COINTEGRATION AND CAUSALITY BETWEEN TAX REVENUE AND ECONOMIC GROWTH IN GHANA

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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 Vector Autoregressive framework. The study found one Cointegration relationship among real Gross Domestic Product, tax revenue, foreign direct investment, government expenditure, consumer price index, gross fixed capital formation and labour force using the Johansen Cointegration approach. The study revealed that there exist both short-run and long-run relationship between economic growth and tax revenue. 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 granger causality test shows a unidirectional causality between tax revenue and economic growth. The direction of causality is from tax revenue to economic growth. Foreign direct investment, government expenditure, gross fixed capital formation and labour force participation rate exerted a positive and statistically significant impact on economic growth both in the short-run and long-run suggesting that these variables are critical in enhancing sustained economic growth. The study concluded that there is positive relationship between tax revenue and economic growth. It was recommended that the government should improve tax collection measures by reducing tax rates and increasing the tax base in order to generate more revenue so as to increase economic growth in Ghana.

Keywords: Taxation**,** Expenditure, Revenue, Cointegration, Causality, Growth

JEL Classification: E62, C32

1. 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 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 tax revenue and economic growth are mainly cross-country studies e.g. Owolabi andOkwu (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.

2. 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.

2.1 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. 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.

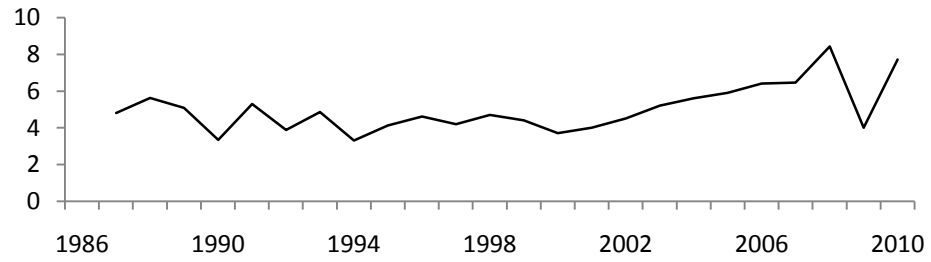

Figure. 1. Trends in real GDP growth in Ghana (1986-2010).

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.

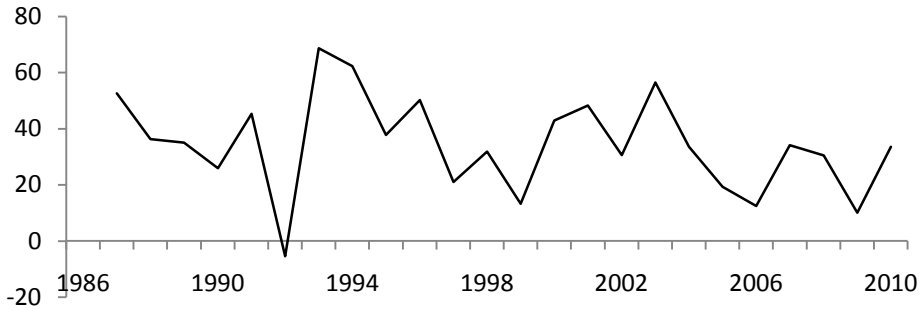

Figure. 2. Trends in tax revenue growth in Ghana (1986-2010).

From the graph in Fig. 2 above the trend in tax revenue shows that the growth pattern have 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.

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

Source:Authors' Compilation from various Studies

3. Methodology

3.1Model specification

Endogenous growth models developed by Barro (1990), Mendosa, Milesi-Ferreti and Asea (1997) predict that fiscal policy can affect the level of product and the long run economic growth. Hence the model to be used in this study is specified as follows:

$$\Delta \ln Y_t = \beta_0 + \beta_1 \Delta \ln TAXR_t + \beta_2 \Delta \ln FDI_t + \beta_3 \Delta \ln GOV_t + \beta_4 \Delta \ln CPI_t + \alpha \Delta \ln K + \delta \Delta \ln L + \varepsilon_t \quad (1)$$

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:

$$\Delta \ln Y_t = \beta_0 + \sum_{i=1}^{p} \theta \Delta \ln Y_{t-i} + \sum_{i=1}^{q} \beta_1 \Delta \ln TAXR_{t-i} + \sum_{i=1}^{r} \beta_2 \Delta \ln FDI_{t-i} + \sum_{i=1}^{s} \beta_3 \Delta \ln GOV_{t-i} + \sum_{i=1}^{t} \beta_4 \Delta \ln CPI_{t-i} + \sum_{i=1}^{u} \alpha \Delta \ln K_{t-i} + \sum_{i=1}^{v} \delta \Delta \ln L_{t-i} + \psi ECT_{t-1} + \nu_t \quad (2)$$

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.

3.2 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 in order to examine the direction of causality in the presence of cointegrating vectors.

3.3 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.

4.Results and discussions

4.1 Results ofunit 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. 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 3however shows that, at first difference all the variables are stationary and we reject the null hypothesis of the existence of unit root.

4.2 Johansen Cointegration Test

According to Johansen (1991), cointegration can be used to establish whether there exists a linear long-term economic relationship among variables. 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 4 and 5.

Table 4.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 5. 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 4 and 5 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 unnormalisedvectors as presented in Table 6.

3.4 Table 6: 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

The normalization of real GDP was done along the fifth vectorin Table 6. 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 estimation. 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. 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.

4.3 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 and the results are presented in Table 7.

Table 7. 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

*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 since the p-value (0.02174) is less than 5% level of significance. Therefore, the null hypothesis is rejected. 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.

4.4 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 8. 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 8, 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.

4.5 Evaluation of the models

Table 9. 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

5.Conclusions

It can be concluded from the study that both the long-run and short-run results shows 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 tax revenue influence economic growth is valid in both the long-run and short-run. 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.

It was observed that there is 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. This negative and significant coefficient is an indication that cointegrating relationship exists among the variables and implies that any disequilibrium in the product market caused by previous years' shocks converges back to equilibrium in the long-run.

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