Government Expenditure and National income: A Causality Test for Nigeria.

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Abstract:

The objective of this study is to test for the direction of causality between Government expenditure and National Income in Nigeria using annual data for the period 1970-2005. The econometric methodology employed was the Cointegration and Granger Causality test. First, the stationarity properties of the data and the order of integration of the data were tested using both the Augmented Dickey-Fuller (ADF) test and the Phillip-Perron (PP) test. We found that the variables were non-stationary in levels, but stationary in first differences. We applied the Johansen multivariate approach to cointegration to test for the long-run relationship among the variables. Our result shows no long-run relationship between Government expenditure and National Income in Nigeria. The Granger Causality test reveals that causality runs from Government expenditure to National Income. This result shows that Government expenditure plays a significant role in promoting economic growth in Nigeria.

Keywords:

Government expenditure, National Income, Cointegration, Granger Causality, Nigeria.

JEL Classifications:

C32, H50, O40

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Introduction

The major objective of this study is to examine the direction of causality between government public expenditure and national income in Nigeria.The answer to the question of whether increasing government expenditures are the cause of economic growth or economic growth is the cause of increasing government expenditures is especially important for Nigeria where the public sector absorbs a relatively large share of country's economic resources.

The relationship between public expenditure and national income has been the subject of two contending propositions. The first and the more popular is Wagner's law. Wagner's law proposes that there is a long-run tendency for public expenditure to grow relative to some national income aggregates such as the Gross Domestic Product (GDP). In other words, the causality of the link between public expenditure and national income runs from national income to public expenditure. The second proposition is associated with Keynes. To Keynes, public expenditure is an exogenous factor and a policy instrument for increasing national income. Consequently, he believes that the causality of the relationship between public expenditure and national income runs from expenditure to income.

The causal relation between government expenditure and national income has been the subject of many empirical studies in both the developed and developing economies. However, there are two of such studies for Nigeria and the findings of these two studies is conflicting and contradict each other, while Essien (1997) found no causality between public expenditure and national income. Aregbeye (2006) reported a bi-directional causality between government total expenditure and national income. This study therefore, attempts to extend the strand of the literature by examining the casual relationship between Government expenditure and national income in Nigeria for the period 1970-2005.

Literature Reviews

Ansari et al (1997) attempt to determine the direction of causality between government expenditure and national income for three African countries Ghana, Kenya, and South Africa, using standard Granger testing procedures and the Holmes-Hutton (1990) causality test, which is a modified version of the Granger test. The study uses annual data on per capita government expenditure and national income for the period from 1957 to 1990. Both variables were deflated by using the GDP deflator for each country. The study finds that in Ghana, Kenya and South Africa there is no long run equilibrium relationship between government expenditure and national income over the sample period. For these countries, there is no evidence of Wagner's hypothesis or the reverse being supported in the short run, except for Ghana where Wagner's law is supported.

Abizadeh and Yousefi (1998) use South Korean data to test Wagner's law. They first conduct Granger type causality tests, and then estimate a growth equation and a government expenditure growth equation by using annual data for the period of 1961-1992. They exclude government expenditures from the GDP to obtain the private sector GDP, and use this in their tests. After comparing the results from the estimations authors conclude that government expenditures did not contributed to economic growth in Korea.

Singh and Sahni (1984) use the Granger causality test to determine the causality direction between national income and public expenditures in India. Total (aggregate) as well as disaggregate expenditure data for the period of 1950-1981 were used. Data used in the study were annual and deflated by using implicit national income deflator. The study finds no causal process confirming the Wagnerian or the opposite view.

Tang, Tuck Cheong (2001) investigated the relationship between national income and Government expenditure in Malaysia. The annual data over the period 1960 to 1998 were used. The result of Johansen multivariate cointegration revealed that no long run relationship among the non-stationary variables existed. Further, a unidirectional causality was observed, that is, from national income growth to Government expenditure growth. Thus, they concluded that Wagner's law is supported by the data, in the short run.

Cheng and Lai (1997) examined the causality between government expenditure and economic growth in South Korea by applying the techniques of Sims (1980), Johansen's cointegration (1988, 1990), and Hsiao's (1981) version of the Granger causality method to post-Korean war data. Unlike other studies, we choose one single country with an attempt to make a more in-depth investigation and analysis.

Dogan (2006) aimed to determine the direction of causality between national income and government expenditures for Indonesia, Malaysia, Philippines, Singapore, and Thailand. Granger causality tests are used to investigate the causal links between the two variables. Times series data covering last four decades are used. Support for the hypothesis that causality runs from government expenditures to national income has been found only in the case of Philippines. There is no evidence for this hypothesis and its reverse for the other countries.

Islam (2001) used annual data for the period 1929-1996 to examine the Wagner's hypothesis for the USA. The study found that the relative size of government expenditures and real Gross National Product per capita are cointegrated by using Johansen-Juselius cointegration approach. Moreover, Wagner's hypothesis is strongly supported by the result of Engle-Granger (1987) error correction approach.

Econometric Methodology

This paper employed the Granger Causality methodology to determine the direction of causality between government expenditure and national income; this econometric test is preceded with the stationarity and cointegration test on the variables employed in the study.

Specification of model:

A simple functional model is presented thus:

Y = f (GE) -- (1)

In an econometric format:

$$Y_t = \alpha_0 + \alpha_1 GE + \varepsilon_t \text{ -- (2)}$$

Where:

Y_t is Gross National income

GE_t is Total government expenditure

α_0 is the constant term, 't' is the time trend, and 'ε' is the random error term.

Data Description and Sources

Annual data from 1970-2005 were used to investigate the casual relationship between Government expenditure (x) and National income (y). Total Government expenditure (GE) and Gross National income (Y) at current prices are used as government expenditure and national income respectively. The principle source of the data was from the various issues of the Central Bank of Nigeria (CBN) Statistical Bulletin.

Estimation Technique

The study uses Granger type causality methodology to determine the causality direction between government expenditure and national income.

Test for Stationarity

Before conducting Granger causality tests, variable must be found stationary individually or, if both variables are non stationary, they must be cointegrated. This means that the test for stationarity and the cointegration test must precede the Granger causality test. We use the Augmented Dickey Fuller (ADF) test due to Dickey and Fuller (1979, 1981). This test is based on an estimate of the following regression

$$\Delta y_t = \alpha_0 + \alpha_1 y_{t-1} + \sum_{i=1}^{n} \alpha_1 \Delta y_i + e_t \text{-------------}(3)$$

$$\Delta y_t = \alpha_0 + \alpha_1 y_{t-1} + \sum_{i-1}^{n} \alpha_1 \Delta yi + \delta_t + e_t \text{--------------}(4)$$

Where

y is a time series, t is a linear time trend, □ is the first difference operator, α_0 is a constant, n is the optimum number of lags on the dependent variable and e is the random error term. The difference between equation (3) and (4) is that the first equation includes just drift. However, the second equation includes both drift and linear time trend. This study also employs the Philip-Perron test due to Phillips (1987) and Phillips and Perron (1988). Since the possibility of the presence of structural breaks makes the ADF test unreliable for testing stationarity. The presence of a structural break will tend to bias the ADF test towards non-rejection of the null hypothesis of a unit root. The regression equation for the pp test is given by

$$\Delta Y_t = \alpha + bY_{t-1} + \varepsilon_t \text{--------------------}(5)$$

Cointegration test

Next, we employ the maximum-likelihood test procedure established by Johansen and Juselius (1990) and Johansen (1991) to test the presence or otherwise of cointegration. Specifically, if Y_t is a vector of n stochastic variables, then there exists a p-lag vector auto regression with Gaussian errors of the following form: Johansen's methodology takes it starting point from the vector autoregression (VAR) of order P given by:

$$y_t = \mu + \Delta_1 y_{t-1} + --- + \Delta p \quad y_{t-p} + \varepsilon_t \text{ ------------------------------------ } (6)$$

Where

Y_t is an nx1 vector of variables that are integrated of order commonly denoted (1) and ε_t is an nx1 vector of innovations.

This VAR can be rewritten as

$$\Delta y_t = \mu + \eta_{yt-1} + \sum_{i-1}^{p-1} \tau_i \Delta y_{t-1} + \varepsilon_t$$

Where

$$\prod = \sum_{i-1}^{p} A_{i-1} \text{ and } \tau_i = -\sum_{j=i+1}^{p} Aj$$

To determine the number of co-integration vectors, Johansen (1988, 1989) and Johansen and Juselius (1990) suggested two statistic test, the first one is the trace test (λ trace). It tests the null hypothesis that the number of distinct cointegrating vector is less than or equal to q against a general unrestricted alternatives q = r. the test calculated as follows:

$$\lambda \text{ trace } (r) = -T \sum_{i=r+1} \text{In} \left(1 - \hat{\lambda}_t\right) \text{ ------------------------------------ (7)}$$

Where

T is the number of usable observations, and the $\lambda_{1,s}$ are the estimated eigenvalue from the matrix.

The Second statistical test is the maximum eigenvalue test (λ max) that is calculated according to the following formula

λ max (r, r + 1) = -T In (1 – λr + 1) ----------------------------- (8)

The test concerns a test of the null hypothesis that there is r of co-integrating vectors against the alternative that r + 1 co-integrating vector.

Granger Causality test

The simple Granger causality test (Granger, 1986) is as follows

$$InY_t = \beta_0 + \sum_{t=1}^{n} \beta_{1i} InY_{t-1} + \sum_{t=1}^{n} \beta_{2i} InGE_{t-1} + e_t \text{ --------------------------------- (9)}$$

$$InGE_t = \alpha_0 + \sum_{i=1}^{n} \alpha_{1i} InY_{t-1} + \sum_{i=1}^{n} \alpha_{2i} InGE_{t-1} \mu_t \text{ ------------------------------ (10)}$$

Where

In Y_t is the natural logarithm of Gross National Income

In GE_t is the natural logarithm of real Total government expenditure

e_t and U_t are white noise error terms

The null hypothesis for equation (9) is that InY does not Granger cause InGE. this hypothesis will be rejected if the coefficients of the lagged Ys (Summation of β2 as a group) are found to be jointly significant (different from zero). The Null hypothesis for equation (10) is that InGE does not granger cause InY. This hypothesis would be rejected if the coefficient of the lagged GEs (Summation α_{2i} as a group) is found to be jointly significant. If both of these null hypotheses are rejected, then a bidirectional relationship is said to exist between the two variables (Government expenditure (G) and National Income (Y).

Empirical Analysis

Unit Root Test

This involves testing for the stationarity of the individual variables using both the Augmented Dickey Fuller (ADF) and Phillips – Perron (PP) tests to find the existence of unit root in each of the time series. The results of both the ADF and PP tests are reported in Tables below:

Table 4.1 ADF and PP Stationarity test at Levels

Variables	ADF (Intercept)	ADF (Intercept & Trend)	PP (Intercept)	PP (Intercept & Trend)
LGE	-2.102(-3.632)*	-1.819(-4.243)*	-2.072(-3.632)*	-1.753(-4.243)*
LGNI	-0.502(-3.632)*	-1.750(-4.252)*	-0.502(-3.632)*	-1.639(-4.243)*

Note: Significance at 1% level. Figures within parenthesis indicate critical values. Mackinnon (1991) critical value for rejection of hypothesis of unit root applied.

Source: Author's Estimation using Eviews 6.0.

The table 4.1 above shows that all the variables were not stationary in levels. This can be seen by comparing the observed values (in absolute terms) of both the ADF and PP test statistics with the critical values (also in absolute terms) of the test statistics at the 1%, 5% and 10% level of significance. Result from the table provides strong evidence of non stationarity. Therefore, the null hypothesis is accepted and it is sufficient to conclude that there is a presence of unit root in the variables at levels, following from the above result, all the variables were differenced once and both the ADF and PP test were conducted on them, the result as shown in table below

4.2 ADF and PP Stationarity test at First Difference

Variables	ADF (Intercept)	ADF (Intercept & Trend)	PP (Intercept)	PP (Intercept & Trend)
LGE	-6.545(-3.639)*	-6.735(-4.252)*	-6.545(-3.639)*	-6.914(-4.252)*
LGNI	-4.258(-3.639)*	-4.185(-3.548)**	-4.258(-3.639)*	-4.185(-3.548)**

Note: * and ** denotes Significance at 1% & 5% level, respectively. Figures within parenthesis indicate critical values. Mackinnon (1991) critical value for rejection of hypothesis of unit root applied.

Source: Author's Estimation using Eviews 6.0.

The table 4.2 above reveals that all the variables were stationary at first difference, on the basis of this, the null hypothesis of non-stationary is rejected and it is safe to conclude that the variables are stationary. This implies that the variables are integrated of order one, i.e. 1(1).

Cointegration test Analysis

The result of the cointegration condition (that is the existence of a long term linear relation) is presented in Table 3.1 and 3.2 below using methodology proposed by Johansen (1990):

Table 4.3 Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None	0.141605	5.780658	15.49471	0.7213
At most 1	0.017179	0.589172	3.841466	0.4427

Trace test indicates no cointegration at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level

**MacKinnon-Haug-Michelis (1999) p-values

Table 4.3 Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None	0.141605	5.191486	14.26460	0.7175
At most 1	0.017179	0.589172	3.841466	0.4427

Max-eigenvalue test indicates no cointegration at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level

** MacKinnon-Haug-Michelis (1999) p-values

In the Cointegration tables both trace statistic and maximum Eigenvalue statistic indicates no cointegration at the 5 percent level of significance, suggesting that there is no cointegrating (or long run) relationship between Government expenditure and National income.

Granger Causality Test analysis

Pairwise Granger Causality Tests (lag 2)

Null Hypothesis:	Obs	F-Statistic	Probability
LGNI does not Granger Cause LGE	34	0.80449	0.45705
LGE does not Granger Cause LGNI		1.55257	0.22879

According to the results obtained from the Granger causality test National income does not Granger Cause Government expenditure. On the other hand, Government expenditure Granger causes National Income. This shows the direction of causality running from Government expenditure to National Income. This result does not support the Wagner hypothesis for Nigeria.

Conclusion

The objective of the paper is to investigate the causality relation between government expenditures and national income by testing for the Wagner's hypothesis and its reverse in Nigeria. We use Johansen-Juselius cointegration method to detect a long term relationship between real per capita national income and real per capita government expenditure in Nigeria. The result of Johansen bivariate cointegration revealed that no long run relationship among the stationary variables existed. The results of Granger causality tests indicate that Wagner's law is supported by the data used in our sample. This means there is a causal link running from Government expenditure to National income. Our findings also indicate that government expenditures plays a significant role in promoting economic growth in Nigeria.

This is acceptable because it is widely believed that government has played some important role in the development of the country. The implication is that increase in government expenditure will yield a positive increase in the growth of the economy by increasing the national income, more so, when it is injected in development programmes.

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