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# A Trivariate Causality Test among Economic Growth, Government Expenditure and Inflation Rate: Evidence from Nigeria

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**Abstract**

This study examined the causal relationships among economic growth, government expenditure and inflation rate in Nigeria over the period 1970 to 2010. The study utilized both the Augmented Dickey-Fuller (ADF) and the Philip Perron tests to examine the properties of the variables. It was observed that the variables were found to be stationary, though not in their level form but in their first difference. In addition, the Johansen and Juselius (JJ) co-integration technique indicated the presence of co-integration among the variables while the tri-variate vector error correction model (VECM) showed the presence of bi-directional causality between government expenditures and economic growth both in the short run and in the long run. Also, it was revealed that in the short run a unidirectional causality existed from economic growth and government expenditure to inflation rate while no feedback from inflation rate was observed. Based on these findings, this study recommends that government should implement policies that would moderate government spending in order to reduce inflation rate. To compliment for the loss in economic growth through the reduction in government spending, lending rate should be moderated to encourage private investment in the Nigerian economy.

**Keywords:** Economic growth, Government Expenditure, Inflation Rate, Trivariate Causality, VEC Model

**Jel Code: C01, C87, H53**

## 1.0 Introduction

Over the years there had been an unresolved debate amongst scholars and researchers on the bond among public expenditure, inflation and economic growth in both developing and underdeveloped economies which Nigeria is inclusive. The debate had centred on whether or not the increasing public spending has the potential to induce inflation and economic growth respectively. While some scholars are of the belief that increasing public expenditure enhances economic growth and inflation, others are of the view that, increase in government spending have the tendency to slower the performance of an economy in both developing and developed countries.

In spite of the foregoing, there is still an unresolved issue theoretically as well as empirically as to the effect of government spending on economic growth. Although, the theoretical positions on the subject matter are quite different yet the conventional assumption is that a large government spending can result to economic instability or stagnation. However, empirical research does not conclusively support the conventional wisdom as opined by Mesgbena (2006). It is noticeable that the foregoing is owing to the fact that, while few studies reports that there exist a positive and significant relationship between governments spending and economic growth. Several others are of the view that government spending

exhibits a significantly negative or no relationship between an increase in government spending and growth in real output. In cognizance of the above argument, this current study seeks to digress from the previous studies by evaluating the relationship between government expenditure and economic growth in Nigeria while incorporating a third variable (inflation).
Though some evidence from the literature confirms that there exists a negative correlation between government size in terms of spending and economic growth, these among others includes; Cooley, Thoms and Gary Hansea (1989), Barro (1990) etc.to mention a few. While other studies pinpoint that, the marginal product of government expenditure tends to exhibit a positive relationship as buttressed by Karras (1989), Johansen and Juselius (1990), Karras (2007), and Karras (1993) respectively. However, the main challenge this study wants to buttress on is the interaction in form of causation between economic growth, inflation and government spending. The above, might depict one of the avenues in which Friedman's idea that inflation is always and everywhere thereby challenging a monetary phenomenon of fiscal theory of the price level. The foregoing is determined by fiscal policies as put by Oxley (1999).

As argued above, plethora studies (see Conte and Darrat (1988), Zahoor and Ahmet (2003) and Amir, Ahmad and Mascoud (2010) have been carried out both in the developed and developing countries on the relationship between government spending and economic growth; between government spending and inflation and between inflation rate and economic growth. These studies have failed to take in to cognizance the nature of causality between these variables. An examination of the causal nexus enables us to capture the dynamic relationship among the variables. The causality method allows us to sidestep the need for a theoretical structural model by treating all endogenous variables in the system as a function of the lagged values of all the endogenous variables in the system (Amarakoon, 2009). This is the gap this study seek to fill in the literature.

The remaining part of this current paper is organized as follows: Section 2 provides review of related literature and empirical review. Section 3, highlights materials and methods, section 4 presents and discuss empirical results. Lastly section 5 concludes and proffers policy measures for the study and future research;

## 2.0 review of related literature / empirical review and theoretical framework

### 2.1 Review of Related Literature / Empirical Review

This section is aimed at evaluating theoretical and empirical literatures that addressed the subject. Here the paper seeks to pinpoint the feedback effect between first, government spending and economic growth. Secondly, the level or extent of causation that runs between economic growth, inflation and government spending in Nigeria and thirdly to identify the causation that runs between inflation and government spending in Nigeria. Several studies have been conducted on the relationship between government spending and economic growth out of which only few have been able to evaluate the extent of causation between these variables which is the focal point of this study. For instance Komain and Brahmasrene (2007) examined the association between government expenditure and economic growth in Thailand by employing Granger causality test, the results revealed that government expenditure and economic growth are not co-integrated implying that they cannot co - move in the long run. The result further confirmed that there is a uni–directional relationship as causality runs from government expenditure to growth thereby depicting a significant positive effect of government spending on economic growth. Furthermore, to confirm the above the study of Vamvoukas (1997) opined that, there exist a feedback causal relationship between government expenditure and revenue via growth. This assumption was buttressed in one of the theoretical hypothesis on the casual relationship between government spending and economic growth. First of all, this theoretical hypothesis is the fiscal synchronization hypothesis where government spending and government revenue vis-a-vis growth in real output are determined simultaneously. In this hypothesis, the public is said to determine the levels of government spending say taxation by weighing the benefits of government services to their costs. Similarly, Cukierman (1992) and Beeker and Mulligan (2003) stipulated that the size of government spending responds to the efficiency of taxes; such that a country without access to efficient taxes will have a smaller government in terms of size and thereby relying relatively heavy on inefficient taxes (such as inflation) for revenue in the long run.
In another instance, Keran (1984) suggested that monetary factor influences or depict a stronger; more predictable and faster impact on economic growth than the way expenditure influences it both in the short and long run. He further argued that given empirical evidence, it could be pinpointed that the

above exerted a stronger, more predictable and faster impact on economic activity than expenditure in United States. In the same vein, Henrekson (1973) and Murthy (1993) argued that the economic growth – government spending link is a long term behaviourial relationship that should be tested on the basis of their co-movement over time.

Other studies like, Levine and Renelt (2001) used extreme bound analysis to demonstrate the relationship between economic growth and some of its determinant factors such as inflation, level of openness; money supply to mention few. Similarly, Dacy (1975) find evidence for the existence of a long run link between national output via growth and government spending. While on the contrary, Ashworth (1994) and Hayo (1978) pinpointed that there is little or no linkage between national output and expenditure. However, Ashworth (1994) further stressed that the differences in time series properties of the underlying data and the choice of the estimation procedure is a crucial factor which may be used to explain diversity in co-integration results.

Similarly, Ansari et al (1997) in their study attempted to determine the causality between government expenditure and national output for three African countries; Kenya, Ghana and South Africa by employing Granger causality test procedure and the Holmes Hutton (1990) causality test which tends to be a modified version of the Granger test. The results of the study depicts that there is no long run relationship among the variables in the countries under consideration. Singh and Satin (1984) carried out a similar study in India to test whether there is causality between national output and public expenditure or not? However, their aims were to determine the direction of causation between these variables. As opposed to the above, evidence from their result showed that there is no causal relationship confirming the Wagnerian law or the Keynesian law either. On a contrary view, Tang (2001) investigated the link between national income and government expenditure in Malaysia over the period1960-1998, the result revealed that there is no long run relationship among the non- stationary variables that existed. Although a uni-directional causality was identified which shows that causality runs from national income growth to government expenditure growth thereby concluding that the Wagner's law was supported by the data in the short run. Dogan (2006) in his study aimed to determine the direction of causation between economic growth and government expenditure for countries like Indonesia, Malaysia, Philippines, Singapore and Thailand by means of employing Granger causality tests on these variables. Evidence from the result supports the hypothesis that casualty runs from government expenditure to national income and this was confirmed only in Philippine for the previous four decades while other countries showed no evidence of causation between government expenditure and economic growth.

Dipendra (1998) in his study investigated the causal link between government expenditure and economic growth in Malaysia by means of employing augmented Granger causality test between the two sets of variables. Evidence from the result showed that there is no reverse causality between the variables under consideration. Ahsan etal (1996) pointed that the use of an additional fiscal or monetary variable can change the fiscal relationship between public expenditure and national income.

Similarly, Kennedy (1998) suggested that co-integration test failed to find co-integration among the variables under consideration if a relevant variable is omitted from the analysis. Given the array of literature, it could be deduce that in light of empirical evidence on the study highlighted that there is the likelihood for the presence of causation among the variables considered. But, the issue is that the direction of causation cannot be established concretely due to the mixed feelings that were identified from the surveyed empirical evidence.

Over and above all, it should be pertinent that the analysis of the long run equilibrium condition among economic growth, government expenditure and inflation involves three steps. This current study attempts to fill the gap in the literature, with special attention that would be paid to know the long run relationship between economic growth, government spending and inflation exist. In particular, our study empirical analysis attempts to shed light on the channels through which economic growth, government spending and inflation accelerates Nigerian economy. This would be established by comparing the present results with the earlier conducted studies. Thereafter we then try to examine in a more detail form the potential channels through which economic growth, government spending and inflation works for the Nigerian economy with the tools of Granger causality via Vector Error Correction Model (VECM).

## 2.2 Theoretical Framework

The study has critically reviewed some literature and surveyed some empirical evidence which has pinpointed that the outcomes were based on certain proponents through their theoretical laws that were established. More importantly, the relationship between government expenditure and economic

growth has been subject to two contending propositions. The first and the more popular is the Wagner's law. Ideally, the Wagner law proposes that there is a long run tendency for public expenditure to grow relative to some national aggregate such as the Gross Domestic product (GDP). In other words, the causality link between public expenditure and economic growth may run from economic growth to public expenditure. The second proposition is associated with Keynes. In Keynes opinion, public expenditure is an exogenous factor and a policy instrument for increasing economic growth induced by increasing national income runs from expenditure to income vis-à-vis economic growth as opined by Chimobi (2010).

## 3.0 Methodology And Data Sources

### 3.1. Data Sources

The study makes use of time series data sourced from statistical Bulletin, Economic and Financial review and Annual Report and statement of Accounts of the central Bank of Nigeria (CBN) and the Federal office of statistics (FOS). The macroeconomics data covered gross domestic product (GDP) consumer price index proxy by (CPI) inflation and government expenditure (EXP) spanning 1970 to 2010 in Nigeria. The data gathered were subject to various econometric tests using E- view, 7.0 versions.

### 3.2. 1 Unit Root Test

Given the non-stationarity characteristics of most macroeconomic variables, testing the properties of these variables has become pertinent to avoid spuriousness of empirical result. In this view this study commences its econometric analysis by taking ascertaining the stationarity properties of the variables using the Augmented Dickey-Fuller and the Phillip-Perron tests.

### 3.2.2. The Co-integration Test

Given that the empirical model specified in equation one below is a multivariate model, the Engel-Granger (1987) co-integration test is inappropriate for testing co-integration among the variables. This is because the EG approach is based on the assumption that there exist only one co-integrating vector that connect the variables and since our model is multivariate there is the possibility of having more than one co-integration vector. In the light of the above weakness the Johansen and Juselius (1990) co-integration test is applied.

### 3.2.3. Granger Causality Test.

The Granger causality approach measures the precedence and information provided by a variable (X) in explaining the current value of another variable (Y). It says that Y is said to be granger-caused by X if X helps in predicting the value of Y. In other words, the lagged values of X are statistically significant. The null hypothesis $H_0$ tested is that X does not granger-cause Y and Y does not granger-cause X.

Several studies (Marin, 1992; Mc Carville and Nnadozie, 1995 Darat, 1996; and Pomponoi, 1996) have used the traditional granger causality test in determining the co-integration between variables, however the use of simple traditional granger causality test has been identified (see Engel and Granger, 1987; and Shan and Morris, 2002) as inappropriate when variables are I(1) series; this is because the simple F-test statistics does not have a standard distribution (Jordaan and Eita, 2007). However, proper statistical inference can only be obtained by analyzing the causality test on the basis of vector error correction model (Yucel, 2009, Nwosa, Agbeluyi and Saibu, 2011).

### 3.3. Model Specification

In order to analyze the extent of the causal nexus between economic growth, government expenditure and inflation, this study employ a VAR model of the form:

U (VAR) = (gdp, gep, inf) (1)

Where: *gdp* = economic growth; *gxp* = government expenditure;
*inf* = inflation rate;

Equation (1) can be expressed more explicitly as.

$$X_t = \alpha + B_1 X_{t-1} + B_2 X_{t-2} + B_3 X_{t-3} + \ldots\ldots + B_q X_{t-k} + u_t . \quad (2)$$

Where: $X_t = [gdp \quad gxp \quad inf]^i$

$X_t$ is a *3 x1* – dimensional Vector of the endogenous variables, α is a *k x1* - dimensional vector of constant and $B_{1.....}$ $B_q$ are *k x k* dimensional autoregressive coefficient matrices and $\mu$ is *k*-dimensional vector of the stochastic error term normally distributed. Equation (2) can be expressed in VECM form as:

$$\Delta Y_t = \mu + \Gamma_1 Y_{t-1} + .....+ \Gamma_{P-1}\Delta Y_{t-P+1} + \Pi Y_{t-1} + \varepsilon_t \quad . (3)$$

where Δ is the first difference operator and $\varepsilon_t$ is a vector of white noise residuals. If Π is of rank $1 \leq r < 3$, then it can be decomposed into $\Pi = \alpha\beta'$, where $\alpha_{(3xr)}$ and $\beta_{(3xr)}$ and equation (3) can be reformulated as:

$$\Delta Y_t = \mu + \Gamma_1 Y_{t-1} + .....+ \Gamma_{P-1}\Delta Y_{t-P+1} + \alpha\left(\beta' Y_{t-1}\right) + \varepsilon_t \quad (4)$$

where the rows of β are interpreted as distinct co-integration vectors and α are the adjustment coefficients (loading factors) indicating the adjustment to long-run equilibrium. The linear combination $\beta' Y_{t-1}$ are stationary processes, therefore all the variables in equation (4) are stationary.

Thus the tri-variate VEC model of equation (4) can be expressed explicitly as:

$$\Delta Y_{1t} = \mu_1 + \sum_{i=1}^{r} \alpha_{1,h} ECT_{h,t-1} + \sum_{k=1}^{p-1} \delta_{11,k}\Delta Y_{1,t-k} + \sum_{k=1}^{p-1} \delta_{12,k}\Delta Y_{2,t-k} + \sum_{k=1}^{p-1} \delta_{13,k}\Delta Y_{3,t-k} + \varepsilon_{1t} \quad (5)$$

$$\Delta Y_{2t} = \mu_2 + \sum_{i=1}^{r} \alpha_{2,h} ECT_{h,t-1} + \sum_{k=1}^{p-1} \delta_{21,k}\Delta Y_{1,t-k} + \sum_{k=1}^{p-1} \delta_{22,k}\Delta Y_{2,t-k} + \sum_{k=1}^{p-1} \delta_{23,k}\Delta Y_{3,t-k} + \varepsilon_{2t} \quad (6)$$

$$\Delta Y_{3t} = \mu_3 + \sum_{i=1}^{r} \alpha_{3,h} ECT_{h,t-1} + \sum_{k=1}^{p-1} \delta_{31,k}\Delta Y_{1,t-k} + \sum_{k=1}^{p-1} \delta_{32,k}\Delta Y_{2,t-k} + \sum_{k=1}^{p-1} \delta_{33,k}\Delta Y_{3,t-k} + \varepsilon_{3t} \quad (7)$$

where $ECT_{h,t-1}$ is the *h*th error correction term, the residual from the *h*th co-integration equation, lagged one period and $\delta_{ij,\,k}$ described the effect of the *k*th lagged value of variable *j* on the current value of variable *i*: *i, j = $Y_1$, $Y_2$, and $Y_3$*(Nwosa Agbeluyi and Saibu, 2011).

## 4.0. Empirical Result And Discussion

The study commence it empirical analysis by first ascertaining the unit roots of the time series used for analysis and the result is presented on Table 1. The ADF test on Table 1, showed that all variables were found to be non-stationary in levels but were stationary after first differencing (that is, the variables are integrated of order one), implying that the variables are I(1) series.

**Table 1: Unit Root Test**

| | Augmented Dickey Fuller Test | | | Philip Perron Test | | |
|---|---|---|---|---|---|---|
| Variables | Levels | Diff | Status | Levels | Diff | Status |
| lgdp | -2.3272 | -5.8304 | I(1) | -1.4561 | -5.8464 | I(1) |
| lgex | -0.8409 | -7.4054 | I(1) | -0.6844 | -7.3554 | I(1) |
| linf | -0.634 | -4.387 | I(1) | -2.907 | -4.3613 | I(1) |

Note: * implies stationarity at one percent level.

**Source: Author's Computation.**

## 4.1 Co-integration result

The co-integration result between economic growth, government expenditure and inflation; using the trace value and the maximum eigen-value ($\lambda_{max}$) in Table 2, with an optimal lag length of three via the Schwarz Bayesian Criterion (SBC) and Akaike's Information Criterion (AIC); showed the existence of

co-integration between economic growth, government expenditure and inflation rate. From Table 4.2, the null hypothesis of no co-integration, that is r=0 was rejected in both the trace statistics and the maximum eigen-value statistics. The statistical values of these tests were greater than their critical values. However, the null hypothesis of no co-integration, that is r≤1 could not be rejected in both the trace statistics and the maximum eigen-value statistics, because their values were less than the critical values, implying that there are at least one co-integrating vector among the series.

**Table 2: Summary of the Co-integration Tests**

| Trace Test | | | | Maximum Eigen value Test | | | |
|---|---|---|---|---|---|---|---|
| Null | alternative | Statistics | 95% critical values | Null | alternative | Statistics | 95% critical values |
| r=0 | r≥1 | 45.151 | 29.797 | r=0 | r=1 | 31.505 | 21.13 |
| r≤1 | r≥2 | 13.647 | 15.495 | r≤1 | r=2 | 11.28 | 14.26 |
| r≤2 | r≥3 | 2.368 | 3.842 | r≤2 | r=3 | 2.37 | 3.84 |

**Source: Author's Computation.**

### 4.2 Causality Result

The VECM causality result presented in Table 3 revealed the causal nexus among gross domestic product, government expenditure and inflation rate (proxy by consumer price index). The result showed that the error correction term for co-integrating equation with gross domestic product (GDP) as a dependent variable is significant at one percent, implying that there exists a strong long run relationship running from government expenditures and inflation rate to economic growth. In addition, government expenditure revealed an evidence of causality with economic growth in the short run while no evidence of causality was observed in the short run from inflation rate to gross domestic product.

The coefficient of error correction term with government expenditure as a dependent variable is observed to be statistically significant at five percent, implying that there exists a strong long run relationship running from economic growth and inflation rate to government expenditures. More so, gross domestic product revealed an evidence of causation with government expenditures in the short run while no evidence of causality was observed in the short run from inflation rate to government expenditures.

Contrary to the above observations, the error correction term with inflation rate as a dependent variable was observed to be insignificant, implying that no existence of long run causality was observed from government expenditures and economic growth to inflation rate. However, in the short run, it was revealed that a unidirectional causality runs from both government expenditure and economic growth to inflation rate.

An important observation from the above discussed findings is that there exist bi-directional causality between government expenditures and economic growth both in the short run and in the long run. However, with respect to inflation rate as a dependent variable, a unidirectional causality was observed from economic growth and government expenditure to inflation rate while no evidence was observed otherwise. The implication of this result is that government spending influences economic growth while the growth of the economic also influences the extent of government spending. Interestingly, both government spending and economic growth also influence inflation rate in Nigeria. This result is in line with theoretical findings that increase in government spending can enhance economic growth but at the same time can cause inflation rate in the economy.

**Table 3: Multivariate Granger Causality Test based on VECM**

| **Independent Variables** | **Dependent variables** | | |
|---|---|---|---|
| | **GDP** | **GEXP** | **CPI** |
| **GDP** | - | 1.3620<br>[3.6692]*** | 9.9851<br>[3.7734]*** |
| **GEXP** | 0.7342<br>[1.9183]** | - | 7.3314<br>[2.0948]** |
| **INF** | 0.1001 | 0.1364 | - |

| | | | |
|---|---|---|---|
| | [0.1987] | [0.2120] | |
| **ECT** | -0.9222<br>[-3.3005]** | -0.4170<br>[-2.0150]** | -0.0105<br>[-0.8239] |

**Source: Author's Computation.**
Notes: numbers in the parenthesis are t-statistics
** and *** denotes significant at 5% and 1% respectively.

## 5. Conclusion And Policy Recommendation

This paper investigated the extent of causality among economic growth, public expenditure and inflation rate in Nigeria for the period spanning 1970 to 2010. This study was motivated by the increased contentions among development economists and policy makers as to the causal nexus between public expenditure, economic growth and inflation rate. Utilizing the unit root and co-integration, it was observed that all the variable were I(1) series, implying that they are integrated of order one. More so, the co-integration result revealed the existence of long run relation among the variables. The Vector Error-correction (VECM) estimate revealed the existence of a bi-directional causality between government expenditures and economic growth both in the short run and in the long run while a unidirectional causality was observed in the short run from economic growth and government expenditure to inflation rate. The implication of this result is that both government spending and economic growth also influence inflation rate in Nigeria. Based on these findings, this study recommends that government should implement policies that would moderate government spending in order to reduce inflation rate. To compliment for the loss in economic growth through the reduction in government spending, lending rate should be moderated in order to encourage private investors in investing in the Nigerian economy. The reduction in inflation rate is essential because price stability is an incentive for investment and motivation for inflow of foreign capital, which can promote economic growth.

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