Cointegration And Causality Analysis of Government Expenditure And Economic Growth In Nigeria

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Abstract:- The study investigates government expenditure and economic growth in Nigeria, using cointegation and causality analysis. The study employs Augmented Dickey-Fuller (ADF) unit root test, Kwiatkowski, Philips, Schmidt and Shin (KPSS) Test, Johansen based Cointegration and Granger Causality Test. The ADF and KPSS tests indicate that the series are all integrated of order one [I(1)]. The results from the Johansen Cointegration tests indicate three long–run relationships between government expenditure and economic growth. While the test for causality shows that economic growth granger-cause government expenditure. The study also indicates that there exist two unidirectional causality running from GDP to TCE and GDP to TRE which supports the Wagner's Law, that government expenditure affects the economic growth. The regression results indicates that the coefficients of TCE, TRE, TDE and THE have positive and statistically significant effect on economic growth. The results of Error Correction Model (ECM) have negative signs and the Error Correction term (EC) indicate that there exists long run relationship between economic growth and Government expenditure. This show that its takes more years to attain equilibrium. The study therefore concludes that government expenditure causes economic growth. Based on the results obtained, the study recommends that government should ensure that capital and recurrent expenditures are properly managed to accelerate economic growth. Moreso, government should promote efficiency in the allocation of resources on human development by encouraging more private sector participation to ensure productivity-intensive growth.

Keywords: Cointegration, Causality, economic growth, and government expenditure,

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1 INTRODUCTION

Over the years, government expenditure has been increasing in geometric term through government various activities and interactions with its Ministries, Departments and Agencies (MDA's), [8]. According to [3] public expenditure either recurrent or capital expenditure, notably on social and economic infrastructure can be growth-enhancing although the financing of such expenditure to provide essential infrastructural facilities-including transport, electricity, telecommuniations, water and sanitation, waste disposal, education and health-can be growth-retarding (for example, the negative effect associated with taxation and excessive debt). The effect of government expenditure on economic growth is still an unresolved issue theoretically as well as empirically. However, there exist two approaches to public expenditure, Wagner's and Keynes approach. The Wagner's approach introduces a model that government expenditures are endogenous to economic development. While Keynes and his supporters, however, raise the thought that public expenditure is the real tool to boost the economic activities.

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In Nigeria, government expenditure has continued to rise due to the huge receipts from production and sales of crude oil, and the increased demand for public (utilities) goods like roads, communication, power, education and health. Besides, there is increasing need to provide both internal and external security for the people and the nation. Unfortunately, rising government expenditure has not translated to meaningful growth and development, as Nigeria ranks among the poorest countries in the world. As many Nigerians have continued to wallow in abject poverty, while more than 50 percent live on less than US$2 per day [12]. Inspite of huge government expenditure that have been devoted to enhance economic growth by successive governments; no noticeable success has been achieved since the economic growth situation in Nigeria still remain very low. It is against this background that this research is set out to empirically investigate government expenditure which has metamorphosed from the level of billion naira to trillion naira on the expenditure side of the budget. Thus, it is not clear whether the government expenditure is enhancing economic growth or not. [9] examines the link between government expenditure and economic growth in Nigeria over the last three decades (1977-2006) using Augmented Dickey Fuller (ADF) unit root test which reveals that all variables incorporated in the model were non-stationary at their levels. In an attempt to establish long-run relationship between public expenditure and economic growth, the result reveals that the variables are cointegrated at 5% and 10% critical level. With the use of error correction model to detect short run behaviour of the variables, the result shows that for any distortion in the short-run, the error term restore the relationship back to its original equilibrium by a unit. A number of suggestions were however made on how government expenditure should be channel in order to influence economic growth significantly and positively in Nigeria [1] employed multivariate co-integration and variance decomposition approach to examine the causal relationship between government expenditures and economic growth for Egypt, Israel, and Syria. In the bivariate framework, the authors observed a bi-directional (feedback) and long run negative relationships between government spending and economic growth. Moreover, the causality test within the trivariate framework (that include share of government civilian expenditures in GDP, military burden, and economic growth) illustrated that military burden has a negative impact on economic growth in all the countries. Furthermore, civilian government expenditures have positive effect on economic growth for both Israel and Egypt.

2 METHODS

The technique of cointegration, Error Correction Model (ECM) and Granger Causality is employed to analyze the relationship between government expenditure and economic growth. In order to carryout this research effectively, it is essential to first check the presence of unit root (non-stationarity). If unit root exist in any variable, then the corresponding series is considered to be non-stationary. Estimation based on non-stationary series may lead to spurious regressions [2]. Therefore, the study examine one unit root (non-stationarity) test and one stationarity test which are applied in this study and each of the Techniques is briefly discussed as follows:

2.1 Kwiatkowski, Philips, Schmidt and Shin (KPSS) Test

[6] enumerated a test for null hypothesis of stationarity were there is no linear trend. The KPSS test tests to see if a series can reject stationarity. This test statistic is as stated below;

$$\text{KPSS} = \frac{1}{T^2}\sum_{t=1}^{T}\frac{W_t^2}{\hat{\partial}_\infty^2} \quad (1)$$

where $W_t = \sum_{j=1}^{t}\hat{\beta}_j$, $\hat{\beta}_j = Y_t - \bar{Y}$ and $\hat{\partial}_\infty^2$ denote an estimator of the long-run variance of z_t.

$\hat{\partial}_\infty^2 = \lim_{T\to\infty} T^{-1}\text{Var}\left(\sum_{j=1}^{t} z_t\right)$, The null Hypothesis of the test is given as $H_0: \partial_v^2 = 0$ (stationary) against the alternative $H_1: \partial_v^2 > 0$ (nonstationary). The test uses the Barlett window with a lag truncation parameter $l_q = q\left(\frac{T}{100}\right)^{\frac{1}{4}}$.

where $\hat{\partial}_\infty^2 = \frac{1}{T}\sum_{j=1}^{T}\hat{\beta}_t^2 + 2\sum_{j=1}^{l_q}\beta_j\left(\frac{1}{T}\sum_{t=j+1}^{T}\hat{\beta}_j\hat{\beta}_{t-j}\right)$

and $\beta_j = 1 - \frac{j}{l_q+1}$. Deterministic terms may be added whenever they are present in the series and the data generating process is transformed to $y_t = D_t + Z_t + w_t$.

2.2 Augmented Dickey Fuller (ADF) Unit Root Test

Unit root test is used to check weather data is stationary or non-stationary. A process is said to be stationary if its probability distribution remains unchanged as time proceeds and we can say that data generation process does not changed. In this study, the Augmented Dickey Fuller (ADF) test is used. The general form of ADF test can be written at level and first difference form as follows:

$$\Delta X_t = \beta X_{t-1} + \sum_{i=1}^{k-1}\theta_i \Delta X_{t-i} + \varepsilon_t \quad (2)$$

where Δ is the first difference operator, β is the coefficient of the previous observation, X_{t-1} is the immediate previous observation, ΔX_{t-i} is the differenced lagged term, k is the number of lags, θ_i is the parameter to be determined and ε_t is white noise. Therefore, we can draw our null hypothesis (H_0) against the alternative hypothesis (H_1) for this model as: H_0: $\beta = 0$ unit root exist against H_1: $\beta < 0$ no unit root exist From the estimation of equation (2) above, the coefficient β is tested based on the t-statistics given as:

$t_\infty = \frac{\hat{\beta}}{se(\hat{\beta})}$, where $\hat{\beta}$ is the estimate of β and $se(\hat{\beta})$ is the coefficient of the standard error.

2.3 Cointegration Analysis

Cointegration could be seen as when economic variables share a common stochastic trend and their first differences are stationary. Hence, they are said to be cointegrated. This analysis helps to identify the long-run economic relationships between two or more variables. The cointegration test is important since if two non-stationary variables are cointegrated, a vector autoregressive (VAR) model in first difference may lead to misspecification and invalid inferences of the model [7]. A vector of an economic time series could be X_k of an (n × 1), where the model X_k could be specify as an unrestricted vector autoregression (VAR) involving up to n-lags of X_k.

$$X_k = \beta_1 X_{k-1} + \cdots + \beta_n X_{k-n} + \mu D_t + \varepsilon_k,\ k = 1, \ldots, K \quad (3)$$

where β_1, μ are (m x m) matrix's of parameters, ε_k is assumed to be independent and Gaussian distributed with mean zero and variance σ. The variable D_t contains the deterministic terms such as a constant, a linear trend and seasonal dummies. Therefore, the equation (3) above could be transformed into a vector error correction (VECM) form as shown below:

Now, subtracting X_{k-1} from both sides of the equation (3) above, This becomes;

$$X_k - X_{k-1} = -X_{k-1} + \beta_1 X_{k-1} + \cdots + \beta_n X_{k-n} + \mu D_t + \varepsilon_t$$
$$\Delta X_k = -X_{k-1} + \beta_1 X_{k-1} + \cdots + \beta_n X_{k-n} + (\beta_2 + \beta_3 + \cdots + \beta_n) X_{k-1} - (\beta_2 + \beta_3 + \cdots + \beta_n) X_{k-1} + (\beta_3 + \beta_4 + \cdots + \beta_n) X_{k-2} - (\beta_3 + \beta_4 + \cdots + \beta_n) X_{k-2} + \cdots + \beta_n X_{k-n+1} - \beta_n X_{k-n+1} + \mu D_t + \varepsilon_t$$
$$\Delta X_k = \Pi X_{k-1} - (\beta_2 + \beta_3 + \cdots + \beta_n)(X_{k-1} - X_{k-2}) - (\beta_3 + \beta_4 + \cdots + \beta_n)(X_{k-2} - X_{k-3}) + \cdots + -\beta_n(X_{k-n+1} - X_{k-n}) + \mu D_t + \varepsilon_t$$
$$\Delta X_k = \Pi X_{k-1} + \Gamma_1 \Delta X_{k-1} + \Gamma_2 \Delta X_{k-2} + \cdots + \Gamma_{n-1}\Delta X_{k-n+1} + \mu D_t + \varepsilon_t$$

Therefore, the vector error correction model (VECM) can conveniently written in the form

$$\Delta X_k = \Pi X_{k-1} + \sum_{i=1}^{n-1}\Gamma_i \Delta X_{k-i} + \mu D_t + \varepsilon_t \quad (4)$$

where $\Pi = -(I_k - \beta_1 - \cdots - \beta_n)$ and $\Gamma_i = -(\beta_{i+1} + \cdots + \beta_n)$, $i = 1, 2, \ldots, i-1$

Therefore, if the characteristic polynomial is given by:
$Y(z) = (1-z)I - \sum_{j=1}^{n-1}\Gamma_j(1-z)z^j$, has all its roots outside the unit-disk, therefore X_k is stationary. But if this polynomial

has one or more unit roots, then X_k is an integrated process as proposed by [4]. Therefore, the present of unit root implies that Π has reduced rank r < m but if the number of unit roots is equal m-r; therefore the process X_k is said to be integrated of order one, which can be written as 1(1). If Π has reduced rank, it can be written as a product of two (m × r) matrices Π = $\mu\beta^{'}$, therefore, the model can be expressed as;

$$\Delta X_k = \mu\beta^{'}X_{k-1} + \sum_{j=1}^{n-1}\Gamma_j\Delta X_k + \Phi D_k + \varepsilon_k, k = 1, \dots, K \qquad (5)$$

where β is the matrix of the long-run coefficient, $\beta^{'}X_{k-1}$= 0 is the long-run equilibrium relationships, r is the number of long-run relationships and μ is the speed of the adjustment to the equilibrium.

2.4 Estimation of Vector Error Correction Model (VECM)

The purpose of the error correction model is to indicate the speed of adjustment from the short-run equilibrium to the long-run equilibrium state.The VECM has cointegration relations built into the specification so that it restricts the longrun behavior of the endogenous variables to converge to their cointegrating relationship, while allowing for short-run adjustment dynamics. The cointegration term is known as the error correction term since the deviation from long-run equilibrium is corrected gradually through a series of partial short-run adjustments. The dynamic specification of the VECM allows the deletion of the insignificant variables, while the error correction term is retained. The size of the error correction term indicates the speed of adjustment of any disequilibrium towards a long-run equilibrium state. When a considered cointegration rank of a system is known and one wish to impose a corresponding restriction, he can conveniently work with the Vector Error Correction Model (VECM) given as:

$$\Delta X_k = \Pi X_{k-1} + \Gamma_1\Delta X_{k-1} + \cdots + \Gamma_{n-1}\Delta X_{k-n+1} + \mu D_t + \varepsilon_t$$

Where Π=$-(I_k - \beta_1 - \cdots - \beta_n)$ and Γ_i=$-(\beta_{i+1} + \cdots + \beta_n)$, i=1,2,…,$i-1$.

In deriving the estimators for the parameters of the vector error correction model (VECM) above, the following additional notation is used: ΔX=$[\Delta X_1, \cdots, \Delta X_K]$, X_{-1}=$[X_0, \cdots, X_{K-1}]$, μ=$[\mu_1, \cdots, \mu_K]$, Π=$[\Pi_1 : \cdots : \Pi_{n-1}]$ and Y=$[Y_0, \cdots, Y_{K-1}]$ with Y_{t-1}=$\begin{bmatrix}\Delta X_{k-1}\\ \vdots \\ \Delta X_{k-n+1}\end{bmatrix}$ (6)

If a sample with K observations and n presample values, the VECM

$\Delta X_k = \Pi X_{k-1} + \Gamma_1\Delta X_{k-1} + \cdots + \Gamma_{n-1}\Delta X_{k-n+1} + \mu D_t + \varepsilon_t$ can now be written compactly as follows: ΔX=ΠX_{-1}+ΓX + μ. (7)

Therefore, given a specific matrix Π, the least square (LS) estimator of Γ is easily written as:

$$\hat{\Gamma} = (\Delta X - \Pi X_{-1})Y^{'}(YY^{'})^{-1} \qquad (8)$$

Now, substituting in (7) gives;

ΔXM=Π$X_{-1}M$+$\hat{\mu}$,

where M=I– $Y^{'}(YY^{'})^{-1}$Y. Therefore, for given *r*, 0< $r < T$, an estimator $\hat{\Pi}$ of Π with *rk*($\hat{\Pi}$) = *r* can be obtained by a canonical correlation analysis or, equivalently, a reduced rank regression based on the latter model. Following [4], the estimator may be obtained by:

$$S_{00} = K^{-1}\Delta XM\Delta X^{'},\ S_{01} = K^{-1}\Delta XM\Delta X_{-1}^{'},$$

$S_{11} = K^{-1}X_{-1}MX_{-1}^{'}$, Therefore solving the eigenvalue problem, it becomes; det($\vartheta S_{11} - S_{01}^{'}S_{00}^{-1}S_{01}$) = 0. (9)

Now, if the ordered eigenvalues be $\vartheta_1 \geq \cdots \geq \vartheta_k$ with corresponding eigenvectors V= $[v_1, \cdots, v_r]$ which satisfy $\vartheta_i S_{11} v_i = S_{01}^{'}S_{00}^{-1}S_{01}v_i$ and normalized such that $V^{'}S_{11}V = I_k$. Therefore if the equation below is choosen

$\hat{\mu} = [v_1, \cdots, v_r]$ and $\hat{\omega} = \Delta MX_{-1}^{'}\hat{\mu}(\hat{\mu}^{'}X_{-1}^{'}MX_{-1}^{'}\hat{\mu})^{-1}$
Then, $\hat{\omega}$ is gotten as LS estimator from the model
ΔXM=$\omega\hat{\mu}^{'}X_{-1}^{'}M$ + $\hat{\mu}$.

Hence, an estimator of Π is given as; $\hat{\Pi} = \omega\hat{\mu}^{'}$. Applying (8), a feasible estimator of Γ is gotten as $\hat{\Gamma}$= $(\Delta X - \hat{\Pi}X_{-1})Y^{'}(YY^{'})^{-1}$. For Gaussian assumptions these estimation are ML estimators conditional on the presample values [5]. Considering this approach the parameter estimator $\hat{\mu}$ is made unique by the normalization of the eigenvectors and $\hat{\omega}$ is adjusted accordingly. Since these are not econometric identification restrictions, only the cointegration space but not the cointegration parameters are estimated consistently in this approach. In order to estimate the matrices ω and μ consistently, it is therefore necessary to impose identifying restriction. In the absence of such restrictions only the product of $\omega\hat{\mu}^{'}$= Π can be consistently estimated.

Therefore considering the estimators of Γ and Π consistently and asymptotically normal under general assumptions as; $\sqrt{G}$vec$([\hat{\Gamma}_1 : \cdots : \hat{\Gamma}_{n-1}] + [\Gamma_1 : \cdots : \Gamma_{n-1}])$ $\overset{d}{\rightarrow} N(0, \square_{\hat{\Gamma}})$ and $\sqrt{G}$vec$(\hat{\Pi} - \Pi) \overset{d}{\rightarrow} N(0, \square_{\hat{\Pi}})$.

Hence, the asymptotic distribution of $\hat{\Gamma}$ is nonsingular where the standard inference may be used for the short-term parameters Γ_j. In view of this, the $(K^2 \times K^2)$ covariance matrix $\square_{\hat{\Pi}}$ can be shown to have rank Kr and is then singular if r < K. This result is due to two forces. First, imposing the rank constraint in estimating Π restricts the parameter space and secondly, Π involves the cointegrating relations which are super consistently estimated.

2.5 Testing For Cointegration Rank

The rank of a matrix is given by the number of non-zero eigenvalues of the matrix. The rank of the matrix Π can be found as the number of eigenvalues of Π which are different from zero. Tests for cointegrating rank: Johansen's procedure [5]. Applies maximum likelihood estimator (MLE) to the autoregressive model:

$$\Delta X_k = \Pi X_{k-1} + \sum_{i=1}^{n-1}\Gamma_i\Delta X_{k-i} + \mu D_t + \varepsilon_t \qquad (10)$$

Johansen's method is to estimate the rank of Π. In doing so, it allows one to test for a particular number of cointegrating vectors.There are two statistics available for testing for cointegrating rank:

– **Trace statistic:** a likelihood ratio test statistic of the null that there are *h* cointegrating vectors against the alternative that there are *n*.

– Maximum eigenvalue statistic: a likelihood ratio test statistic for the null hypothesis that there are *h* cointegrating relations against the alternative that there are *h* + 1. These two statistics will be discussed in details later in this section. Therefore, let try to look at this in more details; Let consider the simplest case where the variables are in deviation from their means, $\Delta X_k = \Pi X_{k-1} + \varepsilon_t$ and k = 1. This is simply a regression of ΔX_k on X_{k-1} where the least squares estimate of Π is found as;

$\widehat{\Pi} = S_{kk}^{-1} S_{0k}$ where $S_{kk} = \frac{1}{T}\sum X_{k-1}^2$ and $S_{k0} = \frac{1}{T}\sum X_{k-1}\Delta X_k$
One might also formulate the model as $X_{k-1} = \Pi^* \Delta X_{k-1} + e_t$. Where the least squares estimate of Π^* is $\widehat{\Pi}^* = S_{00}^{-1} S_{0k}$, where $S_{00} = \frac{1}{T}\sum(\Delta X_k)^2$ and $S_{0k} = \frac{1}{T}\sum X_{k-1}\Delta X_k$.

Notice, that the product of the two least squares coefficient estimates is equal to the squared correlation coefficient, that is; $r^2 = \widehat{\Pi}\widehat{\Pi}^* = S_{kk}^{-1} S_{k0} S_{00}^{-1} S_{0k}$

The case with k=1 just give us the Dickey fuller regression where we test whether $\Pi = 0$, that is, the rank of the scalar Π is zero. But in the case where the model contain lags of ΔX_k and deterministic terms such as an intercept and a trend, one may use the Frisch-Waugh-Lovell theorem and remove the effects of these variables by a two regressions;

i. Regress ΔX_k on $\{1, k, \Delta X_{k-1}, \Delta X_{k-2} \ldots \Delta X_{k-n+1}\}$ to obtain the residuals R_{0k}
ii. Regress X_{k-1} on $\{1, k, \Delta X_{k-1}, \Delta X_{k-2} \ldots \Delta X_{k-n+1}\}$ to obtain the residuals R_{kk}

Now consider the two models $R_{0k} = \Pi R_{kk} + \varepsilon_t$ and $R_{kk} = \widehat{\Pi}^* R_{0k} + e_t$, where the original variables are purged of the effects of the lags of $\{1, k, \Delta X_{k-1}, \Delta X_{k-2} \ldots \Delta X_{k-n+1}\}$. Compute the product matrices;

$S_{kk} = \frac{1}{T}\sum R_{kk}^2$, $S_{00} = \frac{1}{T}\sum R_{0t}^2$, $S_{0k} = \frac{1}{T}\sum R_{0t}R_{kk}$, $S_{k0} = \frac{1}{T}\sum R_{kk}R_{0k}$ and obtain $r^2 = \widehat{\Pi}\widehat{\Pi}^* = S_{kk}^{-1} S_{0k} S_{00}^{-1} S_{0k}$

In the case of k variables there exist k canonical correlations between the variables in X_{k-1} and the variables in ΔX_k or in the case of lag augmentation and deterministic terms between the variables in R_{kk} and the variables in R_{0t}. The canonical correlations can be found as the squared eigenvalues of the $k \times k$ matrix given as; $S_{kk}^{-1} S_{0k} S_{00}^{-1} S_{0k}$, therefore, to find the rank of Π in $\Delta X_k = \Pi X_{k-1} + \sum_{i=1}^{n-1} \Gamma_i \Delta X_{k-i} + \varepsilon_t$ (11)

Simply compute the canonical correlations or the eigenvalues of $S_{kk}^{-1} S_{0k} S_{00}^{-1} S_{0k}$ and test how many of these are not significantly different from zero. In practice the eigenvalues are found from the following determinantal equation given as;

$$|\vartheta S_{kk} - S_{k0} S_{00}^{-1} S_{0k}| = 0$$

The solution is k estimated eigenvalues which can be ranked as follows;

$$1 > \hat{\vartheta}_1 > \hat{\vartheta}_2 > \cdots \hat{\vartheta}_{r-1} > \hat{\vartheta}_r > \hat{\vartheta}_{r+1} \cdots \hat{\vartheta}_k \geq 0$$

and the associated k estimated eigenvectors are given as;

$$\hat{v} = (\hat{v}_1, \hat{v}_2, \cdots \hat{v}_r \cdots, \hat{v}_k)$$

It is important to note that the rank of the Π matrix is given by the number of non-zero eigenvalues. Hence

$$\underbrace{1 > \vartheta_1 > \vartheta_2 > \cdots \vartheta_r >}_{r \text{ eigenvalues} \neq 0} \quad \underbrace{0 = 0 \cdots = 0}_{k-r \text{ eigenvalues} = 0}$$

r eigenvalues ≠ 0 $k - r$ eigenvalues = 0
Now consider the probability model-Lilkelihood function. Assuming Gaussian VAR model (Multivariate Normal distribution): *k*=1, 2, ··· K

$\Delta X_k = \Pi X_{k-1} + \sum_{i=1}^{n} \Gamma_i \Delta X_{k-i} + \varepsilon_t$, $\varepsilon_t \sim$N(0, Σ)
Therefore, the Log-Likelihood function can be obtained as: $L(\Pi, \Gamma_1, \Gamma_2, \cdots, \Gamma_{n-1}, \square | X_1, X_2, \cdots X_T)$

$$= \frac{TK}{2}\log(2\pi) - \frac{T}{2}\log|| - \frac{1}{2}\sum_{t=1}^{T} \varepsilon_t^{'-1} \varepsilon_t$$

and it can be shown the maximum value of the Log-Likelihood function given that the rank of Π is *h* is

$$L^* = const - \frac{T}{2}\ln|S_{kk}| - \frac{T}{2}\sum_{j=1}^{h} \ln(1 - \hat{\vartheta}_j)$$

2.6.1 The Trace Test

Hence, under the null hypothesis $H_0: rank(\Pi) = r \Leftrightarrow \vartheta_{r+1} = \vartheta_{r+2} = \cdots = \vartheta_k = 0$ the value of the Log-Likelihood function is $L_0^* = const - \frac{T}{2}\ln|S_{kk}| - \frac{T}{2}\sum_{j=1}^{r}\ln(1 - \hat{\vartheta}_j)$ and under the alternative hypothesis

$H_1: rank(\Pi) = k \Leftrightarrow all\ \vartheta_j^{'} s \neq 0$ the value of the Log-Likelihood function is $L_1^* = const - \frac{T}{2}\ln|S_{kk}| - \frac{T}{2}\sum_{j=1}^{k}\ln(1 - \hat{\vartheta}_j)$

Hence the usual log likelihood test statistic become

$$2(L_1^* - L_0^*) - T\sum_{j=r+1}^{k}\ln(1 - \hat{\vartheta}_j) \qquad (12)$$

However, the distribution of the LR-test statistics in 3.12 is not a χ^2 distribution.

2.6.2 The Maximum Eigenvalue Test

Another alternative may be to test the null hypothesis $H_0: rank(\Pi) = r \Leftrightarrow \vartheta_{r+1} = \vartheta_{r+2} = \cdots = \vartheta_k = 0$

against the hypothesis $H_2: rank(\Pi) = r + 1 \Leftrightarrow \vartheta_{r+2} = \cdots = \vartheta_k = 0$ with a value of the Log-Likelihood function is

$$L_2^* = const - \frac{T}{2}\ln|S_{kk}| - \frac{T}{2}\sum_{j=1}^{r+1}\ln(1-\hat{\vartheta}_j)$$

Hence the usual log likelihood test statistic become

$$2(L_2^* - L_0^*) - T\ln(1-\hat{\vartheta}_{r+1}) \qquad (13)$$

However, the distribution of the LR-test statistics in (13) is not a χ^2 distribution either.

2.7 Saikkonen and Luthkepohl Test

[10] also proposed a series of tests for the pair of hypothesis which proceed by estimating the deterministic term D_t first, then subtracting it from the observations and applying a Johasen type test to the adjusted series. Therefore, the test is based on a reduced rank regression of the system given as follows:

$$\Delta\tilde{x}_t = \pi\tilde{x}_{t-1} + \sum_{j=1}^{p-1}\Gamma_j\Delta\tilde{x}_{t-j} + \tilde{\mu}_t \qquad (14)$$

where $\tilde{x}_t = y_t - \widetilde{D}_t$ and $\widetilde{D}_t$ is the estimated deterministic term. The parameters of the deterministic term are estimated by the generalized least squares (GLS) procedure proposed by Saikkonen and Lutkepohl. The rank r_0 is the tested rank of the matrix π under taken as H_0, r_0=0,…,K−1, in case of orthogonal trend $r_0 = 0, \dots, K-1$. Therefore, the rank of π is taken as the rank at which the null hypothesis is rejected for the first time like in the Johasen's trace test. Now, the Saikkonen and Lutkepohl test therefore test the following pair of hypothesis: $H_0(r_0)$: rank(π)= r_0 against $H_1(r_0)$: rank(π)> r_0

2.8 Granger Causality Test

The study employs the Granger causality test based on augmented level VAR with integrated and cointegrated processes developed by [11]. The main objective of the Toda-Yamamoto causality test is to overcome the problem of invalid asymptotic critical values when causality tests are performed in the presence of nonstationary or even cointegrated. [11] suggested the following augmented VAR (p+d) model to be used for tests of causality if the variables are integrated;

$$y_k = \hat{\beta} + \hat{A}_1 y_{k-1} + \cdots + \hat{A}_n y_{k-n} + \cdots + \hat{A}_{n+d} y_{k-n+d} + \varepsilon_t \qquad (19)$$

where the circumflex above a variable stand for its estimated value, *d* is the integration order of the variables. The parameters for extra lag(s) such as *d* are unrestricted in testing for Granger causality. [11] show analytically that these unrestricted parameters ensure that the asymptotical distribution theory can be compactly written as follows: Y=$\hat{\mu}z + \hat{\vartheta}$.

Where Y = $(y_1, \cdots, y_k)$ $(n \times k)$ matrix,

$\hat{\mu} = (\hat{\beta}, \hat{A}_1, \cdots, \hat{A}_n, \cdots \hat{A}_{n+d})$ $\{n \times (1 + n(p+d))\}$ matrix,

$$z_k = \begin{bmatrix} 1 \\ y_k \\ y_{k-1} \\ \vdots \\ y_{k-n-d+1} \end{bmatrix} \{(1 + n(p+d) \times 1)\} \text{ matrix, for k=1,}\cdots\text{,K,}$$

Z = $(z_0, \cdots, z_{k-1})$ $\{(1 + n(p+d) \times K)\}$ matrix, and $\hat{\vartheta} = (\hat{\varepsilon}_1, \cdots, \hat{\varepsilon}_k)$ $(n \times K)$ matrix.

Here the null hypothesis can be drawn as TRE_t, TCE_t, TDE_t and THE_t Granger cause GDP_t if $\beta_{1j} \neq 0, \delta_{1j} \neq 0, \vartheta_{1j} \neq 0, \theta_{1j}, \Pi_{1j} \neq 0$ and $\Phi_{1j} \neq 0$ against the alternative hypothesis that TRE_t, TCE_t, TDE_t and THE_t does not Granger cause GDP_t if $\beta_{1j} = 0, \delta_{1j} = 0, \vartheta_{1j} = 0, \theta_{1j}, \Pi_{1j} = 0$ and $\Phi_{1j} = 0$ respectively.

2.9 Model Specification

In an attempt to determine the impact of government expenditure on economic growth in Nigeria, it is ideal to develop a model to justify the relationship that exists between the variables. The framework for this study has its basis on the Wagner's law and Keynesian approach. Therefore, the growth model is specified as follows:

$$Y = \delta_0 + \delta_1 X_1 + \delta_2 X_2 + \delta_3 X_3 + \delta_4 X_4 + \delta_5 X_5 + \varepsilon_t \qquad (20)$$

where; Y = real gross domestic product growth rate, X_1= total recurrent expenditure, X_2 = total capital expenditure, X_3= expenditure on defense, X_4 = expenditure on Health, δ_0 = intercept of the equation, ε_t = Stochastic error term

3.0 RESULTS

3.1 Source of Data

This study uses annual series of Gross Domestic Product (GDP), Total Recurrent Expenditure (TRE) and Total Capital Expenditure (TCE) along with its various components:Total Defense Expenditure (TDE), and Total Health Expenditure (THE) in Nigeria for the period of 1970 to 2008 drawn from the Central Bank of Nigeria (2007, 2008).

3.2 Time Series Plots

The plots of the series in levels and first differences are shown in figure 1 to 10. The plots of the series in levels do not seem to vary about a constant mean (see Fig.1 to Fig.5). The plots of first differences on the other hand seem to have a relatively constant mean (see Fig.6 to Fig.10). The results indicate that the series are stationary after first difference and nonstationary in levels.

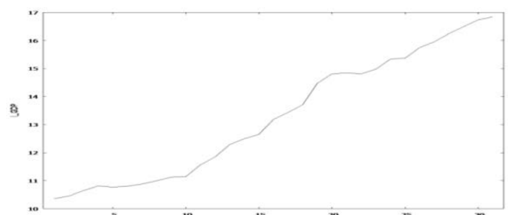

Fig.1: *Time plot of the log transform of GDP in Level.*

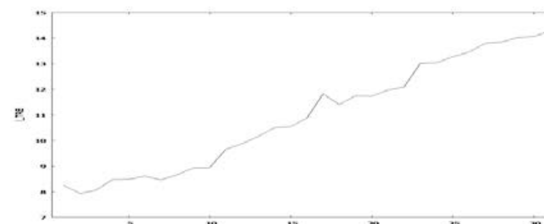

Fig. 2: *Time plot of the log transform of TRE in Level*

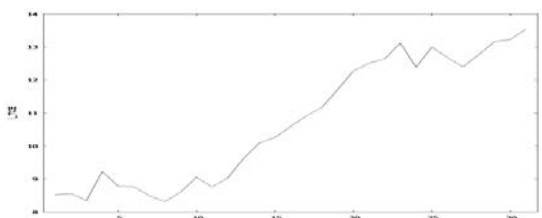

Fig. 3: *Time plot of the log transform of TCE in Level.*

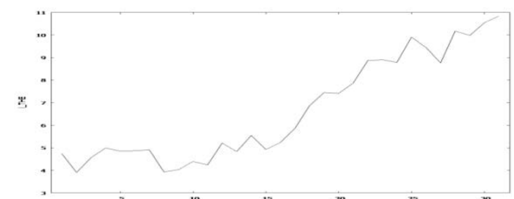

Fig. 4: *Time plot of the log transform of THE in Level.*

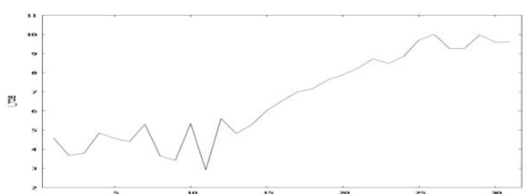

Fig. 5: *Time plot of the log transform of TDE in Level.*

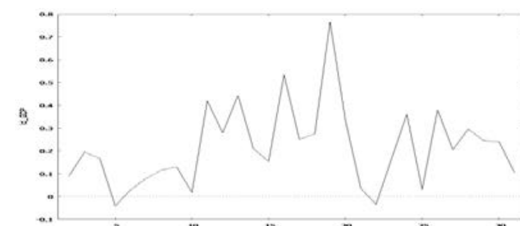

Fig. 6: *Time plot of the first difference of log transform of GDP.*

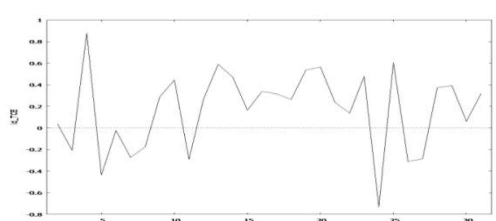

Fig.7: *Time plot of the first difference of log transform of TCE.*

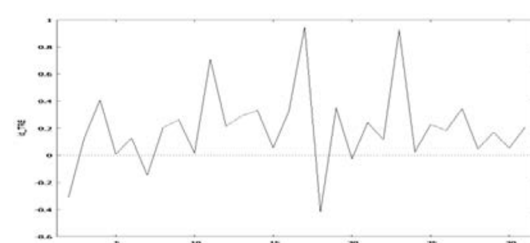

Fig.8: *Time plot of the first difference of log transform of TRE.*

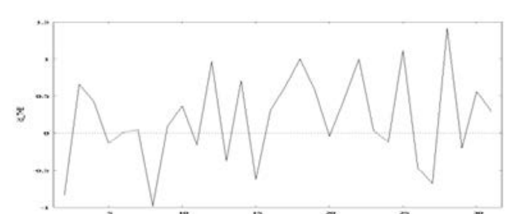

Fig.9: *Time plot of the first difference of log transform of THE.*

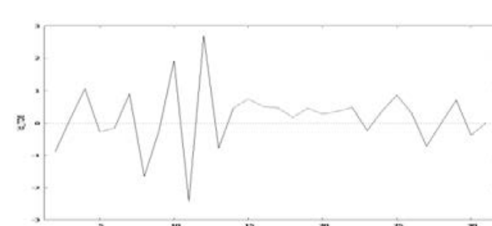

Fig. 10: *Time pl ot of the first difference of log transform of TDE.*

3.3 Tests for Stationarity

The results regarding the order of integration of the series have been determined by Augmented Dickey Fuller (ADF) test. The ADF test was carried out on the levels and first differences of all the variables. The calculated t-values from ADF tests on each variable in levels and in first differences are reported in Table.1.

Table.1: Augmented Dickey Fuller (ADF)

Variables	Level	First Difference
GDP	1.5685	-4.0114
TRE	1.4383	-3.6102
TCE	1.2265	-6.7169
THE	1.7126	-6.0785
TDE	1.0326	-6.2143

Note: Critical values in levels and first difference at 5% ie -1.96 and -2.86 respectively.

Table. 1 present the results of Augmented Dickey Fuller (ADF) Test both in levels and first differences. In the case of the levels of the series, the null-hypothesis of the non-stationarity cannot be rejected for all the series. Therefore, the levels of all the series are non-stationary which implies that these series have unit root. This results therefore shows that total recurrent expenditure, total capital expenditure, total expenditure on health and total expenditure on defence and GDP are nonstationary at levels and stationary in their first differences. The results in Table.1 are consistent with those of prior studies that have been done for other countries such as Israel and Syria [1].

3.4 Kwiatkowski, Philips, Schmidt and Shin, (KPSS) Tests

The test for the null of stationarity of the series have been determined by Kwiatkowski, Phillips, Schmidt and Shin (KPSS). The results are tabulated in Table.2.

Table.2: Kwiatkowski, Philips,Schmidt and Shin, (KPSS) Tests

Variables	Level	First Difference
GDP	0.7922	0.3137
TRE	0.8424	0.3109
TCE	0.9568	0.3317
THE	0.7685	0.1822
TDE	0.8545	0.1530

The KPSS test results in Table.2 indicates that the null hypothesis of stationarity is rejected for all the series in levels. The series are however stationary in their first differences. This confirms the stationarity of first differences of the series, an indication that the series are all integrated of order one i.e I(1).

Note: Criticalvalues in levels and first difference at 5% are 0.463 and 0.473 respectively.

3.5 Cointegration Test

Recall that all the variables are I(1), as evident from the unit root tests. In order to capture the extent of cointegration among the variables, the multivariate cointegration methodology were conducted. The Johansen's trace test and the test by Saikkonen and Luthkepohl are used and the results are shown in Table.3. The trace test and Saikkonen and Luthkepohl results results in Table 3 shows that there are Three (3) long-run equilibrium relationships of the variables (i.e. r = 3) respectively. The cointegration test results as evident in Table 3, indicates that the dependent variable GDP is cointegrated with TRE, TCE, THE and TDE, as such the test statistics strongly reject the null hypothesis. The results concluded that the variables (government expenditure) have long run impact on economic growth in Nigeria.

3.6 Error Correction Model (ECM)

The ECM results are demonstrated in Table 4.The results in Table 4 indicates that the coefficient of TCE, TRE, TDE and THE has positive and statistically significant effect on economic growth in Nigeria. While the results of Error Correction Model (ECM) has negative sign and the significance of the Error Correction term (EC) indicated that there exist long run relationship between economic growth and Government expenditure and its takes more years to attain equilibrium. The ECM indicates a feedback of approximately 75% of the previous year's disequilibrium from long run elasticity of the explanatory variables. That is, the coefficient of the error correction term measures the speed at which the level of real output adjusts to changes in the explanatory variables in an effort to achieve long run static equilibrium. It can be said therefore that the speed of adjustment is high. The adjusted R^2 is 84 percent. By implication, this shows that 84 percent of the variations in real GDP growth can be explained by the variables taken together. The remaining 16 percent variations can be attributed to other forces outside the model. This suggests that government expenditure has influence on the economic growth. Therefore, the null hypothesis that 'government expenditure has no significant effect on economic growth in Nigeria is rejected. This implies that government expenditure has significant effect on the economic growth in Nigeria. These results also show a goodness of fit of the regression. The F-statistics of 28.01 shows that the explanatory variables are important determinants of the GDP growth rate in Nigeria. The Durbin-Watson statistics of 1.98 rules out auto-correlation.

3.7 Autocorrelation of the Residuals

The result of Autocorrelation in the residuals and normality tests is indicated in Table .5, 6 and 7. Table 5 indicates the results for both Breusch-Godfrey autocorrelation LM test (with minimal p-value of 0.0001) and autocorrelation Portmanteau test (with minimal p- value of 0.8692) which shows that there is no residual autocorrelation. The Jarque–Bera statistic in Table 6 shows that the normal distribution of kurtosis statistic is three. The results of the residuals are not too far from normality as evidence in the results of the Skewness and Kurtosis test. However Skewness for the variables are positive except TDE (-0.09581) is negative. The negative value for the skewness indicates that the variable is skewed to the left while positive values are skewed to the right. However, the ARCH LM test statistic in Table 6 shows that the test statistics rejects the first order autoregressive conditional heteroscedasticity (ARCH) based on the p-value.

Table.3 Johansen trace test and Saikkonen and Luthkepohl Cointegration test

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**	LR	95%	P Val
None *	0.971087	228.5978	69.81889	0.0000	133.53	66.13	0.0000
At most 1 *	0.931563	129.3810	47.85613	0.0000	89.03	45.32	0.0000
At most 2 *	0.828083	54.28958	29.79707	0.0000	38.51	28.52	0.0016
At most 3	0.163118	4.988779	15.49471	0.8100	13.49	15.76	0.0019
At most 4	9.822305	0.002749	3.841466	0.9556	5.24	6.79	0.1132

*Trace test indicates 3 cointegrating eqn(s) at the 0.05 level. * denotes rejection of the hypothesis at the 0.05 level. **MacKinnon-Haug-Michelis (1999) p-values.*

Table 4 Error Correction Model (ECM)

Variables	Coefficient	Std. Error	t-Statistic	P value
C	- 26.9735	0.51073	- 52.8140	0.00007
TRE	17.8668	0.68273	26.1697	0.00479
TDE	68.9762	15.2075	44.8449	0.00401
THE	29.7900	17.7360	16.2385	0.00513
ECM1	-27.5514	-22.2550	-12.5163	0.00001
TCE	26.9735	0.51073	52.8140	0.41079
Adjusted R-squared		0.836658		
Durbin-Watson		1.98231		
F		28.01		

Table. 5 Test for Autocorrelation of the Residuals

Portmanteau Test $H_o: R_h = (r_1, \cdots, r_h) = 0$	Test Value	Breusch-Godfrey Test	Test Value
LM statistic	334.8682	LM statistic	96.7596
p-value	0.8692	p-value	0.0001
Degree of freedom	365.0000	Degree of freedom	50.0000

Table. 6: JARQUE-BERA TEST for Normality and ARCH-LM TEST of the Residuals

JARQUE-BERA TEST Variable	Test statistic	p-Value(χ^2)	Skewness	Kurtosis	**ARCH-LM** Test statistic	p-Value(χ^2)	p-Value(F)
GDP	1.9133	0.3842	0.2344	3.1712	28.3311	0.0000	0.0000
TRE	3.8394	0.1467	1.0388	3.2666	18.0229	0.0001	0.0000
TCE	0.7890	0.6740	0.1237	2.0833	3.3700	0.1854	0.1688
THE	4.1815	0.1236	0.0453	3.1390	25.9179	0.0000	0.0000
TDE	6.1921	0.0452	-0.09581	3.2394	27.7012	0.0000	0.0000

3.8 Granger Causality Test

Granger-causality test in first difference VAR is carried out next and the results are as reported in Table .8 below:

Table 7: Toda- Yamamoto Granger Causality Test

S/N	Null Hypothesis	F-Statistic	Prob.	Conclusion
1	TCE does not Granger Cause GDP	2.26378	0.1257	Cannot Reject H_o
	GDP does not Granger Cause TCE	5.68379	0. 0095	Reject H_o
2	TRE does not Granger Cause GDP	5.28102	0.1758	Cannot Reject H_o
	GDP does not Granger Cause TRE	9.72374	0.0462	Reject H_o
3	THE does not Granger Cause GDP	0.60924	0.5520	Cannot Reject H_o
	GDP does not Granger Cause THE	2.08235	0.2420	Cannot Reject H_o
4	TDE does not Granger Cause GDP	2.87846	0.5341	Cannot Reject H_o
	GDP does not Granger Cause TDE	3.24359	0.7857	Cannot Reject H_o
5	TDE does not Granger Cause TCE	0.68569	0.5133	Cannot Reject H_o
	TCE does not Granger Cause TDE	3.66386	0.3409	Cannot Reject H_o
6	THE does not Granger Cause TCE	1.15655	0.2196	Cannot Reject H_o
	TCE does not Granger Cause THE	4.65439	0.3315	Cannot Reject H_o
7	TRE does not Granger Cause TCE	10.3162	0.4123	Cannot Reject H_o
	TCE does not Granger Cause TRE	7.55436	0.2856	Cannot Reject H_o
8	THE does not Granger Cause TDE	12.1668	0.6778	Cannot Reject H_o
	TDE does not Granger Cause THE	7.60960	0.3854	Cannot Reject H_o
9	TRE does not Granger Cause TDE	5.28102	0.2931	Cannot Reject H_o
	TDE does not Granger Cause TRE	9.72374	0.4814	Cannot Reject H_o
10	TRE does not Granger Cause THE	5.98356	0.5093	Cannot Reject H_o
	THE does not Granger Cause TRE	2.72749	0.3856	Cannot Reject H_o

From the results of Granger causality test based on Toda and Yamamoto (1995) methodology is reported in Table 7 above. The results suggest that causality is running from GDP to TCE and TRE and no evidence of bi-directional causality is found between these variables. The probability values of F statistics is given, the low P values suggested we can reject null hypothesis. Hence the study found unidirectional causality running from economic growth to government expenditure for Nigeria. No other direction is found in any other variables. The results from the model support the Wagner's hypothesis. The Wagner's hypothesis explains that increase in GDP causes growth in the government expenditures. It rejects the hypothesis that public expenditures amplify the economic growth at both aggregate and disaggregate levels. This indicates that public expenditure growth is a natural consequence of economic growth in Nigeria. There are many possible explanations for the nonexistence of Keynesian hypothesis in the study. First, large part of public expenditure is devoted to recurrent expenditure; the major components of it are Defense spending and interest payments. Second, the impact of spending on social sector such as education at all levels, heath, poverty alleviation programs and infrastructure come about with time-lag. Third, despite the government efforts of fiscal transparency and improving expenditure management, still government activities on development actually hindered. This is due to lack of effectiveness and efficiency in the government policies vis-à-vis private sector. This inefficiency of public sector is due to elements of corruption and political favoritism.

3.9 Economic Implication

The results of this study have important economic implications. In order to achieve maximum economic growth, public expenditure needs to be better prioritized; investing in health offers high return in terms of economic growth. This means that increasing in expenditure on health services do not only have a large impact on poverty per naira spent, but also enhance growth in human productivity. This is because as more people get good health, they will increase their which will enhance economic growth. This implies that shifting resources from low-productivity sectors, such as general administration to health, will generate economic growth in the country. While increase in public expenditure on defense is to provide adequate security of life and property for sustainable economic growth. Hence insecurity may scare away investors, as such government tends to increase expenditure on security. However, in the long run, increase expenditure on defense may siphon funds away from more productive domestic investment which may be detrimental to economic growth, especially as the government suffers from relative revenue constraints.

4 CONCLUSION AND RECOMMENDATIONS

On the basis of empirical results, the study conclude that government expenditure causes economic growth.Thus conformed to Wagner's hypothesis that growth in the government expenditure causes increased in GDP. The study rejects the hypothesis that public expenditures amplify the economic growth. Finally, the study does not support the existence of Keynesian hypothesis that increase in government expenditures cause economic growth. In a nutshell causality tests apparently indicate that only Wagner's school of thought is valid in Nigeria.Based on the results obtained in this study, it is recommended that; government should ensure that capital and recurrent expenditures are properly managed to accelerate economic growth. Moreso, government should promote efficiency in the allocation of resources on human development by encouraging more private sector participation to ensure productivity-intensive growth. The study also recommends that there should be high degree of transparency and accountability on government spending at various sectors of the economy in order to prevent channeling of public funds to private accounts of government officials. Also, government should increase her funding of anti-corruption agencies such as Economic and Financial Crime Commission (EFCC), and the Independent Corrupt Practices Commission (ICPC) in order to arrest and penalize those who divert and embezzle public funds.

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