Tax Revenue and Economic Growth in Ghana: A Cointegration Approach

Takumah, Wisdom

University of Cape Coast

12 September 2014

Tax Revenue and Economic Growth in Ghana: A Cointegration Approach

Wisdom Takumah
Department of Economics
University of Cape Coast
Cape Coast. Ghana
wtakumah@yahoo.com; wtakumah@gmail.com

Abstract

This study examines the effect of tax revenue on economic growth in Ghana using quarterly data for the period 1986 to 2010 within the VAR framework. The study found that there exist both short run and long run relationship between economic growth and tax revenue. The result indicated a unidirectional causality between tax revenue and economic growth and it flows from tax revenue to economic growth. The result suggests that tax revenue exerted a positive and statistically significant effect on economic growth both in the long-run and short-run implying that tax revenue enhances economic growth in Ghana. The study recommended that the tax base need to be widened and the tax rates reduced in order to generate more revenue. It was recommended that the government should improve tax collection measures in order to generate more revenue so as to increase economic growth in Ghana.

Keywords: Tax revenue, Economic Growth, Cointegration, Causality, Ghana

JEL Classification: H2, E62, C32

Introduction

Taxation is the key to promoting sustainable growth and poverty reduction. It provides developing countries with a stable and predictable fiscal environment to promote growth and to finance their social and physical infrastructural needs. Combined with economic growth, it reduces long term reliance on aid and ensures good governance by promoting the accountability of governments to their citizens (Romer & Romer, 2010). According to Ilyas and Siddiqi (2008), availability and mobilization of revenue is the fundamental factor with which an economy is managed and run. Tax revenue is a core instrument in the hands of the government to fulfill expenditures and it helps in acquiring sustained growth targets. The nature of taxes can help predict a growth pattern. The overall tax burden is significant in explaining variations in economic growth.

The role of taxation in influencing economic growth is not only a major concern of the economic policy makers, tax specialists and administrators but has long been of interest to academics. Tax policy is used for the economic and social purposes like allocation of resources through increasing internal savings, increasing economic growth of the country, providing price stability and controlling the production and consumption level indirectly.

Economists have long been interested in factors that cause different countries to grow at different rates and achieve different levels of wealth. However, many believe that tax revenue is one of the most significant factors that contribute to a country's growth (Myles, 2000). The relationship between taxation and economic growth can be negative, positive or neutral depending on how important the role of tax revenue is, as an economic resource.

Most of the empirical studies on the effects of tax revenue on economic growth are mainly cross-country studies e.g. Owolabi and Okwu (2011); Koester and Kormendi (1989); Worlu and Nkoro (2012) whose findings cannot be directly applied to Ghana since these findings may not accurately and adequately reflect the Ghanaian experience. These countries also differ in their exposure to economic problems and in their stabilization policy experiences. Most importantly, they differ greatly not only in their institutional, political, financial, economic structures, but also in their reactions to external shocks. As a contribution to the literature on the subject, this paper employs a country-specific approach to investigate the effect of tax revenue on economic growth in Ghana.

The remaining sections of this study are organized as follows: section 2 provides an overview of the trends in tax revenue and economic growth in Ghana; Section 3 discusses the relevant literature on the growth models and tax -growth debate; section 4 presents the methodological issues, the empirical estimations and the analysis; and section 5 provides the conclusions.

2. Overview of Trends in Tax Revenue and Economic Growth in Ghana.

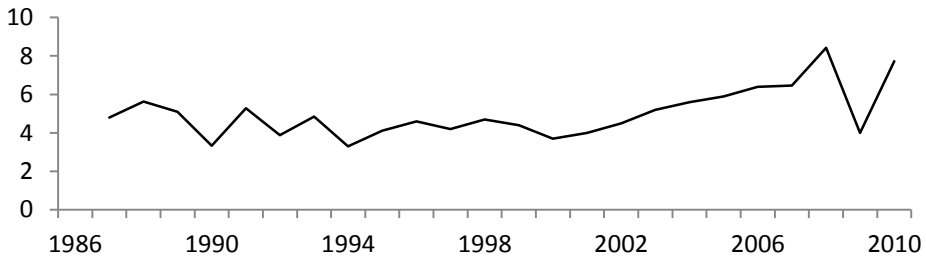
The economy of Ghana is highly dependent on tax revenue as a source of government expenditure for developmental purposes. Fiscal performance in 2011 was good, supported by a strong revenue performance and lower cash outlays. Net arrears clearance, however, fell considerably short of target leaving a considerable carryover into 2012. Payment of the carryover expenditures from 2011, equivalent to about 0.7 percent of non-oil GDP has contributed strongly to fiscal pressures in 2012. Additional pressures have come from the higher-than-budgeted public sector wage increases and the re-emergence of

energy subsidies. A base pay increase of 18 percent — despite single-digit CPI inflation — was granted civil service unions in February 2012, raising the wage bill significantly above the budgeted amount.

Tax collection and administration efforts paid off well in 2011. The non-oil tax revenue as ratio to non-oil GDP rose from 13.2 percent in 2010 to 16.3 percent in 2011 — a remarkable jump of 3.1 percentage points of non-oil GDP in one year. Government has targeted further improvements — 0.4 percentage points of non-oil GDP — in 2012. On the basis of the first half year performance, this estimate is unduly conservative. We project an additional 1.3 percentage points of GDP to 18.0 percent of non-oil GDP for this year, bringing Ghana's tax performance closer to the average 20 percent for our peers.

The new tax measures introduced in the 2012 Budget are expected to yield more than had been originally projected. For example, the establishment of a uniform regime for capital allowances and the raising of the corporate tax rate from 25 to 35 percent are expected to yield an additional 0.3 percentage points of non-oil GDP this year.

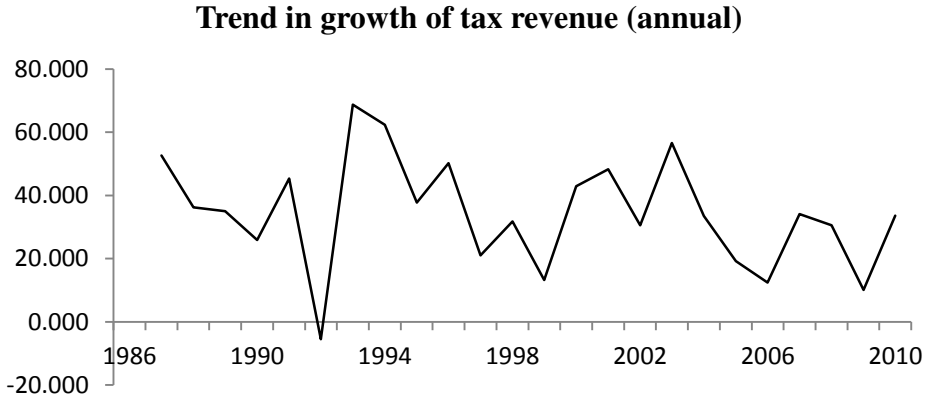
Figure 1: Trends in real GDP growth in Ghana (1986-2010).



Source: Author's estimation from the WDI, 2013

The diagram in Figure 1 above shows that the growth in real GDP has been rising steadily. The growth was oscillating between 1986 and 2000. From 2001 the growth pattern moves steadily upwards, but rises sharply to about 8% in 2007 but declines to about 4% in 2008 before rising again to about 7% in 2010.

Figure 2: Trends in tax revenue in Ghana (1986-2010).



Source: Author's estimation from the WDI, 2013.

From the graph in Figure 2 above the trend in tax revenue has shown that the growth pattern has not being stable over the period. The rate of growth falls from about 50% to 25% between 1986 and 1989. From 1991 the rate of growth in the tax revenue falls sharply and becomes negative, but rises quickly to about 70% in 1993. The trend keeps moving upwards and downwards from1995 to 2010.

3. Literature Review

There are large number of studies which have been carried out to find the relationship between economic growth and taxation. However, findings of these studies tend to give conflicting results. Some studies have shown that taxes have helped improve the performance of the economy whilst other studies have shown that taxation reduces output and hence economic growth while others show little evidence to prove strong relationship between taxation and economic growth of world economies.

Tax policy affects economic growth by discouraging new investment and entrepreneurial incentives, distorting investment decisions and discouraging work effort and workers' acquisition of skills (Solow, 1956). Typically, the output of an economy is measured by GDP and determined by its economic resources—the size and skill of its workforce, and the size and technological productivity of its capital stock.

Engen and Skinner (1992) describe five ways through which taxes might affect economic growth. First, higher taxes can discourage the investment rate (net growth in the capital stock) through high statutory tax rates on corporate and individual income, high effective capital gains tax rates, and low depreciation allowances. Second, taxes may reduce labor supply growth by discouraging labor force participation or hours of work, or by distorting occupational choice or the acquisition of education, skills, and training. Third, tax policy has the potential to discourage productivity growth by decreasing research and development (R&D) and the development of venture capital for "high-tech" industries, activities whose spillover effects can potentially enhance the productivity of existing labor and capital which may lead to increase in economic growth.

Table 1: Selected Studies on the Taxation-Growth Debate

Author(s)	Countries	Methodology	Conclusions
Romer and Romer (2010)	USA (1947-2007)	Multivariate Analysis	Found negative relationship
Koch, Schoeman and Tonder (2005),	South Africa (1960-2002)	Three- Stage Least Squares	Found positive relationship
Karras and Furceri (2009),	OECD countries (1965-2003)	Panel Analysis	Found negative relationship
Worlu and Nkoro (2012)	Nigeria (1980-2010)	Two stage least squares technique	No relationship
Dackehag and Hansson (2012)	25 rich OECD countries (1975-2010)	Panel Analysis	Found negative relationship
Karran (1985)		VAR VECM framework	Found positive relationship
Greenidge and Drakes (2009)	Barbados (1960-2005)	ARDL Bounds testing; VEC	Found negative relationship

4. Methodology

4.1 Model specification

For the purpose of this study, and following Fosu and Magnus (2006), Sakyi (2011) and Mansouri, (2005) the functional form of the model to be used in this study is specified as follows:

$$Y_t = A_t K_t^{\alpha} L_t^{\delta} \quad (1)$$

$$A_t = f(TAXR_t, FDI_t, GOV_t, CPI_t) \quad (2)$$

Equation (13) is specified in the functional form where K_t is capital stock and L_t is labor force. $TAXR_t$ is total tax revenue, FDI_t is Foreign Direct Investment, CPI_t is consumer price index and GOV_t is government expenditure.

Substituting equation (3) into equation (2) gives:

$$Y_t = \mu K_t^{\alpha} L_t^{\delta} TAXR_t^{\beta_1} FDI_t^{\beta_2} GOV^{\beta_3}{}_t CPI_t^{\beta_4} \ell^{\varepsilon_t} \tag{3}$$

To linearize equation 3, we apply logarithm to equation 3 which gives:

$$\begin{aligned} &\ln Y_t = \ln \mu + \beta_1 \ln TAXR_t + \beta_2 \ln FDI_t + \beta_3 \ln GOV_t + \beta_4 CPI_t \\ &+\alpha \ln K + \delta \ln L + \varepsilon_t \ln \ell \end{aligned} \tag{4}$$

$$\begin{aligned} &\ln Y_t = \beta_0 + \beta_1 \ln TAXR_t + \beta_2 \ln FDI_t + \beta_3 \ln GOV_t + \beta_4 CPI_t \\ &+\alpha \ln K + \delta \ln L + \varepsilon_t \end{aligned} \tag{5}$$

For the purpose of estimation and in line with the objective of the study, turning the production function in equation (5) to a growth equation is very useful.

As a result, the growth model to be estimated in this study is:

$$\begin{aligned} &\Delta \ln Y_t = \beta_0 + \beta_1 \Delta \ln TAXR_t + \beta_2 \Delta \ln FDI_t + \beta_3 \Delta \ln GOV_t + \beta_4 \Delta \ln CPI_t \\ &+\alpha \Delta \ln K + \delta \Delta \ln L + \varepsilon_t \end{aligned} \tag{6}$$

Based on economic theory, the expected signs of the coefficients are $\alpha > 0$, $\delta > 0$, $\beta_1 > 0$, $\beta_2 > 0$, $\beta_3 > 0$, $\beta_4 < 0$ or $\beta_4 > 0$.

The short run model for this study is given as:

$$\begin{aligned} \Delta \ln Y_t = \beta_0 &+ \sum_{i=1}^{p} \theta \Delta \ln Y_{t-i} + \sum_{i=1}^{q} \beta_1 \Delta \ln TAXR_{t-i} + \sum_{i=1}^{r} \beta_2 \Delta \ln FDI_{t-i} + \sum_{i=1}^{s} \beta_3 \Delta \ln GOV_{t-i} \\ &+ \sum_{i=1}^{t} \beta_4 \Delta \ln CPI_{t-i} + \sum_{i=1}^{u} \alpha \Delta \ln K_{t-i} + \sum_{i=1}^{v} \delta \Delta \ln L_{t-i} + \psi ECT_{t-1} + \nu_t \end{aligned} \tag{7}$$

Where K_t and L_t are already defined. $TAXR_t$ is total tax revenue, FDI_t is Foreign Direct Investment, CPI_t is consumer price index and GOV_t is government expenditure. 'ln' is

the natural logarithmic operator, Δ is difference operator and ECT_{t-1} is error correction term lagged one period. The coefficients $\beta_1, \beta_2, \beta_3, \beta_4, \alpha$ and δ are the elasticities of the respective variables, with ψ showing the speed of adjustment, β_0 is the drift component, t denotes time and ν_t is the stochastic error term.

4.2 Estimation techniques

The unit root test was used to check the stationarity position of the data. In the second step, the cointegration test was conducted using Johansen's multivariate approach. In the third step, the study employed granger-causality to test for causality. The causality test is followed by cointegration testing because the presence of cointegrated relationships has implications for the way in which causality testing is carried out. Finally, variance decomposition analysis was conducted.

4.3 Johansen and Juselius approach to cointegration

An appropriate solution to a series which is non-stationary and contains unit root is first differencing. However, first differencing results in eliminating all the long-run information which are invariably the interest of economists. Later, Granger (1986) identified a link between non-stationary processes and preserved the concept of a long-run equilibrium. Two or more variables are said to be cointegrated (there is a long-run equilibrium relationship), if they share common trend. Cointegration exists when a linear combination of two or more non-stationary variables is stationary. Johansen (1988) cointegration techniques allow us to test and determine the number of cointegrating relationships between the non-stationary variables in the system using a maximum likelihood procedure.

4.4 Granger causality test

The study of causal relationships among economic variables has been one of the main objectives of empirical econometrics. According to Engle and Granger (1991), cointegrated variables must have an error correction representation. One of the implications of Granger representation theorem is that if non-stationary series are cointegrated, then one of the series must granger cause the other (Gujarati, 2001). To examine the direction of causality in the presence of cointegrating vectors, Granger causality is conducted based on the following:

$$\Delta Y_t = \delta_0 + \sum_{i=1}^{p} \beta_{1i} \Delta Y_{t-i} + \sum_{i=0}^{p} \phi_{1i} \Delta X_{t-i} + \omega_{1i} ECT_{t-1} + v_t \quad (8)$$

$$\Delta X_t = \delta_0 + \sum_{i=1}^{p} \beta_{2i} \Delta X_{t-i} + \sum_{i=0}^{p} \phi_{2i} \Delta Y_{t-i} + \omega_{2i} ECT_{t-1} + u_t \quad (9)$$

Where ΔY and ΔX are our non-stationary dependent and independent variables, ECT is the error correction term, ω_{1i} and ω_{2i} are the speed of adjustments. *P* is the optimal lag order while the subscripts *t* and *t-i* denote the current and lagged values. If the series are not cointegrated, the error correction terms will not appear in equations 8 and 9.

4.5 Variance decomposition

Variance decomposition or the forecast error variance decomposition helps in the interpretation of a VAR model once it has been fitted. The variance decomposition indicates the amount of information each variable contributes to the other variables in the VAR models. It tells us the proportion of the movements in a sequence due to its own shock, and other identified shocks (Enders, 2004). Therefore variance decomposition provides information about the relative importance of each variable in explaining the

variations in the endogenous variables in the VAR. To assign variance shares to the different variables, the residuals in the equations must be orthogonalised. Therefore, the study will apply the Cholesky decomposition method.

4.6 Data analysis

The study employed both descriptive and quantitative analysis. Charts such as graphs and tables were employed to aid in the descriptive analysis. Unit root tests were carried out on all variables to ascertain their order of integration. Furthermore, the study adopted the Johansen's maximum likelihood econometric methodology for cointegration introduced and popularized by Johansen (1988), Johansen and Juselius (1990) and Johansen (1991) to obtain both the short and long-run estimates of the variables involved. All estimations were carried out using Econometric views (Eviews) 7.0 package.

4.7 Source of data

The study employed secondary data. Quarterly time series data were generated from the annual time series collected from 1986 to 2010 using Gandolfo (1981) algorithm. The series were drawn from World Development Indicators, 2013.

5. Results and Discussions

5.1 Results of unit root test

Before applying the Johansen's multivariate approach to co-integration and Granger-causality test, unit root test was conducted in order to investigate the stationarity properties of the variables. All the variables were examined by first inspecting their trends graphically **(Appendix A)**. From the graphs in **Appendix A**, it can be seen that, all the

variables appear to be non-stationary. However, the plots of all the variables in their first differences exhibit some stationary behavior as presented in **Appendix B.** Furthermore, the Augmented Dickey-Fuller (ADF) and Phillips Perron (PP) tests were applied to all variables in levels and in first difference in order to formally establish their order of integration. The Schwartz-Bayesian Criterion (SBC) and Akaike Information Criterion (AIC) were used to determine the optimal number of lags included in the test. The results of both tests for unit root for all the variables at their levels with intercept and trend and their first difference are presented in Table 2 and 3 below.

Table 2: Unit root test for the order of integration (ADF and Philips Perron): At levels with (intercept and trend)

VARIABLES	ADF STATS	P-VALUE	[LAG]	PP STATS	P-VALUE	[BW]
LRGDP	-2.32460	(0.4167)	[1]	-2.02617	(0.6056)	[5]
LTAXR	-2.27823	(0.4633)	[1]	-1.72057	(0.7110)	[6]
LFDI	-2.37778	(0.3888)	[0]	-2.56476	(0.2974)	[2]
LGOV	-1.83541	(0.6812)	[3]	-2.05097	(0.5639)	[5]
LCPI	-2.18095	(0.8927)	[2]	1.161100	(0.9124)	[3]
LGFCF	-2.16477	(0.5041)	[1]	-2.32490	(0.4167)	[0]
LLF	-1.57650	(0.7955)	[3]	-1.49634	(0.8246)	[3]

Source: Computed using Eviews 7.0 Package

From the results of unit root test in table 2, the null hypothesis of unit root for all the variables cannot be rejected at levels. This means that all the variables are not stationary at level since their p-values for both ADF and PP tests are not significant at all conventional levels of significance.

Table 3: Unit root test for order of integration: (ADF and Philips Perron)

At first difference with (intercept and trend)

VARS	ADF STATS	PVALUE	*OI* LAG	PP STATS	PVALUE	*OI* BW
DLRGDP	-5.6964	(0.00)***	*I*(1) [2]	-6.2685	(0.000)***	*I*(1) [9]
DLTAXR	-9.1762	(0.00)***	*I*(1) [5]	-9.3973	(0.000)***	*I*(1) [4]
DLFDI	-10.0675	(0.00)***	*I*(1) [3]	-10.065	(0.000)***	*I*(1) [1]
DLGOV	-6.0439	(0.00)***	*I*(1) [2]	-5.8450	(0.000)***	*I*(1) [4]
DLCPI	-4.14834	(0.00)***	*I*(1) [1]	-5.8508	(0.000)***	*I*(1) [5]
DLGFCF	-5.7627	(0.00)***	*I*(1) [5]	-14.948	(0.000)***	*I*(1) [3]
DLLF	-8.1328	(0.00)***	*I*(1) [0]	-10.055	(0.000)***	*I*(1) [4]

Source: Computed using Eviews 7.0 Package

Note: *IO* represents order of integration and D denotes first difference. ***, ** and * represent significance at the 1%, 5% and 10% levels respectively..

Table 3 however shows that, at first difference all the variables are stationary and we reject the null hypothesis of the existence of unit root. We reject the null hypothesis of the existence of unit root in D(LRGDP), D(LTAXR), D(LFDI), D(LGOV), D(LCPI) , D(LGFCF), and D(LLF) at the 1% level of significance. From the above analysis, one can therefore conclude that all variables are integrated of order one *I*(1) and in order to avoid spurious regression the first difference of all the variables must be employed in the estimation of the short run equation.

Granger-causality test

To find out the direction of causality between tax revenue and economic growth and selected macroeconomic variables, the study conducts a pair wise Granger causality test using lag 6 and the results are presented in Table 3.

Table 4: Granger causality test

Null Hypotheses	F Statistics	Probability
LTAXR does not Granger Cause LRGDP	2.60942	0.02174**
LRGDP does not Granger Cause LTAXR	1.43880	0.24485
LFDI does not Granger Cause LRGDP	5.07238	0.00017***
LRGDP does not Granger Cause LFDI	1.28988	0.27123
LGOV does not Granger Cause LRGDP	2.79044	0.01616 **
LRGDP does not Granger Cause LGOV	0.49565	0.80986
LCPI does not Granger Cause LRGDP	4.14804	0.00021***
LRGDP does not Granger Cause LCPI	1.11417	0.35915
LK does not Granger Cause LRGDP	2.64459	0.02993**
LRGDP does not Granger Cause LK	3.42963	0.00464***
LLF does not Granger Cause LRGDP	2.90914	0.01278**
LRGDP does not Granger Cause LLF	5.31035	0.00012***

Note: *, ** and *** denote rejection of null hypothesis at 10%, 5% and 1% level of significance. Source: Conducted using Eviews 7.0 package.

The result of the granger causality test in Table 4 shows that there is unidirectional causality between tax revenue and economic growth. In the empirical literature, the result is consistent with the findings of Chigbu, Akujuobi, and Ebimobowei (2012) who found uni-directional causality between tax revenue and economic growth in Nigeria.

Test for cointegration of real GDP

According to Johansen (1991), cointegration can be used to establish whether there exists a linear long-term economic relationship among variables. In this regard, Johansen

(1991) asserts that cointegration allows us to specify a process of dynamic adjustment among the cointegrated variables and in disequilibrated markets. Given that the series are *I*(1), the cointegration of the series is a necessary condition for the existence of a long run relationship. The co-integration results of both the trace and maximum-eigen value statistic of the Johansen cointegration test are presented and displayed in Tables 5 and 6.

Table 5: Johansen's cointegration test (trace) results

Hypothesized No. of CE(s)	Eigen value	Trace Statistics	5 Percent Critical Value	Probability
None*	0.358555	155.9800	150.5585	0.0238
At most 1	0.303277	113.3530	117.7082	0.1913
At most 2	0.256727	78.66172	88.80380	0.2153
At most 3	0.209830	50.17931	63.87610	0.4059
At most 4	0.130553	27.57067	42.91525	0.6477
At most 5	0.080093	14.14047	25.87211	0.6460

Trace test indicates 1 cointegrating equation(s) at 5% level of significance

Note: * denotes rejection of the hypothesis at the 5% significance level

Source: Computed Using Eviews 7.0 Package.

Table 6: Johansen's cointegration test (maximum eigen value) results.

Hypothesized No. of CE(s)	Eigen value	Trace Statistics	5 Percent Critical Value	Probability
None*	0.358555	50.5985	42.6275	0.0266
At most 1	0.303277	34.3530	37.7082	0.3832
At most 2	0.256727	24.6172	28.8038	0.4224
At most 3	0.209830	18.1793	22.8761	0.7686
At most 4	0.130553	10.5707	13.9152	0.6477
At most 5	0.080093	5.21447	6.8720	0.8202

Trace test indicates 1 cointegrating equation(s) at 5% level of significance

Note: * denotes rejection of the hypothesis at the 5% significance level

Source: Computed Using Eviews 7.0 Package.

It can be seen from Tables 5 and 6 that both the trace statistic and the maximum-Eigen value statistic indicate the presence of one cointegration among the variables. This confirms the existence of a stable long-run relationship among economic growth (Y) as measured by real GDP, tax revenue, capital stock as measured by the share of gross fixed capital formation to GDP (K), labor as measured by labor force (LF), government expenditure as a share of GDP and consumer price index (CPI).

Based on the indication of one cointegrating vector among the variables, the estimated long-run equilibrium relationship for economic growth (real GDP) was derived from the unnormalised vectors as presented in **Appendix C.**

The fifth vector appears to be the one on which we can normalize the real GDP from the unnormalised cointegrating coefficients in **Appendix C**. The choice of this vector is based on sign expectations about the long- run relationships as indicated in equation below.

The long run relationship was derived by normalizing LRGDP and dividing each of the cointegrating coefficients by the coefficient of real GDP. The long run relationship is specified as:

$$LRGDP = 0.0128T + 0.6445LTAXR + 0.3015LFDI + 0.4369LGOV - 0.0262LCPI + 0.5679LGFCF + 0.7810LLF$$

Where T is time trend, $LTAXR_t$ is total tax revenue, $LFDI_t$ is Foreign Direct Investment, $LCPI_t$ is consumer price index, $LGOV_t$ is government expenditure, $LGFCF$ is gross fixed capital formation and LLF is labor force.

The model above represents the long run effects on output. Firstly, the trend exerts a positive effect on real GDP. This implies that holding all other factors constant in the long run, as time passes by, the real GDP of Ghana will grow by about 1.28% each quarter. This

is justified by the fact that as time goes on, technology, institutions and human behavior changes and such changes will naturally grow the activities in the real sector.

Tax revenue has a positive and significant effect on real GDP. The coefficient of 0.6445 implies that in the long run, a 100 percent increase in foreign direct invest will lead to approximately 64 percent increase in real GDP. It means that tax revenue would lead to economic growth when it is used to undertake infrastructural developments and spending in other sectors by the government to increase productivity. This finding is in line with Mullen and Williams (1994); Karran (1985) all found a positive and significant effect of tax revenue on economic growth.

FDI is statistically significant in the long run and it has a positive effect on real GDP in Ghana. The coefficient of 0.3015 implies that in the long run, a 100 percent increase in foreign direct invest will lead to approximately 30 percent increase in real GDP. The economic justification is that FDI produces externalities in the form of technology transfers and spillovers which enhances economic growth. Government expenditure (GOV) was statistically significant and it exerted a positive impact on economic growth. This implies that one percent increase in government expenditure in the long-run would lead to 0.4369 percent increase in economic growth. The positive effect is in conformity with the findings of Kouassy (1994) for Ivory Coast. The CPI with a coefficient of -0.0262 has a negative and significant impact on economic growth. Thus, a one percent increase in CPI will decrease economic growth by 0.03 percent. This shows that a higher level of CPI represents distortion in an economy. The results however contradict the findings by Erbaykal and Okuyan (2008) and Omoke (2010) who found positive relationship.

The coefficient of capital of 0.5679 shows that a one percent increase in capital input would result in a 0.5679 percent increase in real GDP, holding all other factors constant. This supports the theoretical conclusion that capital contributes positively to growth of GDP. It is consistent with conclusions reached by Aryeetey and Fosu (2003) and Fosu and Magnus (2006) in the case of Ghana. Labor force is positive and statistically significant with a coefficient of 0.7810. This is consistent with the argument of Jayaraman and Singh (2007) who asserted that there can be no growth achievement without the involvement of labor as a factor input.

Short Run Dynamics

Engle and Granger (1991) argued that when variables are cointegrated, their dynamic relationship can be specified by an error correction representation in which an error correction term (ECT) computed from the long-run equation must be incorporated in order to capture both the short-run and long-run relationships. The ECT is expected to be statistically significant with a negative sign. The negative sign implies that any shock that occurs in the short-run will be corrected in the long-run. If the error correction term is greater in absolute value, the rate of convergence to equilibrium will be faster.

Table 7: Results of error-correction model (VECM)

Variable	Coefficient	Std error	t- statistic	Probability
ECT(-1)	-0.127256	0.051767	-2.458245	0.0172
D(LRGDP(-1))	0.320643	0.150578	2.129420	0.0363
D(LRGDP(-5))	0.128851	0.057355	2.24655	0.0320
D(LTAXR(-1))	0.278789	0.101697	2.741368	0.0076
D(LFDI(-6))	0.125464	0.035708	3.513610	0.0008
D(LGOV(-2))	0.346251	0.196253	1.764309	0.0781
D(LCPI(-3))	-0.013610	0.005980	-2.276010	0.0257
D(LGFCF(-4))	0.424726	0.126021	3.370279	0.0016
D(LLF(-5))	0.526412	0.134675	3.908758	0.0002
CONSTANT	0.125069	0.024983	5.006204	0.0000

Source: Computed using Eviews 7.0 Package

R-squared= 0.787958 DW=1.996140 F-Statistics=3.75548 Prob=0.0001

Adjusted R-Squared= 0.54108

From Table 6, the estimated coefficient of the error correction term is -0.127256 which implies that the speed of adjustment is approximately 12.7 percent per quarter. This negative and significant coefficient is an indication that cointegrating relationship exists among the variables. The size of the coefficient on the error correction term (ECT) denotes that about 12.7 percent of the disequilibrium in the product market caused by previous years' shocks converges back to the long-run equilibrium in the current year. According to Kremers et al. (1992), a relatively more efficient way of establishing cointegration is through the error correction term.

Tax revenue is also significant at lag one in the short run where it exerts a positive effect on real GDP with coefficient of 0.278789. The positive effect is justified by the fact that tax revenue generated by the government will be used for infrastructural development in the various sectors of the economy which will lead to increase in output. This is consistent with the findings of Ogbonna and Ebimobowei (2012) who found a positive and significant effect of tax revenue on economic growth in the short-run.

The positive effect of FDI reemphasizes the fact that Ghana has benefited positively from the spillover effect of foreign investors in the country. (CPI) which represents macroeconomic instability has a negative and significant effect on economic growth. Specifically, a one percent increase in CPI will cause growth in real GDP to fall by 0.01361 percent. This result confirms the findings of (Gokal and Hanif, 2004).

Also, government expenditure is positive and significant at lag 2. Thus, one percent increase in government spending in the previous two quarters will cause growth in real GDP to rise by 0.346251 percent in the second quarter. The short-run coefficient of capital is positive and significant just as the long run estimate. Thus in the short run a percent increase in capital would lead to approximately 0.424726 percent increase in GDP growth in the fourth quarter. Similarly, labor force is positive and significant in the short run. One percent increase in the LLF in the short run would increase real GDP growth by 0.526412 percent.

Evaluation of the models

Table 8: Diagnostic test for LRGDP model

Diagnostic	Statistic	Conclusion
Ramsey Reset Test	F-statistic = 0.18532 (0.668125) Log likelihood ratio= 0.2468 (0.619353)	Equation is correctly specified
ARCH Test	F-statistic 0.33603(0.9160) Obs*R-squared 2.1343(0.4427)	There is no ARCH element in the residual.
Breusch-Godfrey Serial Correlation LM Test	F-statistic 3.8247(0.2947) Obs*R-squared 30.91210 (0.2651)	No serial correlation
Multivariate Normality	Jackque-Bera test=1.5391 p-value = 0.5463	Residuals are normal

Source: Computed Using Eviews 7.0 Package

Variance decomposition analysis

The forecast error variance decomposition provides complementary information for a better understanding of the relationships between the variables of a VAR model. It tells us the proportion of the movements in a sequence due to its own shock, and other identified

shocks (Enders, 2004). The results of the forecast error variance decomposition of the endogenous variables, at various quarters are shown in Table 8.

Table 9: Result of variance decomposition of real GDP

Qtr	LRGDP	LTAXR	LFDI	LGOV	LCPI	LGFCF	LLF
2	92.5470	4.88372	0.07328	0.03917	0.01466	1.85967	0.58240
4	62.4214	14.2740	5.14456	10.6908	1.43891	4.39323	1.63696
6	43.8584	3.19070	0.30072	36.2944	0.09833	0.64436	15.6129
8	46.3671	2.88666	0.87239	37.1662	0.63080	0.25633	11.8204
10	44.4135	2.42456	0.50244	36.6004	0.24124	0.02279	15.7949
12	46.3174	1.94807	0.58510	35.3929	0.28899	0.10000	15.3673
14	46.3224	1.34464	0.60197	33.9630	0.20221	0.09001	17.4756
16	45.4595	1.28940	0.61977	33.6392	0.17132	0.20751	18.6132
18	45.4847	2.24143	0.58681	32.7476	0.26674	0.62149	18.0511
20	43.7545	3.97174	0.52975	36.2596	0.41709	0.58664	14.4806

Source: Computed Using Eviews 7.0 Package

Table 9 shows that the largest source of variations in real GDP forecast error is attributed to its own shocks. The innovations of tax revenue, foreign direct investment, government expenditure, CPI, gross fixed capital formation and labor force are important sources of the forecast error variance of real GDP. The ratio of real GDP to gross fixed capital formation contributed least to the forecast error variance of real GDP. This suggests that all the variables play important part in real GDP with the most effective variable being government expenditure (LGOV).

In explaining the forecast error variance of real GDP above, it is observed that in the short term horizon (two years), medium-term and long-term horizon innovations of labor force and government expenditure are the most important sources of variations besides its own shock. The source of least forecast error variance of real GDP is the innovations of gross fixed capital formation throughout the short-term, medium-term and long-term horizons. The most effective instrument for real GDP seems to be government expenditure.

Conclusions

It can be concluded from the study that both the long-run and short-run results found statistically significant positive effects of tax revenue on economic growth in Ghana. Thus, the study found that the modern endogenous growth model which argued that government tax revenue influence economic growth is valid in both the long-run and short-run. The study also found a positive and significant effect of FDI on real GDP both in the long run and short run. This reemphasizes the significant role that FDI plays in the growth process of Ghana. Government expenditure, gross fixed capital formation (K) and labor force exerted a positive and statistically significant effect on economic growth. The results of the VECM showed that the error correction term for economic growth did carry the expected negative sign.

The study also demonstrated that there exist a uni-directional causality between tax revenue and economic growth and the flow of causality is through tax revenue to economic growth in Ghana. This implies that tax revenue leads to economic growth but the reverse does not hold. Government needs to put in more effort in revenue mobilization since tax revenue serve as a source of funding for government expenditure in undertaking infrastructural development. This is because tax revenue exerts a positive effect on economic growth. This could be done by improving efficiency in tax administration by strengthening and modernizing customs administration and the streamlining of tax exemptions.

References

Aryeetey, E., & Fosu, A. (2003). Economic growth in Ghana: 1960-2000. *Draft, African Economic Research Consortium, Nairobi, Kenya* .

Chigbu, E., Akujuobi, L. E., & Ebimobowei, A (2012). An empirical study on the causality between economic growth and taxation in Nigeria. *Current Research Journal of Economic Theory , 4*, 65-90.

Dackehag, M., & Hansson, A. (2012). Taxation of income and economic growth: An empirical analysis of 25 rich OECD countries. *Journal of Economic Development, 21*(1), 93-118

Enders, W. (2004). Applied Econometric Time Series [M], New York: John Willey & Sons. Inc.

Engen, E. M., & Skinner, J. (1992). Fiscal policy and economic growth. *Journal of Development Economics*, 39(1), 5-30.

Engle, R. F., & Granger, C. W. (1991). *Long-run economic relationships: Readings in cointegration.* Oxford University Press.

Erbaykal, E., & Okuyan, H. A. (2008). Does inflation depress economic growth? Evidence from Turkey. *International Journal of Finance and Economics , 13,* 6-19.

Fosu, A. K. (1990). Exports and economic growth: the African case. *World Development , 18*, 831-835.

Fosu, O. A., & Magnus, F. J. (2006). Bounds testing approach to cointegration: an examination of foreign direct investment trade and growth relationships.

Gandolfo, G., Martinengo, G., & Padoan, P. C. (1981). *Qualitative analysis and econometric estimation of continuous time dynamic models.* North-Holland Publishing Company.

Gokal, V., & Hanif, S. (2004). *Relationship between inflation and economic growth.* (Economics Department Reserve Bank of Fiji, Working Paper 2004/04). Retrieved November 2011, from http://www.reserve bank.gov.

Granger, C. W. (1986). Developments in the study of cointegrated economic variables. *Oxford Bulletin of economics and statistics , 48*, 213-228.

Greenidge, K., & Drakes, L. (2009). Tax Policy and Macroeconomic Activity in Barbados. *Money Affairs , 23*, 182--210.

Gujarati, D. N. (2001). *Basic econometrics*, (4th ed.). New York: The McGraw-Hill Companies Inc.

Ilyas, M., & Siddiqi, M. (2008). The impact of revenue gap on economic growth: A case study of Pakistan. *Statistical Bulletin , 20,* 166-208.

Jayaraman, T., & Singh, B. (2007). Foreign direct investment and employment creation in Pacific Island countries: An empirical study of Fiji. *Asia-Pacific Research and Training Network on Trade, 24,* 142-178.

Johansen, S. (1988). Statistical analysis of cointegration vectors. *Journal of economic dynamics and control , 12*, 231-254.

Johansen, S. (1991). Estimation and hypothesis testing of cointegration vectors in Gaussian vector autoregressive models. *Econometrica: Journal of the Econometric Society* , *51*(6), 1551-1580.

Johansen, S., & Juselius, K. (1990). Maximum likelihood estimation and inference on cointegration with applications to the demand for money. *Oxford Bulletin of Economics and statistics , 52*, 169-210.

Karran, T. (1985). The determinants of taxation in Britain: An empirical test. *Journal of Public Policy , 5*, 365-386.

Karras, G., & Furceri, D. (2009). Taxes and growth in Europe. *South-Eastern Europe Journal of Economics , 2*, 181-204.

Koch, S. F., Schoeman, N. J., & Tonder, J. J. (2005). Economic growth and the structure of taxes in South Africa: 1960-2002. *South African Journal of Economics , 73*, 190-210.

Koester, R. B., & Kormendi, R. C. (1989). Taxation, aggregate activity and economic growth: Cross-country evidence on some supply-side hypotheses. *Economic Inquiry , 27*, 367-386.

Kouassy, O. (1994). The IS LM models and the assessment of the real impact of public spending on growth in Africa: evidence from Cote d'Ivoire. *Economic policy experience in Africa: What have we learned?* , *7*, 35-63

Kremers, J. J., Ericsson, N. R., & Dolado, J. J. (1992). The power of cointegration tests. *Oxford bulletin of economics and statistics , 54*, 325-348.

Mansouri, B. (2005). *The interactive impact of FDI and trade openness on economic growth: Evidence from Morocco.* Paper presented at the 12th Economic Research Forum (ERF) Conference, Cairo.

Mullen, J. K., & Williams, M. (1994). Marginal tax rates and state economic growth. *Regional Science and Urban Economics , 24*, 687-705.

Myles, G. D. (2000). Taxation and economic growth. *Fiscal Studies , 21*, 141-168.

Ogbonna, G., & Ebimobowei, A. (2012). Impact of petroleum revenue and the economy of Nigeria. *The Social Sciences , 7*, 405-411.

Omoke, P. C. (2010). Inflation and economic growth in Nigeria. *Journal of Sustainable Development , 3*, 159-234.

Owolabi, S., Obiakor, R., & Okwu, A. (2011). Investigating liquidity-profitability relationship in business organizations: A study of selected quoted companies in Nigeria. *British Journal of Economics, Finance and Management Sciences , 1*, 11-29.

Romer, C. D., & Romer, D. H. (2010). The macroeconomic effects of tax changes: Estimates based on a new measure of fiscal shocks. *The American Economic Review , 100*, 763-801.

Sakyi, D. (2011). Trade Openness, foreign aid and economic growth in post-liberalization Ghana: An application Of ARDL bounds test. *Journal of Economics and International Finance , 3*, 146-156.

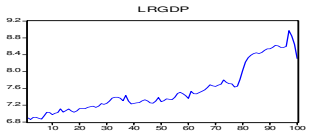
Solow, R. M. (1956). A contribution to the theory of economic growth. *The quarterly journal of economics , 70*, 65--94.

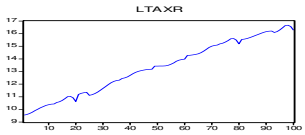
Worlu, C. N., & Nkoro, E. (2012). Tax revenue and economic development in Nigeria: A macroeconometric approach. *Academic Journal of Interdisciplinary Studies* , *48*, 198-211.

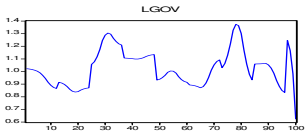
APPENDICES

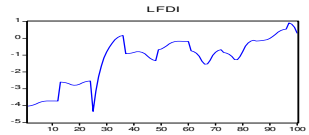
APPENDIX A

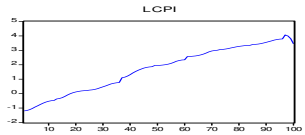
Plots of the variables (series) at levels

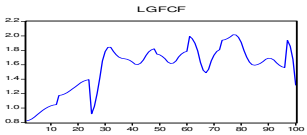


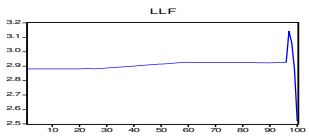






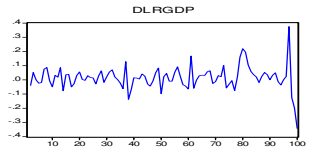


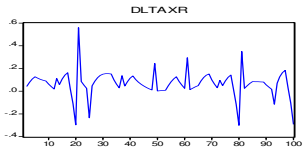


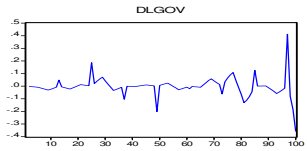


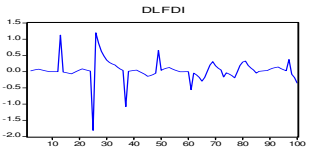
APPENDIX B

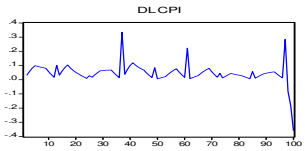
Plots of the variables (series) at first difference

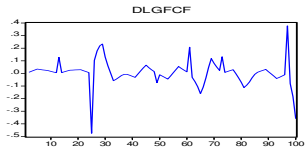


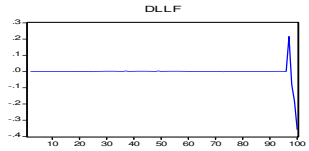












APPENDIX C

Un-normalized cointegrating coefficients

LRGDP	LTAXR	LFDI	LGOV	LCPI	LGFCF	LLF	TREND
-29.385	3.74492	5.24203	3.26820	-0.0065	-32.614	-5.4875	0.62785
11.9932	3.80171	2.3457	-0.8115	0.2993	-1.7508	3.8962	-0.8033
5.69728	-12.612	-4.6924	2.50332	0.2546	10.0806	2.25120	0.83534
-2.5030	-3.2034	1.18659	-1.5543	0.2371	-4.8592	-13.795	0.79466
-2.2079	1.4232	0.6656	0.9648	-0.0578	1.2540	1.7245	0.0283
-7.2676	-1.6903	1.84689	2.42605	-0.0521	-0.3961	-5.7541	1.33454
-1.3736	2.00280	1.06357	-1.3687	-0.0590	-5.3974	78.7632	-0.1539

Source: computed using Eviews 7.0 Package