FISCAL DEFICIT - OUTPUT GROWTH NEXUS IN GHANA: A SEARCH FOR OPTIMAL THRESHOLD[1]

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Abstract

Fiscal deficit have been implicated in the theoretical literature as one of the main sources of macroeconomic instability. However, empirical findings on the impact of deficit on output growth are basically inconclusive. This paper investigates the nexus between fiscal deficit and output growth as well as the threshold level of fiscal deficit that is conducive for output growth. The empirical results indicate that there exist a positive relationship between fiscal deficit and economic growth albeit with a year lag. The optimal level of fiscal deficit conducive for economic growth was identified at 5.0 percent. The findings of this paper provide ample evidence in support of the proposition that fiscal deficit in excess of a certain threshold is inimical to growth. On the policy front, this suggests that the authorities should implement policy measures to reduce fiscal deficit to levels not exceeding 5.0 per cent (levels consistent with economic growth) in order to maximize the growth potentials of such deficit policy.

JEL Classification: C2, E1, E2, O4, O5
Keywords: Fiscal Deficit, Economic Growth, Optimal Deficit, Ghana

INTRODUCTION

Fiscal deficit is the difference between the government's total spending and its revenue and non-debt capital receipts. It represents the total amount of borrowed funds required by the government to fully meet its expenditure. Fiscal deficit can either be financed by borrowing from the monetary authorities (money creation) or from the market (from both the bank and non-bank public).

The impact of fiscal deficit on output growth is one of the highly belligerent issues in the economic literature. The received wisdom is that fiscal deficit is a source of macroeconomic instability. Results from several empirical studies, however, fail to conclusively support this assertion. Perhaps the conflicting results could be attributable to the linearity assumptions implicit in most of the existing studies.The conflicting results have brought to the fore the need to investigate whether there exist a threshold level of fiscal deficit in the determination of economic growth.

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1 Views expressed in this paper is personal to the author and do not necessarily reflect the official position of his employers, the West African Monetary Institute.

In the literature, one stance of the argument, building on Keynes, is that fiscal deficit accelerate capital accumulation and growth. The key point here is that fiscal deficit as a result of public sector investment, particularly in infrastructure, boosts growth in the private sector. Increasing public investment within an appropriate policy agenda provides the private sector with adequate equability and incentives to invest and thereby enhance economic growth. However, some authors including (Onwioduokit, 1996) while agreeing with this assertion opined that not just deficit, but the magnitude of deficit, including its sustainability has implications on macroeconomic stability and by extension growth.

In Ghana, throughout the period (2001-2010) fiscal operations resulted in deficit higher than targeted. Fiscal balance as a ratio of GDP was in double digits for most of the period with the exception of 2002, 2003, 2004 and 2005. In 2010 a single digit deficit of 8.2 percent of GDP was recorded compared to 18.4 and 12.3 percent recorded in 2008 and 2009, respectively (WAMI, 2010).

The real GDP growth increased from 4.2 percent in 2001 to 4.5 percent in 2002. Between 2003 and 2008, the rate was consistently above 5.0 percent. In 2010 the country achieved 5.0 percent real GDP growth, 0.6 percentage points lower than the 5.6 percent recorded in 2008. The lower than-target performance of the economy was largely attributed to the general slowdown in the global economy leading to reduction in international remittance inflows, lower imports and moderation in construction activities. On the domestic front, the key factor that constrained growth was the economic stabilisation programme and its concomitant monetary tightening which somewhat whittled down the rate of economic activities. The real GDP growth in 2009 was largely driven by agricultural sector growth rate which stood at 6.2 percent, compared to 5.1 percent in 2008. Industry and services sectors recorded declining growth rates of 3.8 and 4.6 percent, from respective levels of 8.1 and 9.3 percent in 2009 (WAMI, 2010).

In the light of the argument that has arisen in recent times regarding the impact of fiscal deficit on economic growth, it is germane to empirically ascertain two critical issues for Ghana: first, the relationship between Fiscal deficit and economic growth, and second, the optimal level of fiscal deficit that is favorable for output growth. The assumption is that beyond a certain threshold, fiscal deficit is detrimental to economic growth. The main objectives of this paper are to investigate the relationship between budget deficit and economic growth and to estimate the optimal level of deficit that is conducive for output growth. Identification of the appropriate threshold for this critical indicator while adding to the literature on the subject is also vital in the overall economic management as it would inform policy in Ghana. The remaining sections of the paper are organized as follows: Part II reviews theoretical and empirical literature while part III contains theoretical framework and research methodology. The results are presented in Part IV. Part V contains summary and some concluding remarks.

debt and taxes. The estimation involved a standard fixed effect panel data estimation and bi-variate linear regression of growth on the fiscal deficit using pooled data. An important contribution of the empirical analysis is the existence of a statistically significant non-linearity in the impact of fiscal deficit on growth. However, the author s underscored that the non-linearity reflected the underlying composition of deficit financing.

In effect, Adams and Bevan (2002) posited that at a given level of government spending, a shift from a balanced budget to a (small) deficit may temporarily reduce distortions especially if the distortions impact growth rather than output. Based on a consistent treatment of the government budget, the authors found evidence of a threshold effect at a level of the deficit around 1.5 percent of GDP. While there appeared to be a growth payoff to reducing deficit to level, this effect disappeared or reversed itself on further fiscal contraction. The magnitude of this payoff, but not its general character, necessarily depended on how changes in the deficit were financed (through changes in borrowing or seigniorage) and on how the change in the deficit was accommodated elsewhere in the budget. The authors also found evidence of the interaction effects between deficit and debt stock, with high debt stocks exacerbating the adverse consequences of high deficit.
In his contribution to the debate, Keho (2010) investigated the causal relationship between fiscal deficit and economic growth in seven member countries of the West African Economic and Monetary Union (WAEMU). The specific objective was to examine if fiscal deficit was really bad for economic growth in all countries of the WAEMU. The study employed annual time series data on real GDP growth, ratio of gross fixed capital formation and public deficit or surplus as a percentage of GDP. Unlike most empirical works on granger causality tests, the analysis was undertaken in a multivariate form using gross fixed capital formation as a control variable. This mediating variable related meaningfully to economic growth in traditional growth models and mitigated the possibility of distorting the causality inferences due to omission of relevant variables. Overall the author argued that the results gave support to the WAEMU budgetary rule aiming at restricting the size of fiscal deficit as a prerequisite for sustainable growth and real convergence.

Larbi (2012) explored the long run impact of budget deficits on the economic growth of Ghana. The Johansen cointegration procedure was explored to determine the long run relationship between the explanatory variables and growth with hypothesized test that budget deficits have no significant long run impacted on economic growth. The Granger Causality test was utilized as further test for the relationship between economic growth and budget deficit. The author reported significant positive long run relationships between the capital stock, openness, total government expenditure and the growth rate. The coefficient of budget deficit variable was also positive and statistically significant. The Granger causality test also showed a rejection of the null hypotheses in favour of the alternative. Thus study concluded that budget deficits have a positive and significant

undue spending on consumption at the expense of investment would probably dissuade growth.

Whereas public expenditure might dislocate private sector output (the crowding out effect), it could also advance private sector productivity. The net effect on aggregate output of the crowding-out effect of public expenditure evidently pivots on the relative marginal productivities of the public and private sectors. A huge budget deficit has significant effect on national savings and could crowd out private investment. Inadequate investment damages future productivity. The crowding out arises via higher interest rates as companies compete for that limited available funds. The higher interest rates dissuade private investments causing growth to decline. Furthermore, deficit creates a gap in private capital formation by plummeting available saving for private sector borrowers, thus *crowding out* private capital formation.

Once the deficits are not utilized for investment purposes, total capital formation is certain to decrease. A dominant characteristic of government borrowing is that, it is impervious to interest rates. In essence, the government can borrow to finance its deficit irrespective of the interest rate because its deficit must be financed. Consequently, deficits diminish the funds available for private investment. The crowding out effects of public spending on the private sector may be detrimental to growth. It is also argued that the externality effect of deficit, in contrast, enhances growth by increasing the productivity of the private sector. In this scenario, a higher level of deficit could achieve a high growth rate.

Numerous studies including (Taylor 1985) have shown that the effect of fiscal deficit on growth is ambiguous: deficit can lower or raise output growth. Taylor (1985) presented an alternative theoretical framework, and demonstrated that the impact of fiscal deficit is far more complex than is generally predicted. He called the alternative the classical growth cycles (CGC) model. The CGC model begins with the assumption that growth in output and employment is a persistent feature of the economy, both in the short run and the long run. It assumes that investment decisions are rooted in profitability considerations and are responsible for growth. This view contrasts with the standard view that growth is a long-run phenomenon resulting from exogenous changes in population and technology.

Yavas (1998) argued that an increase in size of fiscal deficit will increase the steady-state level of output if the economy is at low steady-state (i.e. underdeveloped), and will decrease the steady-state level of output if the economy is at a high steady-state (i.e., developed). He contended that in the underdeveloped countries a significant portion of the deficit is directed to the building of the infrastructure of the economy and this type of expenditure will have a stimulating effect on private sector production. In contrast, the developed countries already have most of their infrastructure built and a major part of

their deficit spending is on welfare programmes and various social services. Accordingly, the positive effect of spending on these programmes on private output will not be as great as that of expenditures on infrastructure.

Heitger (2001) viewed increases in size of government deficit arising from increased consumption as constraints on growth, while increases in size that arise from government investment should have positive effect on growth. His central hypothesis is that government expenditures on core public goods including the rule of law, internal and external and security have a positive impact on economic growth, but this positive impact of government tends to decline or even reverse if government further increases expenditures in a way that it also provides private goods. He stresses that two important reasons for a negative impact of excessive government spending on economic growth are the fact that the necessary taxes reduce the incentives to work, to invest and to innovate, and the fact that government crowds out more efficient private suppliers.

In all, the relationship between growth and fiscal deficits orbit over three related issues: disproportionate domestic borrowing by the government which crowds out private sector investment and thrust up interest rates; the accumulation of public debts; and the anxiety that the government may resort to seigniorage through inflation tax. These effects function through three conduits: First, high deficits may lead to higher real interest rates in financial markets, which may reduce investment and growth. Second, high deficits may increase risk premiums on interest rates, particularly raising the inflation risk and default risk premium. High interest rates risk premiums may discourage private investment. Third, high budget deficits may signal a high tax burden in future, which may discourage current aggregate expenditures and therefore private investment (Hermes and Robert, 2001)

Empirical Literature

One of the initial works on the effect of fiscal deficit on growth was by Diamond (1965), who argued that, a permanent increase in the ratio of domestically held debt to national income depresses the steady state capital-labour ratio. At the initial rate of interest, consumers are unwilling to hold the original volume of physical capital and bonds, in addition to the new bonds. Rising interest rates stimulate additional saving and reduce investment until capital market equilibrium is re-established. Thus, persistent government deficit crowds out private capital accumulation. However, Diamond's analysis focused on permanent changes in deficit but failed to shed light on the effects of temporary changes. Kormendi and Meguire (1985) conducted a cross-sectional study across forty-seven countries investigating the effects of monetary variance, risk, government spending, inflation and trade openness on growth. Specifically, with respect to government deficit spending, the authors found that the mean growth rate of the ratio of government deficit spending to output had a positive effect on output growth.

Aschauer (1989) used annual data for the US over the period 1953-1986 to examine the effect of government deficit on private investment and the rate of return to private capital. He found that an increase in public investment arising from deficit may be expected to reduce private investment nearly one-to-one as the private sector utilizes the public capital for its required purposes rather than expand private capacity. At a deeper level, a distinctive feature of public infrastructure capital is that it complements private capital in the production and distribution of private goods and services. Hence, public investment might be thought to raise private investment as the former raises the profitability of private capital stock. The empirical results indicated that while both channels appear to be operating, the latter comes to dominate, so the net effect of a rise in deficit financed public investment had a positive effect on private investment. This means that government deficit financed investment had a positive effect on private investment and caused *crowding-in* rather than *crowding-out.*

Eisner and Pieper (1987) using OLS estimation technique reported a positive impact of cyclically and inflation-adjusted fiscal deficit on economic growth in the United States and other Organization for Economic Cooperation and development (OECD) countries in the period 1962 to 1985.

Barro (1991) examined ninety eight (98) countries during the period 1960—1985 and reported a negative relationship between the output growth rate and the share of government consumption expenditures. He noted that growth rates are positively related to measures of political stability and inversely related to a proxy for market distortions. He found measures of political instability inversely related to growth and investment. He further averred that the first source of economic growth, human capital, can be measured in terms of education level and health. He concluded that the growth rate of real per capita GDP is positively related to initial human capital (proxied by 1960 school-enrolment rates). He explained that theories in which the initial values of human capital and per capita GDP matter for subsequent growth rates also suggest relations with physical investment and fertility. The author also suggested that countries with higher human capital also have lower fertility rates and higher ratios of investment to GDP.

He noted that in endogenous growth models of Rebelo (1990) and Barro (1990), per capita growth and the investment ratio tend to move together. He stated that growth is inversely related to the share of government consumption in GDP, but insignificantly related to the share of public investment. Finally he submitted that when the share of public investment was considered; a positive but statistically insignificant relationship between public investment and the growth rate was found.

Fischer (1993) noted that large fiscal deficit and growth are negatively related. Among other variables such as inflation and distorted foreign exchange markets, he emphasized

the importance of a stable and sustainable fiscal policy, to achieve a stable macroeconomic framework. Easterly et al (1992) supported these findings as they reported a consistently negative relationship between growth and fiscal deficit.

Nelson and Singh (1994) used data on a cross section of seventy (70) developing countries during two time periods, 1970-1979 and 1980-1989, to investigate the effect of fiscal deficit on GDP growth rates. The GDP growth rate was used as the dependent variable. Among the explanatory variables in the study were government fiscal deficit, government revenue, defence spending, domestic private and public investment, population growth rate, per capita income, education, and the inflation rate. Their results suggested that defence spending and private investment had a significant positive impact on economic growth both in the 1970s and the 1980s for the countries analysed. Government revenue had a negative impact on growth. The education variable provided no conclusive effects. Public investment had a positive impact on economic growth in the 1980s but had no impact in the 1970s. This study concludes that the fiscal deficit had no significant effect on the economic growth of these nations in the 1970s and 1980s.

Devereux and Love (1995) investigated the impact of government deficit in a two-sector endogenous growth model developed by King and Rebelo (1990), the authors extended the model to incorporate an endogenous consumption leisure decision. The authors concluded that there is a positive relationship between lump sum financed government deficit spending and growth rates. They explained that, as in many "endogenous growth" models, the rate of growth are positively related to the rate of return on human and physical capital accumulation. The return on human capital accumulation is higher the greater the fraction of time spent working, in either sector. A higher rate of government deficit spending generates negative wealth effects, leading to a reduction in leisure and a rise in hours worked, consequently, the rate of growth rises. Although government spending raises the long-run growth rate; it reduces welfare since government deficit spending is 'a less than perfect substitute' for private spending.

Al-Khedair (1996) studied the relationship between the Fiscal deficit and economic growth in the seven major industrial countries (G-7). The data utilized covered the period 1964 to 1993. The variable included in model were, Fiscal deficit, the money supply, nominal exchange rate, and foreign direct investment. He found that the fiscal deficit has a significant positive impact on economic growth in France, Germany, and Italy. Overall results concluded that the fiscal deficit positively and significantly affect economic growth in all the seven major industrial countries.

Phillips (1997) critically analyzed the Nigerian fiscal policy between 1960 and 1997 with a view to identifying workable ways for the effective implementation of Vision 2010. He observed that fiscal deficit have been an abiding feature in Nigeria for decades. He noted that with the exception of the period 1971 to 1974, and 1979, there had been an overall

deficit in the federal Government budgets each year since 1960. The chronic fiscal deficit and their financing largely by borrowing, he asserted, resulted in excessive money supply, worsened inflationary pressures, and complicated macroeconomic instability, resulting in negative impact on external balance, investment, employment and growth. He contended however that fiscal policy could be an effective tool for moving Nigeria towards the desired state in 2010 only if it is substantially cured of the chronic fiscal deficit syndrome it has suffered for decades.

Anyanwu (1998) deviated markedly from past studies and concentrated on the impact of deficit financing. He applied regression analysis to pooled cross-section and time series data for Nigeria, Ghana and the Gambia. The results did not reveal a significant positive association between overall fiscal deficit (and its foreign financing) and domestic nominal deposit interest rates. However, the author reported a significant positive relation between domestic financing of the fiscal deficit and domestic nominal deposit rates. He concluded that the concern of economists in the Sub-region should shift from the deficit itself to the manner of financing the deficit.

Bahmani (1999) investigated the long-run relationship between U.S. federal real fiscal deficit and real fixed investment using quarterly data over the 1947-1992. The methodology in this study is based on the Johansen-Juselius cointegration technique. Their empirical results indicated that real fiscal deficit crowded in real investment, supporting the Keynesians who argue for the expansionary effects of fiscal deficit, by raising the level of domestic economic activity, "crowd- in" private investment.

Prunera (2000) showed a possible mechanism through which deficit may hinder human capital accumulation and therefore economic growth. Taking deficit as an indicator for the presence of disequilibrium and inefficiencies in a country, the author highlighted deficit as a factor that could be reducing the effectiveness of time devoted to education and training. Following a simple growth model and allowing for slight changes in the law of human capital accumulation, the author noted that deficit might sharply reduce human capital accumulation. On the other hand, a deficit reduction carried on for a long time, taking that reduction as a more efficient management of the economy, may prove useful in inducing endogenous growth. He submitted that empirical evidence for a sample of countries seems to support the theoretical assumptions of an inverse relationship between deficit and human capital accumulation as well as the presence of a strongly negative association between the quantity of deficit in the economy and the rate of growth. However, the author averred that there was a certain role for fiscal deficit in economic growth.

Adams and Bevan (2002) assessed the relation between fiscal deficit and growth in a panel of 45developing countries. The author applied an overlapping generation's model in the tradition of Diamond (1965) that incorporated high-powered money in addition to

debt and taxes. The estimation involved a standard fixed effect panel data estimation and bi-variate linear regression of growth on the fiscal deficit using pooled data. An important contribution of the empirical analysis is the existence of a statistically significant non-linearity in the impact of fiscal deficit on growth. However, the author s underscored that the non-linearity reflected the underlying composition of deficit financing.

In effect, Adams and Bevan (2002) posited that at a given level of government spending, a shift from a balanced budget to a (small) deficit may temporarily reduce distortions especially if the distortions impact growth rather than output. Based on a consistent treatment of the government budget, the authors found evidence of a threshold effect at a level of the deficit around 1.5 percent of GDP. While there appeared to be a growth payoff to reducing deficit to level, this effect disappeared or reversed itself on further fiscal contraction. The magnitude of this payoff, but not its general character, necessarily depended on how changes in the deficit were financed (through changes in borrowing or seigniorage) and on how the change in the deficit was accommodated elsewhere in the budget. The authors also found evidence of the interaction effects between deficit and debt stock, with high debt stocks exacerbating the adverse consequences of high deficit.
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relationship with growth in Ghana. The need to invest in the human resource to equip the labour force with the required skills for improved productivity was underscored.

Onwioduokit (2012) sought to ascertain the relationship between fiscal deficits and economic growth in Guinea and to determine the threshold level of fiscal deficit and economic growth. The author applied a threshold autoregressive model that included seven other growth variables. The empirical results indicate that there exist a positive relationship between fiscal deficit and economic growth in Guinea albeit with a one year lag. The threshold level of fiscal deficit conducive for economic growth for Guinea was identified at 3.0 percent. The author averred that the Guinean authorities should endeavour to implement policy measures aimed at reducing fiscal deficits to levels below or equal to 3.0 per cent (levels consistent with economic growth).

Antwi, et al (2013) evaluated budget deficit sustainability for Ghana between 1960 and 2010 using the present value budget constraint approach. The Granger causality test supported a bi-directional causation such that both expenditure and revenue have temporal precedence over each other. The authors interpreted this to mean that past and present values of government revenue provide important information to forecast future values of expenditure. The test for co-integration favoured the sustainability of budget deficit at 10.0 per cent significance level. The authors concluded that government can continue to service its past accumulated deficits without large future correction to the balance of income and expenditure.

Akosah (2013) examined the threshold effect of budget deficit on economic growth in the Ghanaian case, using quarterly data from 2000–2012. The study found an inverse long run relationship between budget deficit and economic growth, especially as the deficits have often been used to finance recurrent expenditures, suggesting that high budget deficit, driven by recurrent expenditures, slows down economic growth. In the short run, however, the author found lower level of budget deficit to promote economic growth, while a deficit beyond the threshold level of 4.0 per cent of GDP was found to be detrimental to economic growth. The study therefore noted that fiscal restraint to the level below the threshold would both stimulate a sustainable economic growth and overall stability in Ghana.

As indicated earlier, both Onwioduokit (2012) and Akosah (2013) found certain threshold of deficit for Guinea and Ghana to be 5.0 and 4.0 per cent, respectively. However, where as Akosah (2013) used quarterly time series from 2000q1 to 2012q4 and adopted the overall budget balance in the analysis, Onwioduokit (2012) in line with the WAMZ convergence criteria that define deficit as a ratio of GDP excluding grants was applied. In the present study annual data would be used to estimate the deficit threshold for Ghana. Also, deficit excluding grants is adopted in line with the WAMZ convergence criteria that Ghana is a member.

THEORETICAL FRAMEWORK AND RESEARCH METHODOLOGY

The non-linearity in the impact of deficit on growth has been examined in empirical studies based on various model specifications. Reinhart and Rogoff (2010) used correlations between debt and growth while Kumar and Woo (2012) and Egert (2012) studied the impact of public debt on growth along with other determinants of growth in a general growth framework. The statistical techniques used in empirical exercises include OLS, quadratic, spline and panel regressions, besides using exogenously/endogenously determined threshold deficit levels and calculating debt thresholds based on credit ratings of major rating agencies. The threshold level of deficit varies for different regions/ country groups as also across countries. This section provides empirical modeling framework for estimating optimal level of fiscal deficit in Ghana.

The analytical framework adopted for this study follows essentially the Keynesian theoretical framework as adapted by Onwioduokit (2012)[2].

Specification of the Empirical Model

In specifying the empirical model, the study relies on the theoretical framework presented in.

APPENDIX 1. From both the demand and supply sides of the economy, variables such as interest rate, exchange rate, inflation, Fiscal deficit, investment (change in capital stock) and labour are identified as the key variables explaining growth. However, it is appropriate to include in the empirical model those reform variables that also influence economic growth. In Ghana, financial sector reforms have been undertaken, while trade liberalization policies have also been implemented. Hence, it is appropriate to include financial reforms variable (M2/GDP) and trade openness variable (OPN) in the empirical model. The key variables in the empirical model are defined as follows:

Dependent variable

Y_{it} = $GDPG_t$ = Growth rate of real GDP

Independent variables

INV_t = Gross fixed capital formation as a ratio of GDP as a proxy for growth in capital stock.

Lab = Secondary school enrolment as a proxy for labour force.

Def_t = FD/GDP = Fiscal deficit/GDP, excluding grants

Inf_t = Inflation rate

Int_t = $Interest\ Rate = Lending\ Rate$

2See APPENDIX 1

$M2/GDP_t$ = M_2/GDP ratio – measuring financial depth

Dep_t = Exchange Rate expressed as a given amount of local currency per US dollar (Depreciation/ appreciation)

OPN_t = Degree of openness of the economy, measured as $[(Imports + Exports)/GDP]$

Besides investment, labour force and Fiscal deficit; other control variables included in the model are, interest rate (int), exchange rate depreciation/ appreciation (dep), inflation (inf), financial deepening M2/GDP and openness index (OPN). Interest rate has an important role in economic growth. Higher interest rates reduce the growth of consumer spending and economic growth. This is because more incentive to save in a bank rather than spend, more expensive to borrow, therefore less spending on credit and less investment; increase cost of mortgage repayments, therefore, reduce disposable income and therefore consumer spending. Consequently, an inverse relationship is expected between interest rate and economic growth.

Exchange rate development impacts on the economic growth process. On balance a positive relationship between depreciation and economic growths expected based on theory. Inflation is another significant variable influencing output growth rate. This variable is especially significant in Ghana, where food price and other exogenous factors including high imports of food and intermediate products play very significant role. In general, very high levels of inflation may undermine economic growth. However if the inflation rate is low, stable and sustainable, it may be interpreted as an indicator of macroeconomic stability that would enhance growth. And if the economy is at equilibrium higher inflation should impact adversely on growth. Hence, an inverse relationship is expected with output growth.

Financial deepening measured by the ratio of $M_2$to GDP, essentially seek to capture the role of the financial sector development in economic growth. The conventional wisdom predicts a positive correlation between the level of financial deepening and economic growth. In modern economic theory the role of the financial sector is seen to be catalytic to the growth of the economy. Also, the index of openness proxy by the ratio of the sum of imports plus export over GDP is expected to positively influence growth, all things being equal, the more open the economy the more access to foreign capital that is expected to increase investment and economic growth. Thus, the level of openness of the economy is expected to positively impact on economic growth.

Fiscal deficit is another significant variable influencing output growth rate. This variable is especially significant for most developing countries including the Ghana, where fiscal discipline or lack of it plays very important role. In general very high levels of fiscal deficit may undermine economic growth. However if the fiscal deficit is low, stable and sustainable, it may be interpreted as an increased demand for goods and services. And if

the economy is below its equilibrium on Keynesian cross, higher Fiscal deficit, that is increased government expenditures, could stimulate growth. Consequently a positive relationship with output growth is anticipated.

Based on the general framework provided and the foregoing variables identified, the linear growth equation is explicitly specified as follows:

$$GDPG_t = \alpha_0 + \alpha_1 INV_t + \alpha_2 Def_t + \alpha_3 inf_t + \alpha_4 int_t + \alpha_5 M2GDP_t + \alpha_6 Dept + \alpha_7 OPN_t + \alpha_8 Labt + U_t \quad 1$$

Where, $\alpha_1, \alpha_2, , \alpha_5, \alpha_6, \alpha_7, \alpha_8 > 0$ and $\alpha_3, \alpha_4 < 0$.

Specification of Threshold Autoregressive (TAR) Model

The TAR model specifies that individual observations can fall into discrete classes based on the value of an observed threshold variable (Lee and Wong, 2005). Following the framework of Onwioduokit (2012), we specify the threshold model for the Ghana as follows:

$$GDPG_t = \alpha_0 + \alpha_1 GDP_{t-1} + \alpha_2 Def_t[DM_t(Def_t < K^*)] + \alpha_3 Def_t[DM_t(Def_t > K^*)] + \alpha_4 INV_t + \alpha_5 inf_t + \alpha_6 int_t + \alpha_7 M2GDP_t + \alpha_8 Dep_t + \alpha_9 OPN_t + \alpha_{10} Labt + U_t \quad 2$$

Where DM_t = Dummy variable with values 1 if $Def_t > K^*$ or 0 otherwise.

Def_t = Annual fiscal deficit - GDP ratio.

K^* = The threshold level of fiscal deficit/GDP which is to be calculated.

α_2 = The effect of fiscal deficit below the threshold level.

α_3 = The effect of fiscal deficit above the threshold level.

Other variables are as previously defined.

All the variables are as defined above. From the above equation, *a priori* expectations of a threshold effect of deficit on growth are that $\alpha_2 \geq 0, \alpha_3 < 0$.

Data Sources and Estimation Methodology

GDP growth data, gross capital formation as well as secondary school enrolment data were obtained from the World Bank's World Development Indicators; Fiscal deficit data were obtained from the Ministries of Finance of Ghana. Imports, Exports, Interest rates, exchange rate, and broad money growth data were sourced from banks of Ghana, while inflation rates were obtained from the Ghana Statistics office. All variables are measured either in growth rate terms or as ratios, while the study period spans 1980 to 2009.

Different models specified are estimated using different econometric techniques. For the linear growth model, the study employs the Classical Ordinary Least Squares Technique (OLS). For the threshold model, the study uses the non-Linear Least Square (NLLS) method as suggested by Khan *et al.* (2001). As explained by Onwioduokit (2012), the

method involves the following procedures: for any K*, the model is estimated by OLS, yielding the Residual Sum of Squares (RSS) as a function of K*. The least square estimate is found by selecting the value of K* that minimizes the sum of squared residuals. An extensive and systematic analysis of the data was carried out to ensure conformity with basic properties of the OLS estimate. In particular, the stationarity test using Augmented Dickey Fuller (ADF) and the co-integration test, using Engle-Granger Two-Step procedure (EGTS) were applied. The use of EGTS is informed by the large number of the explanatory variables and the fact that not all the series are integrated at order one to warrant the use of the Johansson Technique.

After identifying the threshold level for deficit, it is important to determine whether the threshold effect is statistically significant. In this regard, this study conducted Normality Test (J-Qtest); Serial Correlation (LM test); Heteroscedasticity (ARCH) and Stability (Cusum square).

PRESENTATION AND ANALYSIS OF RESULTS

Unit Root Test Results

Essential we adopted both the Augmented Dickey-Fuller (ADF) and the Phillip-Perron (PP) tests for stationarity of the variables used in this study. The results of the unit root test based on the ADF test as presented in Table 1 show that, at 5 percent level of significance, only three variables (depreciation, inflation and investment) are stationary at levels, all other variables (fiscal deficit, lending rate, openness, broad money and real GDP growth) are stationary at first difference.

The results obtained using the Phillips Perron (PP) unit root test (Table 2) indicate that two variables (depreciation and inflation) are stationary at levels, while all other variables are stationary at first difference. The next stage of our analysis is to determine if the variables have long-run relationships through the process of co-integration.

Table 1: ADF Unit Root Test Results

VARIABLE	ADF-STATISTIC AT LEVEL	ADF-STATISTIC AT 1ST DIFFERENCE	CONCLUSION
DEF	-1.689993	-5.747422***	I(1)
DEP	-4.516771***	--	I(0)
INF	-4.446612***	-	I(0)
INV	-3.737748**	-	I(0)
LENDR	-1.592134	-5.023924***	I(1)
M2/GDP	-3.373956	-4.433918***	I(1)
OPEN	-2.979166	-5.423338***	I(1)
RGDPG	-2.669785	-5.749859***	I(1)

Source: Author's Computation *** Significant at 1%, ** Significant at 5%

Table 2: Phillip Peron Unit Root Test Results

VARIABLE	PP-STATISTIC AT LEVEL	PP-STATISTIC AT 1ST DIFFERENCE	CONCLUSION
DEF	-1.594106	-5.682527***	I(1)
DEP	-4.512320***	-	I(0)
INF	-4.464446***	-	I(0)
INV	-0.615877	-12.13321***	I(1)
LENDR	-1.650847	-5.046763***	I(1)
M2/GDP	-0.242127	-4.539315***	I(1)
OPEN	-3.129887	-6.440880***	I(1)
RGDPG	-2.231657	-6.739905***	I(1)

Source: Author's Computation *** Significant at 1%, ** Significant at 5%

Co-integration Tests Analysis

Having established that some of the variables are stationary at first difference I(1) while the rest are stationary at levels, that is I(0), it is necessary to examine further if the variables maintain a long-run relationship among them. That is to say, to examine if they are co-integrated. Once this is established, it implies that although some of the variables exhibit random walk, there is a stable long-run relationship amongst them and that they will not temper off from themselves. To do this, we carried out the Engle-Granger two-step (EGTS) procedure on the variables that are I (1). The test entailed regressing these variables and obtaining the residuals. Next, the residuals were tested for stationarity by applying ADF unit root test. Once the results indicate the absence of unit root, it means that the variables are co-integrated. The result of our EGTS test is reported in Table 3.

The ADF tests on the residuals at level confirm that the calculated ADF statistic (-4.420325) is greater (in absolute sense) than the tabulated critical value (-2.650145) at 1.0 percent level of significance. Thus, the null hypothesis of non-stationarity of the residuals is rejected. The obvious conclusion from these results is that the variables used in this study are co-integrated. That is, there is a stable long run relationship between them although there might be some deviations in the short run.

Table 3: Cointegration Test Results-Engel Granger First &Second Steps Results

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	6.984495	3.935880	1.774570	0.0881
DEF	-0.342823	0.211893	-1.617905	0.1182
LENDR	-0.101947	0.096031	-1.061604	0.2986
M2/GDP	-0.270689	0.146530	-1.847322	0.0766
OPEN	0.075249	0.036474	2.063092	0.0496

R-squared	0.379919	Mean dependent var	3.840000
Adjusted R-squared	0.280706	S.D. dependent var	3.318454
S.E. of regression	2.814421	Akaike info criterion	5.058402
Sum squared resid	198.0241	Schwarz criterion	5.291935
Log likelihood	-70.87602	F-statistic	3.829330
Durbin-Watson stat	1.302337	Prob (F-statistic)	0.014628

Engle-Granger Second Step Results

Null Hypothesis: Residuals have unit root		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.420325	0.0001
Test critical values:	1% level	-2.650145	
	5% level	-1.953381	
	10% level	-1.609798	

Analysis of Linear Growth Estimation Results

The estimation of results for the linear growth equations (equations 1) is presented in Table 4. The equation represents formulation of the hypothesis that the growth in real output in Ghana depends on the growth rate of fiscal deficit as a ratio of GDP, real investment (INV_t), money stock (M_2) to GDP ratio (measure of financial depth), the lending rate ($LENDR_t$), the rate of depreciation of the domestic currency vis-a-vis the US dollar, rate of inflation (INF_t) and the degree of openness of the economy ($OPEN_t$). The general to specific methodology was adopted in the estimation process. The parsimonious equation reported here was arrived at after an iterative process of variable elimination. The parsimonious estimation results are presented in Table 4.

The results of the growth equation reveal that while some estimated coefficients are consistent with *a priori* expectations, others are not. Starting with our variable of interest, which is fiscal deficit, it is stirring to note that the coefficients of this variable maintain positive sign in line with our a priori expectation. This suggests that the relationship between fiscal deficit and economic growth in Ghana is positive. The t-test confirms that deficit coefficient is statistically significant at 1.0 percent. Thus, we can safely reject the null hypothesis that there is no relationship between deficit and economic growth in Ghana. It should however be noted that the impact of deficit on growth is not contemporaneous as the variable impact on growth positively with a lag of one year. This is not surprising as it takes time for the investment in infrastructure finance by deficit to mature and impact growth.

The result indicates that a 1.0 percent increase in deficit will increase growth by 0.4 percent with one year lag. This is consistent with the findings on Nigeria Onwioduokit (2013). However the impact of deficit on growth reverses in a longer time horizon as a 1.0 percent increase in deficit is shown from the result to reduce growth by 0.3 percent with a two year lag. This outturn is difficult to explain, but it is plausible to assume that deficit after a certain threshold are not conducive for economic growth perhaps; this might be the explanation for the negative coefficient of deficit with two year lag in the result.

The coefficient of the rate of depreciation is rightly signed and significant a year lag, confirming aprori expectation. However, the second year lagged depreciation impact growth negatively as 1.0 percent depreciation will reduce real economic growth rate by approximately 0.3 percent. The two year lagged result though inconsistent with aprori expectation is plausible. Since the Ghanaian economy is not a highly industrial economy, depreciation might actually reduce growth since it takes time for the primary products to respond to domestic price incentives that arises from depreciation. The country main exports until very recently were cocoa and gold, the gold is sold at the international market thus the depreciation of the domestic currency does not directly affect its price. On the other hand cocoa production has a gestation period, thus the price incentive through depreciation may not translate to higher output in the short run.

Table 4: Parsimonious Deficit-Growth Model Results

Variable	Coefficient	Std. Error	t-Statistic	Prob.
RGDPG(-1)	0.498568	0.146474	3.403793	0.0043
DEP	0.035635	0.025892	1.376279	0.1904
INV	0.200909	0.085832	2.340715	0.0346
LENDR	-0.238053	0.062625	-3.801257	0.0019
OPEN	-0.085142	0.049216	-1.729981	0.1056
DEF(-1)	0.376337	0.142759	2.636166	0.0195
DEP(-1)	0.176729	0.024845	7.113251	0
INF(-1)	-0.043922	0.01793	-2.449657	0.0281
INV(-1)	0.192968	0.127708	1.511005	0.153
OPEN(-1)	-0.14659	0.054604	-2.684602	0.0178
DEF(-2)	-0.295082	0.117	-2.522069	0.0244
INF(-2)	-0.031808	0.011198	-2.840621	0.0131
LENDR(-2)	0.18724	0.056867	3.292619	0.0053
OPEN(-2)	0.167861	0.036158	4.642392	0.0004

R-squared	0.911379	Mean dependent var	4.221429
Adjusted R-squared	0.829088	S.D. dependent var	3.044407
S.E. of regression	1.258603	Akaike info criterion	3.604735
Sum squared resid	22.17715	Schwarz criterion	4.270838
Log likelihood	-36.46629	Hannan-Quinn criter.	3.808369
Durbin-Watson stat	1.862459		

Investment is rightly signed and significant supporting the *aprori* expectation that investment impacts economic growth positively. In line with theoretical expectations a 10.0 percent increase in investment will increase the real growth rate by 2.0 percent, all things being equal. However, first year lagged investment though rightly signed was not significant. Lending rate is rightly signed and significant at 1.0 percent. This is consistent with theory that hypothesizes an inverse relationship between the two variables. Thus, a 1.0 percent increase in the lending rate will reduce real economic growth by 0.24 percent, *citeris paribus*. However, second year lagged lending rate was wrongly signed though significant at 1.0 percent. This could be attributed to the structural problems in the

Ghanaian economy, including huge depreciation of the domestic currency and historically high inflation rate that make the lending rates to be unstable over the study period.

Openness variable is rightly signed and significant at 1.0 percent, consistent with *aprori* expectation, however with a lag of two years. This is also consistent with the argument in the literature that for a developing country like Ghana, the level of openness should be well sequenced for it to benefit the economy. Apparently, excessive openness of the economy might be detrimental to economic growth in the short run since it might likely weaken rather than strengthen the competitiveness of domestic products.

Inflation is rightly signed and significant. The results indicate that 1.0 percent increase in inflation rate will lead to a reduction of 0.4 percent in the real growth rate of the economy with a lag of one year and 0.3 percent reduction in the second year. Although the literature on the relationship between inflation and growth is basically inconclusive, conventional wisdom suggests that low and stable inflation is growth enhancing. The result represents a "fairly good fit" with about 82.9 percent of the systematic variation in the real growth rate being explained by the model on the average.

Analysis of the Threshold Model Results

As indicated earlier, the existence of threshold in the relationship between economic growth and fiscal deficit in Ghana is estimated using the procedure proposed by Onwioduokit (2012). This procedure involves estimating threshold model (equation 2) by OLS method and computing the residual sum of squares (RSS) for the different or chosen threshold levels of deficit ranging from K = -1% to K = -10%. The threshold estimate of deficit is found by selecting the one that minimizes the RSS, thus maximizing the adjusted R^2.

The estimation results, based on repeated estimation of the threshold model for the different values of expected threshold (K), are reported in Table 5. The first column labelled K, gives the range over which the search for the threshold is conducted. The dummy variable D_{1t} represents the effect of deficit lower than the chosen threshold (K) value while G_{2t} represents the effect for deficit higher than the threshold. Only the explanatory variables that are statistically significant are reported along with the deficit dummies to conserve space.

As shown in Table 5 the minimization of RSS occurs between the threshold ranges of between 1.0 to 5.0 percent, where the RSS records the lowest value of 15.68.

Table5: Fiscal deficit-Growth Threshold Model Results

K	Variable	Coefficient	Std. Error	t-Statistic	Prob.	RSS	Adj. R^2
1%	D1*DEF(-1)	-0.455995	0.129189	3.529673	0.0037	15.68	0.87
	G1*DEF(-1)	0.538609	0.413225	-1.303428	0.0150		
	INV	0.180143	0.075417	2.388622	0.0328		
	LENDR	-0.247017	0.054774	-4.509768	0.0006		
	DEP(-1)	0.146552	0.025273	5.798667	0.0001		
	INV(-1)	0.289328	0.118897	2.433443	0.0301		
	OPEN(-1)	-0.124116	0.048613	-2.553145	0.0240		
	DEF(-2)	-0.220348	0.107031	-2.058739	0.0601		
	LENDR(-2)	0.189112	0.049620	3.811174	0.0022		
	OPEN(-2)	0.119296	0.037850	3.151838	0.0076		
2%	D2*DEF(-1)	-0.455995	0.129189	3.529673	0.0037	15.68	0.87
	G2*DEF(-1)	0.538609	0.413225	-1.303428	0.0150		
	INV	0.180143	0.075417	2.388622	0.0328		
	LENDR	-0.247017	0.054774	-4.509768	0.0006		
	DEP(-1)	0.146552	0.025273	5.798667	0.0001		
	INV(-1)	0.289328	0.118897	2.433443	0.0301		
	OPEN(-1)	-0.124116	0.048613	-2.553145	0.0240		
	DEF(-2)	-0.220348	0.107031	-2.058739	0.0601		
	LENDR(-2)	0.189112	0.049620	3.811174	0.0022		
	OPEN(-2)	0.119296	0.037850	3.151838	0.0076		
3%	D3*DEF(-1)	-0.455995	0.129189	3.529673	0.0037	15.68	0.87
	G3*DEF(-1)	0.538609	0.413225	-1.303428	0.0150		
	INV	0.180143	0.075417	2.388622	0.0328		
	LENDR	-0.247017	0.054774	-4.509768	0.0006		
	DEP(-1)	0.146552	0.025273	5.798667	0.0001		
	INV(-1)	0.289328	0.118897	2.433443	0.0301		
	OPEN(-1)	-0.124116	0.048613	-2.553145	0.0240		
	DEF(-2)	-0.220348	0.107031	-2.058739	0.0601		
	LENDR(-2)	0.189112	0.049620	3.811174	0.0022		
	OPEN(-2)	0.119296	0.037850	3.151838	0.0076		
4%	D4*DEF(-1)	-0.455995	0.129189	3.529673	0.0037	15.68	0.87
	G4*DEF(-1)	0.538609	0.413225	-1.303428	0.0150		
	INV	0.180143	0.075417	2.388622	0.0328		
	LENDR	-0.247017	0.054774	-4.509768	0.0006		
	DEP(-1)	0.146552	0.025273	5.798667	0.0001		
	INV(-1)	0.289328	0.118897	2.433443	0.0301		
	OPEN(-1)	-0.124116	0.048613	-2.553145	0.0240		
	DEF(-2)	-0.220348	0.107031	-2.058739	0.0601		
	LENDR(-2)	0.189112	0.049620	3.811174	0.0022		

	OPEN(-2)	0.119296	0.037850	3.151838	0.0076		
5%	D5*DEF(-1)	-0.455995	0.129189	3.529673	0.0037	15.68	0.87
	G5*DEF(-1)	0.538609	0.413225	-1.303428	0.0150		
	INV	0.180143	0.075417	2.388622	0.0328		
	LENDR	-0.247017	0.054774	-4.509768	0.0006		
	DEP(-1)	0.146552	0.025273	5.798667	0.0001		
	INV(-1)	0.289328	0.118897	2.433443	0.0301		
	OPEN(-1)	-0.124116	0.048613	-2.553145	0.0240		
	DEF(-2)	-0.220348	0.107031	-2.058739	0.0601		
	LENDR(-2)	0.189112	0.049620	3.811174	0.0022		
	OPEN(-2)	0.119296	0.037850	3.151838	0.0076		
6%	D6*DEF(-1)	-0.390375	0.138151	2.825723	0.0143	19.19	0.84
	G6*DEF(-1)	-0.193489	0.188384	1.027095	0.3231		
	RGDPG(-1)	0.441337	0.146989	3.002512	0.0102		
	INV	0.232823	0.085829	2.712625	0.0178		
	LENDR	-0.224027	0.061246	-3.657790	0.0029		
	DEP(-1)	0.168307	0.024701	6.813844	0.0000		
	INF(-1)	-0.037276	0.017926	-2.079511	0.0579		
	OPEN(-1)	-0.148624	0.052726	-2.818815	0.0145		
	DEF(-2)	-0.283753	0.113214	-2.506346	0.0263		
	INF(-2)	-0.026691	0.011391	-2.343246	0.0357		
	LENDR(-2)	0.173802	0.055696	3.120525	0.0081		
	OPEN(-2)	0.146618	0.037958	3.862601	0.0020		
7%	D7*DEF(-1)	-0.376677	0.145803	2.583461	0.0227	21.48	0.82
	G7*DEF(-1)	-0.275489	0.213014	1.293289	0.2184		
	RGDPG(-1)	0.480071	0.152284	3.152477	0.0076		
	INV	0.212481	0.089455	2.375291	0.0336		
	LENDR	-0.229168	0.065407	-3.503735	0.0039		
	DEP(-1)	0.169006	0.028023	6.030887	0.0000		
	INF(-1)	-0.038427	0.020173	-1.904941	0.0791		
	OPEN(-1)	-0.140047	0.056671	-2.471223	0.0281		
	DEF(-2)	-0.286049	0.120301	-2.377785	0.0334		
	INF(-2)	-0.029906	0.011805	-2.533312	0.0250		
	LENDR(-2)	0.178680	0.059556	3.000192	0.0102		
	OPEN(-2)	0.148454	0.047506	3.124926	0.0081		
8%	D8*DEF(-1)	-0.371840	0.147649	2.518409	0.0257	21.90	0.81
	G8*DEF(-1)	-0.438410	0.212865	2.059573	0.0601		
	RGDPG(-1)	0.498554	0.151059	3.300389	0.0057		
	INV	0.198736	0.088682	2.240992	0.0431		
	LENDR	-0.244448	0.066499	-3.675986	0.0028		
	DEP(-1)	0.181487	0.028202	6.435212	0.0000		
	INF(-1)	-0.047503	0.020508	-2.316301	0.0375		

	OPEN(-1)	-0.139059	0.059322	-2.344132	0.0356		
	DEF(-2)	-0.297490	0.120810	-2.462473	0.0285		
	INF(-2)	-0.032580	0.011705	-2.783361	0.0155		
	LENDR(-2)	0.195706	0.062282	3.142257	0.0078		
	OPEN(-2)	0.172204	0.038810	4.437065	0.0007		
9%	D9*DEF(-1)	-0.367802	0.148763	2.472404	0.0280	21.91	0.82
	G9*DEF(-1)	-0.433196	0.204254	2.120873	0.0537		
	RGDPG(-1)	0.501871	0.151293	3.317219	0.0056		
	INV	0.191835	0.091362	2.099738	0.0558		
	LENDR	-0.241035	0.065015	-3.707397	0.0026		
	DEP(-1)	0.179893	0.026808	6.710500	0.0000		
	INF(-1)	-0.046327	0.019438	-2.383379	0.0331		
	OPEN(-1)	-0.136932	0.061236	-2.236144	0.0435		
	DEF(-2)	-0.293895	0.120706	-2.434797	0.0301		
	INF(-2)	-0.032145	0.011579	-2.776099	0.0157		
	LENDR(-2)	0.185295	0.058850	3.148597	0.0077		
	OPEN(-2)	0.169551	0.037529	4.517843	0.0006		
10%	D10*DEF(-1)	-0.374288	0.149835	2.498001	0.0267	22.16	0.82
	G10*DEF(-1)	-0.363947	0.202028	1.801468	0.0949		
	RGDPG(-1)	0.502688	0.158678	3.167983	0.0074		
	INV	0.203696	0.094258	2.161045	0.0499		
	LENDR	-0.237842	0.065011	-3.658488	0.0029		
	DEP(-1)	0.175904	0.027353	6.430869	0.0000		
	INF(-1)	-0.043129	0.020575	-2.096155	0.0562		
	OPEN(-1)	-0.146210	0.056805	-2.573896	0.0231		
	DEF(-2)	-0.289506	0.136221	-2.125270	0.0533		
	INF(-2)	-0.031882	0.011646	-2.737666	0.0169		
	LENDR(-2)	0.186442	0.059656	3.125311	0.0080		
	OPEN(-2)	0.168262	0.037774	4.454411	0.0006		

*Computed by the Researcher; * Threshold level of Fiscal deficit K* =1- 5%*

To further confirm the threshold effect, the adjusted R^2 from the estimation at 5.0 percent yields the highest value of 87.0 percent. A close study of the Table 5 shows that the coefficient of deficit dummy for deficit above the threshold (G_{2t}), carries a positive sign indicating that higher than negative 5.0 percent, the effect of deficit on growth may be positive. Conversely, the coefficient of deficit dummy D_{1t}, representing effect of deficit below the threshold level possess negative sign, suggesting that, deficit level beyond -5.0 percent is detrimental to growth in Ghana. Thus the threshold level of fiscal deficit for Ghana is identified at 5.0 percent. It should be noted that the two parameters are statistically significant at conventional levels.

Further examination of Table 5 reveals that, in line with the empirical literature, the growth of investment, openness, and depreciation have strong positive effect on growth. The coefficients of these variables were found to be statistically significant at level in all the regressions regardless of the value of the deficit threshold (K). These variables maintain consistently positive signs and statistically significant. This suggests that the increased investment, openness and depreciation are beneficial to economic growth in Ghana.

Given the record of deficit in Ghana and this empirical evidence, the location of deficit threshold for Ghana at the range of 1.0 and 5.0 percent seems both reasonable and realistic. Over the period covered by the study (1980-2009), Ghana recorded average deficit of 4.4 percent, with the highest and the lowest rates of 12.6 percent and 6.5 percent, respectively in 1993 and 1981 (surplus).

Table 6 presents another interesting finding of this study. The effects of deficit, measured by the signs of the coefficients of the deficit dummies are generally positive. The coefficients of the deficit dummy G_{21t}, maintain positive values between 1 and 5.0 percent, suggesting that deficit impacts positively on growth within the deficit range of 1-5.0 percent. The policy implication is that running a deficit beyond 5 percent will be detrimental to growth. Thus the range 1 – 5 percent provides the amphi-theatre for a menu of policy choices on deficit levels that would be consistent with economic growth in Ghana.

Table 6: Ranges of Fiscal deficit Conducive for Growth

	D_{1t} = Effect of deficit below K		G_{2t} = Effect of deficit above K	
K	Coefficient	Effect	Coefficient	Effect
1%	-0.455995	Negative	0.538609	**Positive**
2%	-0.455995	Negative	0.538609	**Positive**
3%	-0.455995	Negative	0.538609	**Positive**
4%	-0.455995	Negative	0.538609	**Positive**
K*=5%	**-0.455995**	**Negative**	**0.538609**	Positive
6%	-0.390375	Negative	-0.193489	**Negative**
7%	-0.376677	Negative	-0.275489	**Negative**
8%	-0.371840	Negative	-0.438410	**Negative**
9%	-0.367802	Negative	-0.433196	**Negative**
10%	**-0.374288**	**Negative**	**-0.363947**	**Negative**

Source: Computed by the Researcher

Diagnostic Test Results

Diagnostic tests were carried out for the 5 percent threshold model. Diagnostic results for the optimal level of deficit are depicted in table 7.

Table7: Diagnostic Test at 5 Percent Threshold

TEST TYPE	STATISTIC	VALUE	PROBABILITY	REMARKS
Normality	Jarque Bera	1.166246	0.558153	Normally distributed residuals
Serial Correlation (LM)	F-statistic	1.699995	0.2273	No serial correlation
Heteroscedasticity (ARCH)	F-statistic	1.335586	0.2587	No heteroscedasticity
Stability	Cusum squares	Within bands		Stable

The residuals for all the estimated equation was found to be normally distributed and stable. No serial correlation and heteroscedasticity were observed in the equation, implying that the estimates are reliable and as a result, can be relied on for policy formulation.

SUMMARY AND CONCLUSIONS

This paper investigated the relationship between budget deficit and economic growth, as well as the fiscal deficit threshold for Ghana. The results indicated a positive relationship between the two variables with a year lag. This implies that a 1.0 percent increase in deficit will result in approximately 0.4 percentage increase in economic growth. Furthermore, fiscal operations of government that result in deficit in excess of -5.0 per cent is detrimental to growth as the empirical results have identified 5.0 per cent as the optimal level of deficit in Ghana. The identified threshold level is different from 4.0 per cent identified by Akosah (2013). This is generally because unlike Akosah that applied quarterly data for the period 2001 to 2012 and applied overall balance as the measure of deficit, the present study in line with known practice was based on annual data and the concept of deficit applied was fiscal deficit as a ratio of GDP excluding grant based on the WAMZ definition of deficit in its convergence criteria.

The key policy implication is that operating a balance or surplus budget may be detrimental to growth in Ghana. Accordingly the range 1.0 – 5.0 percent provides the arena for a carte du jour of policy choices on deficit levels that would be promote economic growth in Ghana. Thus the authorities should strive to bring down the level of fiscal deficit excluding grants to 5.0 per cent or bellow in order to stimulate output growth.

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APPENDIX 1:

Recall that in a simple Keynesian framework, desired aggregate demand relationship is specified in the goods market as:

$$Y = C + I + G + (X - M) \quad (1)$$

With the following behavioural equations:

$$C = a + bY^d, \quad b > 0$$

$$Y^d = Y - T$$

$$I = \delta + \gamma i, \quad \gamma < 0$$

$$G = \bar{G}$$

$$X = s + \sigma e, \quad \sigma > 0$$

$$M = m + \phi Y^d, \quad \phi > 0$$

Where Y is output; C, consumption; I, investment; G, government spending which is assumed to be exogenous; X, exports; M, imports; Y^d, disposable income; T, tax revenue; i, interest rate; e, exchange rate.

At equilibrium (after substituting behavioural equations into the desired aggregate demand equation (1)), output will be given by

$$\bar{Y} = \frac{A}{\theta} + \frac{1}{\theta}(\gamma i + \sigma e + G - (b - \phi)T) \quad (2)$$

Where $\theta = 1 - b + \phi, \quad A = a + \delta + s - m$

From equation (2), increasing taxes will reduce output, while increasing government spending will increase output.

But Fiscal deficit (FD) is given by

$$FD = G - T \approx G - (b - \phi)T \quad (3)$$

Fiscal deficit is the excess of government expenditure over its revenue. Assuming that the government derives its total revenue from tax sources (realistic assumption), G-T gives the deficit position of the government. Since individuals do not spend all their income, the total revenue that could be generated from consumption expenditure is $(b - \phi)T$. Thus, subtracting this from government expenditure will give approximate position of the fiscal balance.

Putting (3) into (2) gives

$$\bar{Y} = \frac{A}{\theta} + \frac{1}{\theta}(\gamma i + \sigma e + FD) \quad (4)$$

Given that Ghana is basically a small-open, economy the model is extended to incorporate the money sector as well as the external sector. The money market in an open economy can be represented by the following equations:

Money Demand Function: $\frac{M^D}{P} = kY + \lambda i, \qquad k > 0, \ \lambda < 0$ (5)

Money Supply Function: $\frac{M^S}{P} = m_1 \frac{B}{P} + m_2 i, \qquad m_1, m_2 > 0$ (6)

Equilibrium Condition: $M^D = M^S$ (7)

where $P \equiv$ is the general price level, $B \equiv$ international reserves held by the central bank and m_1, m_2 are coefficients.

From the above money market model, the LM schedule[3] can be specified as

LM Schedule: $i = \psi \frac{B}{P} + \varphi Y, \qquad \psi < 0, \ \varphi > 0$ (8)

Given the importance of the external sector in Ghana, the influence of the sector is incorporated through the balance of payments schedule. The balance of payments schedule is given as

BP Schedule: $B = A_2 - \theta_0 Y + \theta_1 e + \theta_2 i, \qquad \theta_0, \theta_1, \theta_2 > 0$ (9)

where A_2 is the aggregate of exogenous components in the net export function and $\theta_0, \theta_1, \theta_2$ are coefficients.

Putting equation (8) into (3) gives

$$Y = A_1 + \beta_1 \frac{B}{P} + \beta_2 Y + \sigma e + FD \tag{10}$$

where $\beta_1 = \frac{\psi\gamma}{\theta}$ and $\beta_2 = \frac{\phi\gamma}{\theta}$

Putting equation (9) into (10) produces

$$Y = A_1 + \frac{\beta_1}{P}\left(A_2 - \theta_0 Y + \theta_1 e + \theta_2 i\right) + \beta_2 Y + \sigma e + FD \tag{11}$$

Isolating like terms and re-arranging equation (11) gives

$$Y = C + \frac{1}{P}\left(\alpha_1 e + \alpha_2 i\right) + \alpha_3 e + \alpha_4 FD \tag{12}$$

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3 The LM curve is used to determined equilibrium in the money market

where

$$1+\beta_1\theta_0-\beta_2=\varphi,\quad C=\frac{A_1+\beta_1 A_2}{\varphi},\quad \alpha_1=\frac{\beta_1\theta_1}{\varphi},\quad \alpha_2=\frac{\beta_1\theta_1}{\varphi},\quad \alpha_3=\frac{\sigma}{\varphi},\quad \alpha_4=\frac{1}{\varphi}$$

Recasting the second term on the right-hand side of equation (12) in logarithmic generic term gives

$$Y=C+\lambda e+\alpha_2 i-\pi+\alpha_4 FD \tag{12"}$$

where $\pi \equiv$ the rate of inflation and $\lambda=\alpha_1+\alpha_3$.

In equation (12"), equilibrium output is positively related to Fiscal deficit.

In a time series context, output is influenced by its own past level (output dynamics) which is consistent with accelerator principle. Equation (12B) can be restated as

$$Y_t=c+\varpi Y_{t-1}+\alpha_2 i_t+\lambda e_t+\alpha_4 FD_t-\pi \tag{13}$$

Recasting (13) gives

$$y_t=c+\delta_1 i_t+\delta_2 e_t+\delta_3 FD_t+\delta_4\pi \tag{14}$$

where $y_t=Y_t-Y_{t-1}$ which captures the change in GDP (growth rate of GDP) and $\delta_1,\delta_4<0$. Equation (14) .s essentially an output (GDP) growth model which gives the long-run relationship between output growth (change in output) and Fiscal deficit. This relationship is positive; implying that widening of Fiscal deficit will improve growth. However, some empirical studies document the negative relationship between growth and fiscal deficit, while some others establish a positive relationship as given by the simple Keynesian framework. This ambiguity of the relationship between growth and fiscal deficit suggests a threshold effect of fiscal deficit on growth. This will inform the empirical modelling of growth-deficit relationship in this study.

From the supply-side of the economy, output is a function of capital stock and labour. A simple Cob-Douglas production function generates a growth model of the form

$$y=\omega_0+\omega_1\Delta\ln K+\omega_2\Delta\ln L \tag{15}$$

Where K refers to capital stock, L refers to labour force growth, Δ is a change notation and $\omega_0,\omega_1,\omega_2$ are coefficients.