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The Causal Link between Government Expenditure and Government Revenue in Ghana

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Abstract

The study aimed at determining the causal link between government expenditure and government revenue of Ghana over the period 1960 to 2007. Four hypotheses were tested namely: tax-spend hypothesis, spend-tax hypothesis, fiscal synchronization hypothesis and institutional separation hypothesis. The data was obtained from World Bank development indicators' and the state of the Ghanaian economy. The study employed Granger causality test, augmented Dickey and Fuller (ADF) and Phillip-Perron (PP) tests to examine the causal link between government expenditure and revenue of Ghana. The result shows that there is bi-directional causality such that both government expenditure and government revenue of Ghana have temporal precedence over each other. This means that changes in government revenue precede changes in government expenditure. In order to ensure that expenditure do not move too far away from revenue, the tax net of Ghana should be expanded to capture all "taxable" individuals and firms to increase government revenue.

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Introduction

Budget deficit in Ghana plays a central role in achieving economic and social objectives including macroeconomic stability, sustainable growth and poverty reduction. However, in recent times the deficit position of Ghana and other developing countries has worsened, drawing attention to its long term sustainability [Bank of Ghana, 2005]. For the economy of Ghana, there has been persistent tendency towards budget deficit since independence as a result of ever expanding government expenditure, inadequate revenue generation capacity of government and increasing debt levels [Pomeyie, 2001]. In this case, government expenditure for most years has exceeded government revenue leading to deficits on the budget. Expenditure of Ghana has been rising steadily due to increase demand for infrastructure and payment of interest on debt. For instance, total expenditure to GDP increased from 31.62 percent in 2005 to 33.71 percent in 2006 and

35.9 percent in 2007 [Bank of Ghana, 2007]. Contrary, the various sources of Ghana's revenue have become highly inadequate due to narrow tax base, high rate of tax evasion and corruption in the revenue collection agencies [ISSER, 1994]. For instance, tax revenue decreased from 23.81 percent of GDP in 2005 to 22.25 percent in 2006 [ISSER, 2007]. However, total government revenue to GDP increased marginally from 23.87 percent in 2005 to 24.1 percent 2006 but declined to 23.6 percent in 2007 [Bank of Ghana, 2007]. There is therefore, a limit on the ability of Ghana to raise increasing amounts of tax for development. This has led to over spending by the government which tends to create deficit on the budget.

A large literature has dealt with the subject of the causal relationship between government expenditure and government revenue in the case of developing countries. However, the subject has not been widely explored in relation to the Ghanaian economy. In respect

of this therefore, the main purpose of the paper will examine the causal relationship between government expenditure and government revenue in Ghana for the period 1960 to 2007. The rest of this paper will give a brief review of literature, data and the methodology used, estimation and results, and concluding remarks.

Review of Relevant Literature

There are four hypotheses that explain the causal relationship between government expenditure and revenue. The tax-spend hypothesis postulates that raising taxes in an attempt to reduce deficit also causes expenditure to rise. Moalusi [2004] suggests that if taxes are raised they will propel growth in government spending. Hence, it is not possible to reduce budget deficit by increasing taxes [Nyamongo, Sichei and Schoeman, 2007]. Darrat (1998), in a study, finds that the tax-and-spend hypothesis in Turkey shows negative causal relationship running from taxes to spending. Also, a tax-spend analysis in Taiwan concludes that government expenditure normally adjusts for deviations from long-run equilibrium in budget deficit [Carneiro *et al*, 2005; Barua, 2005].

Contrary, the spend-tax hypothesis predicts that government initially incurs expenditure and then increases tax revenue to finance deficits. The view is that exogenous disturbances like wars, unstable political conditions and natural disasters induce an increase in government spending and therefore an increase in tax revenues. Empirical work to support this hypothesis has been done in the case of Guinea-Bissau by Carneiro et al [2005]. By using annual data between 1981 and 2002, it indicates that expenditure and revenue exhibit unilateral causality from expenditure to revenue but stable relationship in the long-run. The study concludes that the risk of budget deficit explosion in the long-run is limited but government should control spending to restore fiscal discipline in the short-term [Carneiro *et al,* 2005].

Thirdly, the fiscal synchronization hypothesis suggests that revenue and expenditure decisions are determined simultaneously in the process of equalizing marginal benefit and marginal cost of government services [Barua, 2005; Carneiro *et al,* 2005]. A study in four developing countries (Benin, Cote d'Ivoire, Niger and Togo) shows a strong bi-directional causation [Barua, 2005: 9].

Finally, the institutional separation hypothesis postulates that government decision to spend is independent of its decision to tax. Hence, there is no relationship between government revenue and expenditure. This is possible if government determines expenditure on the basis of requirements of citizens and imposes tax up to a tolerable limit of the citizens [Moalusi, 2004; Barua, 2005]. A study in Bangladesh using annual data from 1974 to 2004 shows no causal relationship between revenue and expenditure in the short run. It shows that deviation from long-run equilibrium relationship is corrected by short-run adjustment of expenditure and GDP [Barua, 2005].

Methodology

Data Sources

The study employed annual data on government revenue-GDP and government expenditure-GDP of Ghana for the period 1960 to 2007. The data was obtained from World Bank development indicators' and the state of the Ghanaian economy. The use of annual data is dictated by the unavailability of quarterly data for most of the years whilst the choice of study period is depended on the availability of well-documented data for Ghana.

Variables

The main variables employed in the study include government expenditure-GDP and government revenue-GDP ratios. This is because as the economy grows, government expenditure and revenue grows in proportion to real GDP. These variables are relevant to the study because changes in government spending or revenue create changes in fiscal deficits [Delong, 2002; Barua, 2005].

Analytical Procedures

The study adopted the Granger causality model used by Moalusi (2004). This is mainly

because both countries are developing economies. However, whereas Moalusi (2004) specified both bivariate and multivariate Granger causality models, this study specifies a bivariate model. This is because both government expenditure and revenue are expressed as ratios of GDP. The first step is to perform stationarity tests on our variables in order to avoid the problem of spurious regression and failure to account for appropriate dynamic specification [Mahendra, 2006]. This involves the use of time series techniques to determine the presence of unit roots. Time series analysis is used because it concerns the analysis of data collected overtime such as monthly, quarterly or yearly values. The purpose of such analysis is meant to discern whether there is some pattern in the values collected with the intention of forecasting economic trends. This permits the adjustment of economic time series for influences impairing the detection of medium to long-term trend of a series [Dolado, Jesús and Marmol, 1999]. In this case, we employ the augmented Dickey and Fuller (ADF) and Phillip-Perron (PP) tests to examine the presence of unit root. This is because these tests are simple to understand and provide more convenient procedures to determine the properties of time series data. The tests have been carried out using E-Views 5 software. In the choice of optimal lag length, the Akaike Information Criteria (AIC) is used in respect of ADF test whilst the Bartlett Kernel lag length is used for the PP test. These tests are based on the Mackinnon one-sided P-values.

In this case, we test the null hypothesis of non-stationarity of government expenditure and revenue against the alternative hypothesis of stationarity of the variables. These tests will verify the stationarity properties of government revenue and expenditure series of Ghana. This means, in order to use the causality test, the variables are required to be stationary at their level or upon differencing to an appropriate level.

To determine the causal link between government expenditure and government revenue series of Ghana, we apply the Granger causality test as stated in the following bivariate expression below:

$$EXG_t = \alpha_0 + \sum_{i=1}^{n} \alpha_{1i} EXG_{t-i} + \sum_{i=1}^{n} \alpha_{2i} REVG_{t-i} + \varepsilon_{1t}$$
………..………………. (1)

$$REVG_t = \beta_0 + \sum_{k=1}^{m} \beta_{1i} REVG_{t-k} + \sum_{k=1}^{m} \beta_{2i} EXG_{t-k} + \varepsilon_{2t}$$
………………………..... (2)

Where EXG_t and $REVG_t$ are government expenditure-GDP and government revenue-GDP at time t; α_0 and β_0 are intercepts, α_{1i} and β_{1i} are slope coefficients of own lagged values, α_{2i} and β_{2i} are slope coefficients of lagged values of other variables in equation (1) and (2) respectively whilst ε_t is error term. Equation (1) means that government expenditure-GDP ratio at a particular time is influenced by its past values and past values of government revenue-GDP series; whilst equation (2) means that government revenue-GDP ratio at any time is influenced by its past values and past values of government expenditure-GDP series. This means that in a regression of the variables on their own lagged values, the inclusion of lagged values of the other variable significantly improves the prediction of that variable. In estimating the causal link between government expenditure and revenue series of Ghana, the null hypothesis of no Granger causality is tested against the alternative of Granger causality. In this case, the null hypothesis is not rejected if $\sum \alpha_{2i}$

and $\sum \beta_{2i}$ are statistically equal to zero

simultaneously. This means that past and present values of government revenue provide no important information to forecast future values of expenditure [Barua, 2005].

Results and Discussion

The stationarity tests are conducted using the levels and first differences of government

expenditure-GDP and revenue-GDP series of Ghana. It also takes into account trend and intercepts (constants without trend) of the variables. This is because a visual examination of the data on government revenue-GDP and expenditure-GDP series of Ghana suggests the presence of time trend.

Table 1 and Table 2 present the results of the test statistics for both ADF and PP of government revenue-GDP and government expenditure-GDP series of Ghana in respect of the study period. Table 1 indicates that the results of ADF and PP tests do not allow for rejection of the null hypothesis of non-stationarity for the levels of government expenditure-GDP series *(EXG)* and government revenue-GDP series *(REVG)*. This occurred both for the test with trend and the constant without trend. In this case, the test shows that both government expenditure-GDP series and revenue-GDP series of Ghana supports the null hypothesis when ADF and PP tests are used. This means that government expenditure and revenue of Ghana are non-stationary in their levels.

However, many time series data need to be appropriately differenced in order to achieve stationarity [Dolado, Jesús and Marmol, 1999]. As a result, we proceed to test and confirm the stationarity of these variables after their first difference. The unit root test on the variables in their first difference produced estimates that show a reverse situation compared to the estimates in the levels. Table 2 shows the test for first differences of government expenditure-GDP series (ΔEXG) and government revenue-GDP series ($\Delta REVG$) of Ghana. From the estimation, both tests reject the null hypothesis of non-stationarity of the variables after first differencing. This is possible even at 1 percent level of significance for both ADF and PP tests with trend and without trend. This leaves no controversy in terms of both ADF and PP tests in achieving stationarity after the first difference of government expenditure-GDP and government revenue-GDP series. In this case, the estimation show that government expenditure-GDP and revenue-GDP series

favour the existence of unit root in the levels, but indicate stationarity after first differencing. Hence, we conclude that both government expenditure and revenue of Ghana are stationary and integrated of order one. We then proceed to find the causal link between these variables using the Granger causality test is represented in Table 3 below.

The estimates from Table 3 indicate that we reject the null hypothesis of no causality between government expenditure-GDP and government revenue-GDP of Ghana in both cases. This means that the coefficients

$$\sum \alpha_{2i} \quad \text{and} \quad \sum \beta_{2i} \text{ are statistically not}$$

equal to zero. In this case, there is bi-directional causality such that both government expenditure and government revenue of Ghana have temporal precedence over each other. Yet, the existence of Granger causality does not imply that the occurrence of revenue is the result of expenditure. It means that changes in government revenue precede changes in government expenditure [Barua, 2005].

This result indicates that past and present values of government revenue provide important information to forecast future values of government expenditure. This can be very useful in understanding the nature of economic problems [Barua, 2005]. This finding supports the work of Oshikoya and Tarawalie [2008] that used annual time series data and found evidence of bi-directional causality in Ghana during the period 1980-2008.

Other diagnostic tests carried out are the normality test. We use the Jarque-Bera test which is based on OLS residuals and follows the chi-squared distribution with 2 degrees of freedom. It jointly tests skewness (S = 0) and kurtosis (K = 3) of the OLS residuals. We test the null hypothesis that the residuals are normally distributed against alternative that the residuals are not normally distributed. The test for normality, in the case of Ghana, estimated S = -0.035139, K = 2.267128 and a Jarque-Bera statistic of 1.084087 at a probability of 0.581559. This means that the

estimates clearly support the normality assumption as pictured in figure 1. In this case, the study fails to reject the null hypothesis that the residuals are normally distributed. It is therefore concluded that the residuals of Ghana's expenditure-GDP and revenue-GDP series between 1960 and 2007 are normally distributed.

We also test for heteroscedasticity, which confirms the OLS assumption that the variance of each of the disturbance term is equal. In this respect, if we persist in using the usual testing procedures despite heteroscedasticity, whatever conclusion is drawn or inferences made may be very misleading [Gujarati, 2004]. We test the null hypothesis that there is no heteroscedasticity against alternative that there is heteroscedasticity. The test is conducted using the white heteroscedasticity test. The estimate indicates that the number of observations multiplied by R-square (n.R²) gives a value of 1.539232 at a probability of 0.463191. Hence, we do not reject the null hypothesis. It is therefore, concluded that there is no heteroscedasticity in government expenditure-GDP and revenue-GDP series of Ghana over the study period. This means that the assumption of equal variance of the disturbance term hold for government expenditure and revenue of Ghana between 1960 and 2007.

For efficiency of the estimates, we test for autocorrelation since the classical linear regression model assumes the existence of no autocorrelation in the disturbance term. This is important because, in the absence of the assumption, the OLS estimator may no longer have minimum variance among all linear unbiased estimators. In this case, the estimates may not be as efficient as other linear unbiased estimators and that the t, F and χ^2 tests may give misleading conclusions [Gujarati, 2004]. We test the null hypothesis that there is no autocorrelation in the disturbance term against alternative that there is autocorrelation in the disturbance term. The test uses the Durbin-Watson d test because it is best suited for small samples. In respect of Ghana, the test produces a Durbin-Watson statistic of 1.895125. This means that we fail to reject the null hypothesis of no autocorrelation. In this case, government expenditure and revenue exhibit no autocorrelation and hence there is minimum variance in the disturbance term. This makes it efficient in arriving at better conclusions.

Conclusions and Policy Implications

This paper examined the causal relationship between government expenditure and government revenue in the case of Ghana. For unit root test, the ADF and PP tests achieved stationarity of the variables after first difference. The Granger causality test indicated a bi-directional causation such that both government expenditure and government revenue of Ghana have temporal precedence over each other. Other diagnostic tests indicate normal distribution of residuals, no heteroscedasticity and no autocorrelation of the variables.

Efforts should be made by all the revenue authorities to consistently increase government revenue as revenue and expenditure must be stationary and integrated of the same order. In this respect, since reduction in government expenditure is not plausible, the tax net of Ghana should be expanded to capture all "taxable" individuals and firms. This would ensure that expenditure do not move too far away from revenue.

Also, any policy to increase expenditure in Ghana should consider past and present values of government revenue. This is because expenditure and revenue take temporal precedence over each other. Hence, past and present values of government revenue provide important information to forecast future values of expenditure. Since there are structural constraints of raising increasing amounts of revenue, government should assess the costs and benefits of all expenditure and eliminate those for unproductive sectors.

Table-1 : Levels

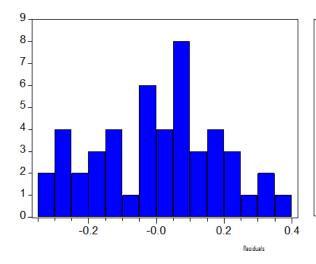| Variable	ADF		PP	
	Constant	Constant	Constant	Constant
	No Trend	Trend	No Trend	Trend
Data Period: 1960-2007				
EXG	-1.831012	-2.852240	-1.824912	-2.554048
REVG	-1.668219	-2.914847	-1.754793	-2.523154

Table-2 : First Differences

Variable	ADF		PP	
	Constant	Constant	Constant	Constant
	No Trend	Trend	No Trend	Trend
Data Period: 1960-2007				
ΔEXG	-5.620420***	-5.552860***	-6.633597***	-6.515187***
$\Delta REVG$	-6.382306***	-6.318479***	-6.380414***	-6.308134***
Note: *** indicates rejection of the null hypothesis of non-stationary at 1 percent significance level based on the MacKinnon critical values.				

Table-3: Granger Causality Test

Null Hypothesis:	Obs	F-Statistic	Probability
EXG does not Granger Cause REVG	47	0.45684	0.50264
REVG does not Granger Cause EXG	47	2.20932	0.14431

Figure 1: Residuals from Regression of Expenditure-GDP series.

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