to-GDP ratio means that lag of debt-to-GDP ratio has a positive impact of 0.021 on primary balance. The coefficient of government expenditure is negative and statistically significant at 5percent level of significance. The implication of a negative coefficient -0.8955 is that, changing government expenditure by 1percent will change the size of government primary balance-to-GDP ratio by 0.8955percent. The results for lag of debt-to-GDP and government spending are not consistent with Bohn's (1998) criteria for debt sustainability as prescribed by the fiscal reaction. The coefficient of the output gap also has implications for the primary balance position. Izák (2009) found that countries that are able maintain a

strong positive output gap through a sustained increase in GDP achieve a stabilize debt-to-GDP ratio are allowed to run a primary budget deficit. The positive coefficient of output gap reported means that Ghana's debt sustainability position has not completely breached the threshold. The positive coefficient of 0.152 for output gap implies that potential output is greater than actual output which is an indication that a consistent growth in GDP will stabilize Ghana's debt-to-GDP ratio, hence bringing debt levels back to the path of sustainability as suggested by Izák (2009).

The results reported in Table 4 above is not consistent with the criteria postulated by Bohn (1996). Based on the positive coefficient of lag of debt-to-GDP ratio of 0.0214 and the negative sign of the coefficient of government expenditure of -0.895, the study concludes Ghana's debt is not sustainable since Ghana is one of the countries in sub-Saharan Africa that has persistently recorded budget deficits. Nonetheless the evidence of debt unsustainability is found to be weak, that is about 2.14 percent. On the other hand, the impact of government expenditure on primary balance to GDP ratio was found to very high, that is about 89 percent. The findings in this study is at variance with similar study by Chandia & Javid (2013). Using annual frequency data from 1971 to 2008 to estimate a fiscal reaction function, Chandia & Javid (2013) found a positive relationship between primary surplus-to-GDP ratio and lag of debt-to-GDP ratio in Pakistan, hence making debt sustainable in Pakistan. Chandia & Javid (2013) further showed that surplus-to-GDP ratio responds negatively to change in government expenditure.

#### 4.4 Long-run ARDL results

It is observed from Table 5 that debt, government expenditure, and debt service are the key determinants of growth in the long-run. However, gross domestic investment inflation, foreign direct investment and democracy were found to be statistically insignificant at 5 percent significance level. The study concludes that inflation, foreign direct investment and democracy does not explain economic growth in the long-run.

**Table 5: Estimated long-run ARDL results**

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNINVT	0.159930	0.070700	2.262089	0.0363
LNDEBT	-0.173821	0.060919	-2.853300	0.0279
INF	-0.031826	0.037351	-0.852071	0.4054
LNG	0.050034	0.016200	3.088334	0.0016
LNFDI	0.615223	0.651492	0.944329	0.3575
DEMO	0.432117	1.125743	0.383850	0.1261
LNDSE	-0.417396	0.220724	-1.891024	0.0547
C	-2.987144	1.370985	-2.178829	0.0429

Researcher's estimates

Debt was found to have a negative impact on growth after controlling for other determinants of growth. The coefficient of debt was found to be negative and statistically significant at 5percent level of significance. The coefficient of debt is -0.17 as reported in the Table 5 above. This implies that an increase in debt by 1 percent will reduce economic growth by 0.17 percent in the long run in Ghana.



Munir *et al.* (2016) argues that debt has a negative on economic growth because of the existence of institutional and structural rigidities in most developing countries. In most developing countries, funds acquired through debt may sometimes end up in unproductive expenditures or corruption related activities. By implication, this reduces the investment creation potential of the debt acquired. More so, the opportunity cost of repaying the debt is foregone production. This claim is supported by the negative and statistically significant coefficient of debt service. Every one percent increase in debt service reduces economic growth by 0.41 percent. The coefficient of debt service is correctly signed and consistent with the findings of Frimpong and Oteng-Abayie (2006). They argue that the high cost debt service completely crowds out the productive sectors of the economy, hence reducing economic growth.

Again, the coefficient of government expenditure is 0.162 and statistically significant at 5percent level of significance in the long-run. Increasing government expenditure in the long run will drive growth by 0.16 percent. This finding is consistent with the work of Chauvin & Golitin (2010) who had the position that the multiplier effects of government expenditure manifest themselves fully in the long-run where there is some flexibility in the mobility of factors of production. The study also found that gross domestic investment had an impact on economic growth in the long-run. The coefficient of gross domestic investment was found to be 0.159 and statistically significant at 5percent level of significance. This is an indication that a one percent increase gross domestic investment will increase economic growth by 0.15 percent. This result is consistent with the findings of Adams (2009) for sub-Saharan Africa countries. He found that an increase in domestic investment which augments the productivity of capital and labour drives economic growth.

#### 4.5 Short-run results

We found that debt has an impact on economic growth in Ghana after controlling for other determinants of economic growth in the short run. The coefficient of debt is negative and statistically significant at 5 percent level of significance in the short-run. As reported in Table 6 below, showed that, in the short-run, a 1 percent increase in government debt would lead to 0.18 percent decline in Ghana's economic growth. The results agree with findings by El-Mahdy & Torayeh (2009). According to El-Mahdy & Torayeh (2009), countries with unsustainable debt levels where more likely to experience declining growth whenever their levels increases.

**Table 6: Estimated short-run ARDL results**

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNINVT)	0.026484	0.026484	2.201850	0.0410
D(LNDEBT)	-0.189884	0.067728	-2.803588	0.0288
D(INF)	-0.030472	0.016660	-1.828963	0.0680
D(LNG)	0.047906	0.022941	2.088205	0.0307
D(LNFDI)	0.589061	0.649960	0.906304	0.3767
D(DEMO)	0.023446	0.006233	3.761591	0.0221
D(LNDSER)	-0.229546	2.770445	-0.082855	0.1442
ECM (-1)	-0.957475	0.216035	-4.432040	0.0003
R-squared	0.877311			
Adjusted R-squared	0.841266			

F-statistic	53.10891
Prob(F-statistic)	0.024711
Akaike info criterion	4.348329
Schwarz criterion	4.735435
ARDL (1, 0, 0, 0, 0, 0)	

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Researcher's estimates

The coefficients of foreign direct investment and debt service did not have an impact on economic growth at 5 percent level of significance in the short-run. However, the coefficient of inflation was negative and highly significant at 10percent significance level. The study revealed that an increase in inflation by every 1 percent will reduce economic growth by 0.030 percent. The negative relationship between inflation and economic growth is consistent with findings by Ahortor et al. (2012), Frimpong and Oteng-Abayie (2010), and Aryeetey and Fosu (2003). Moreso, the coefficient of government expenditure and gross domestic investment was found to be significant at 5percent significance level in the short run. Increasing gross domestic investment will drive economic growth in the short run in Ghana. The positive coefficient of gross domestic investment (0.026484) is inconsistent with the theoretical underpinnings of the debt “overhang” effect by Krugman (1989) and the empirical work of Frimpong and Oteng-Abayie, (2006). The latter study found a negative relationship between gross domestic investment and economic growth and explained that the lower returns on investment due to the debt overhang effect discourages domestic investment, hence reducing economic growth. Increasing government expenditure was also found to increase economic growth by 0.0479 in the short-run. According to Cooray (2009), the multiplier effects of increased government expenditure is what drives economic growth in the short-run. The coefficient of the error correction term is negative and statistically significant at 5percent level of significance. The error correction term is the long-run speed of adjustment coefficient. It measures the speed at the variables return to a long-run equilibrium if there is a shock to any of the independent variables. A coefficient of -0.862 implies that the speed of adjustment is very short since it is close to one (1). The study concludes based on the results in the above that debt has a negative impact on growth in the short-run.

#### 4.6 Model Diagnostic Tests

The null hypothesis of the Jarque Bera test states that the residuals are normally distributed. The results however show that Jarque-Bera statistic strongly accepts the null hypothesis that the residuals are normally distributed. The null hypothesis of the Breusch LM test for serial correlation states that there is no serial correlation. The probability value of the Breusch LM test for serial correlation is 0.1269. A probability value of 0.1269 implies that the null of no serial correlation among the variable is strongly accepted. The null hypothesis of the Breusch-Pagan-Godfrey test states the absence of heteroskedasticity. The probability value of no heteroskedasticity based on the Breusch-Pagan-Godfrey test is 0.12. This implies the acceptance of null hypothesis which states that there is no heteroskedasticity. Finally, the CUSUM and CUSUMSQ tests for parameter stability revealed that the parameters are stable. The CUSUM and CUSUMSQ tests displayed below show that variations to the model is within control.

Figure 3: CUSUM Test Results

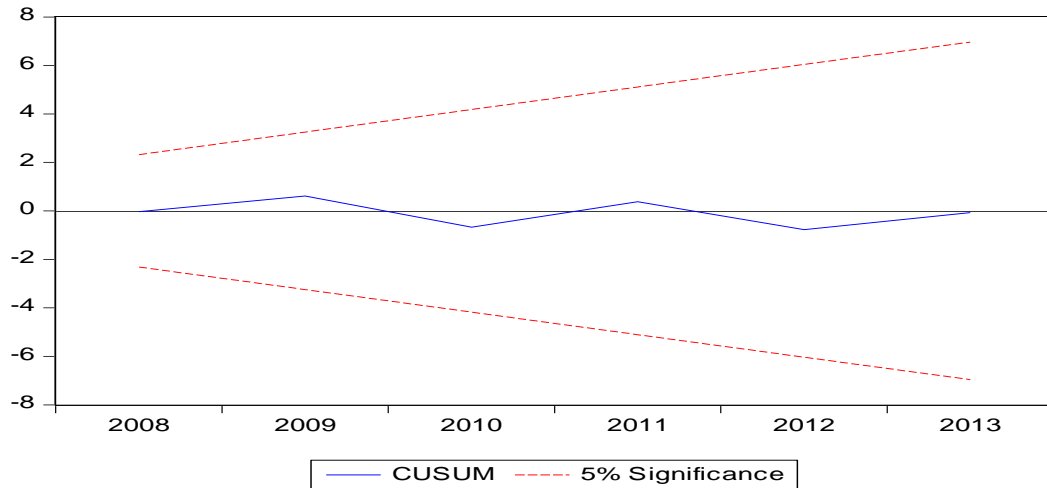
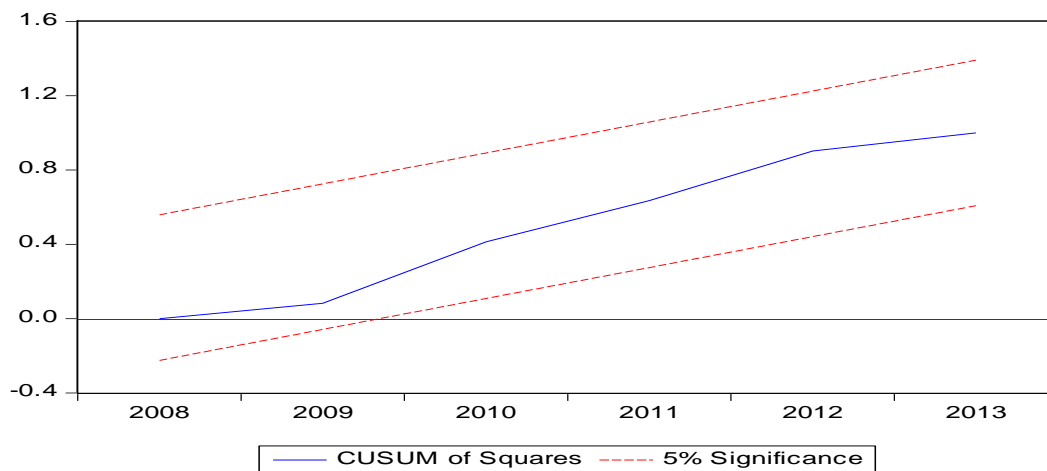


Figure 4: CUSUMSQ Test Results



**Table 7: Estimated diagnostics test**

Test Type	Results
Normality test (Jarque Bera)	[0.509] (0.775)
Breusch LM test for serial correlation	[5.548] (0.126)
Breusch-Pagan-Godfrey test for heteroskedasticity	[1.660] (0.123)
Cusum	Stable
Cusum squares	Stable
[ ] Statistics ( ) Probability values	

Researcher's estimates

## 5.0 CONCLUSION AND RECOMMENDATION

The paper sought to test for debt sustainability in Ghana, and to examine the impact of debt on economic growth in Ghana. The ADF and KPSS unit root test revealed a mix order of integration among the variables. However, the bounds test for cointegration revealed evidence of cointegration among the variables. Hence, the study established that there exists a long-run stable relationship among the variables, namely, economic growth, debt, government expenditure, debt service, gross domestic investment, foreign direct investment and democracy. The Fully Modified Ordinary Least Squares (FMOLS) estimates revealed that lag of debt-to-GDP ratio and government spending had an impact on primary balance-to-GDP ratio after controlling for output gap and lag of primary balance-to-GDP ratio. It was further revealed that Ghana's debt has not been sustainable since Ghana's fiscal position has consistently been in deficits. Further, the ARDL results showed that debt has a negative impact on growth in both the short and long-run though the impact in the long-run is greater. Government expenditure and gross domestic investment were found to have a positive impact on economic growth in Ghana. The other determinant of growth based on the short-run ARDL results was inflation. Debt service was found to have an impact on economic growth only in the long-run.

The findings from this study has great policy implication for Ghana. Following from the above findings, the study recommends the following for consideration by policy makers:

- i) The unsustainable debt position implies that policy makers should revisit Ghana's medium-term debt management strategy to ensure that it is robust enough to create fiscal and borrowing space for government to generate sufficient buffers;
- ii) Again, Ghana's debt management strategy should be designed in way that allows policy makers to assess public debt based on the expenditure for which the debt is incurred in terms of its income generating opportunities, therefore the expenditure mix of government must be periodically reviewed.
- iii) In the wake of a persistent budget deficit, the study recommends that government should design and institutionalize fiscal rules that will serve as guide to government expenditure and revenue decisions;
- iv) The study also recommends government to institutionalize structural reforms that seek to eliminate unplanned and unproductive government expenditure;
- v) The study recommends that any borrowing activity that only burdens governments with annual interest payments and lacks the ability to generate income should be completely avoided. In this regard, government borrowing streamlined to generate effective demand and provide capital for production.
- vi) Again, all borrowing activities of government should be matched with specific macroeconomic targets.
- vii) The unsustainability of Ghana's debt is an indication of persistent budget deficit, which means that government is unable to raise enough to close the deficit gap. Revenue authorities should therefore roll out innovative and more digitized mechanisms to enable them maximize government revenue collection.

It is believed that when these policies are effectively implemented, it will go a long way to reduce Ghana's public debt to minimize its effects on growth. Finally, concerted efforts must be made by government to consistently grow Ghana out of debt by pragmatically leveraging our debt.

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**APPENDIX**

VAR Lag Order Selection Criteria

Endogenous variables: GDP\_GROWTH LNINVT LNDEBT INF LNG

LNNFDI LNDEMO LNDSEI\_GDP

Exogenous variables: C

Date: 10/17/18 Time: 14:40

Sample: 1970 2014

Included observations: 44

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-217.7293	NA	0.075925	17.28687	17.62559	17.38441
1	-73.89154	199.1600*	5.95e-05*	9.991657*	12.70140*	10.77197*

\* indicates lag order selected by the criterion

LR: sequential modified LR test statistic (each test at 5percent level)

FPE: Final prediction error

AIC: Akaike information criterion

SC: Schwarz information criterion

HQ: Hannan-Quinn information criterion

Date: 10/15/18 Time: 09:49

Sample (adjusted): 1972 2013

Included observations: 41 after adjustments

Trend assumption: No deterministic trend

Series: GDP\_GROWTH LNINVT LNDEBT INF LNG LNNFDI LNDEMO

LNDSEI\_GDP

Lags interval (in first differences): 1 to 1

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.995212	254.8064	111.7805	0.0000
At most 1 *	0.940900	137.2897	83.93712	0.0000
At most 2	0.807680	42.06219	46.06141	0.0016
At most 3	0.574465	38.79311	40.17493	0.0684
At most 4	0.433458	19.99614	24.27596	0.1578
At most 5	0.270673	7.495659	12.32090	0.2785
At most 6	0.024766	0.551718	4.129906	0.5198

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

#### Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.995212	117.5167	42.77219	0.0000
At most 1 *	0.940900	62.22748	36.63019	0.0000
At most 2	0.807680	36.26908	30.43961	0.0084
At most 3	0.574465	18.79697	24.15921	0.2255
At most 4	0.433458	12.50048	17.79730	0.2617
At most 5	0.270673	6.943941	11.22480	0.2544
At most 6	0.024766	0.551718	4.129906	0.5198

Max-eigenvalue 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

#### ARDL Cointegrating And Long Run Form

Dependent Variable: GDP\_GROWTH

Selected Model: ARDL(1, 0, 0, 0, 0, 0)

Date: 10/16/18 Time: 07:20

Sample: 1970 2014

Included observations: 44

Cointegrating Form				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNINVT)	0.026484	0.026484	2.201850	0.0410
D(LNDEBT)	-0.189884	0.067728	-2.803588	0.0288
D(INF)	-0.030472	0.016660	-1.828963	0.0680
D(LNG)	0.047906	0.022941	2.088205	0.0307
D(LNFDI)	0.589061	0.649960	0.906304	0.3767
DLN(DEMO)	0.023446	0.006233	3.761591	0.0221
D(LNDSER)	-0.229546	2.770445	-0.082855	0.1442
CointEq(-1)	-0.957475	0.216035	-4.432040	0.0003

Cointeq = GDP\_GROWTH - (5.9599\*LNK + 1.9738\*LNDEBT -0.0318\*INF + 0.0500\*LNG + 0.6152\*LNFDI +0.0234 -4.4174\*LNDSE -29.9871 )

Long Run Coefficients				
Variable	Coefficient	Std. Error	t-Statistic	Prob.

LNINVT	0.159930	0.070700	2.262089	0.0363
LNDEBT	-0.173821	0.060919	-2.853300	0.0279
INF	-0.031826	0.037351	-0.852071	0.4054
LNG	0.050034	0.016200	3.088334	0.0016
LNFDI	0.615223	0.651492	0.944329	0.3575
LNDEMO	0.432117	1.125743	0.383850	0.1261
LNSER	-0.417396	0.220724	-1.891024	0.0547
C	-2.987144	1.370985	-2.178829	0.0429

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R-squared	0.877311	Mean dependent var	5.509917
Adjusted R-squared	0.841266	S.D. dependent var	2.371254
S.E. of regression	1.880233	Akaike info criterion	4.348329
Sum squared resid	63.63499	Schwarz criterion	4.735435
Log likelihood	-48.52827	Hannan-Quinn criter.	4.459801
F-statistic	53.10891	Durbin-Watson stat	2.066219
Prob(F-statistic)	0.024711		

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## ARDL Bounds Test

Date: 09/16/17 Time: 11:25

Sample: 44

Included observations: 44

Null Hypothesis: No long-run relationships exist

Test Statistic	Value	k
F-statistic	9.826151	7

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## Critical Value Bounds

Significance	I0 Bound	I1 Bound
10percent	2.03	3.13
5percent	2.32	3.5
2.5percent	2.6	3.84
1percent	2.96	4.26

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