

An Examination of the Relationship between Government Revenue and Government Expenditure in Nigeria: Cointegration and Causality Approach

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Fiscal policy, which entails an appropriate alignment in government revenue and expenditure, is of crucial importance in promoting price stability and sustainable growth in output, income and employment. It is one of the macroeconomic policy instruments that can be used to prevent or reduce short-run fluctuations in output, income and employment in order to move an economy to its potential level. However, for sound fiscal policy, a good understanding of the relationship between government revenue and government expenditure is very important, for instance, in addressing fiscal imbalances. Thus, the causal relationship between public revenue and public expenditure has been an issue that has generated heated debates globally, over the years, among economists and policy analysts. Four major hypotheses have emanated from the debates namely: the revenue-spend hypothesis (where there is a unidirectional causality from government revenue to government expenditure); the spend-revenue hypothesis (where there is a unidirectional causality from government expenditure to government revenue); the fiscal synchronization hypothesis (where there is bidirectional causality between government revenue and government expenditure); and the institutional separation hypothesis (where there is no causality between government revenue and government expenditure).

This study makes a modest contribution to the debates by empirically analyzing the relationship between government revenue and government expenditure in Nigeria, using time series data from 1970 to 2007, obtained from the Central Bank of Nigeria (2004, 2007). In particular, the study examines the validity of the four aforementioned hypotheses to Nigeria. It employs the Engel-Granger two-step cointegration technique, the Johansen cointegration method and the Granger causality test within the Error Correction Modeling (ECM) framework. Empirical findings from the study indicate, among other things, that there is a long-run relationship between government revenue and government expenditure in Nigeria. There is also evidence of a unidirectional causality from government revenue to government expenditure. Thus, the findings support the revenue-spend hypothesis for Nigeria, indicating that changes in government revenue induce changes in government expenditure. The empirical findings suggest, among other things, that: controlling the swings in government revenue is very necessary in controlling government expenditure and avoiding unsustainable fiscal imbalances in Nigeria; and to increase government spending, efforts should be made to enhance government revenue, but efforts to enhance government revenue should be accompanied with appropriate

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public expenditure reforms in order to achieve sustainable economic growth, since higher government revenue invites higher government expenditure, while the quality of expenditure is central to achieving any meaningful growth.

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I. Introduction

The causal relationship between government revenue and government expenditure is an issue that has generated heated debate globally, over the years, among economists and policy analysts. An understanding of this relationship is critical in the formulation of a sound or excellent fiscal policy to prevent or reduce unsustainable fiscal deficits (Eita and Mbazima, 2008). Indeed, a good understanding of the relationship between public revenue and public expenditure is of crucial importance in appreciating the consequences of unsustainable fiscal deficits and in addressing such imbalances (Hondroyiannis and Papapetrou, 1996; Eita and Mbazima, 2008). It is also highly consequential in evaluating government's role in the distribution of resources (Chang, 2009). Such evaluation paves the way for sound fiscal policy formulation and implementation to achieve rapid and sustainable socio-economic growth and development, all other things remaining the same. Excellent fiscal policy - as noted by Eita and Mbazima (2008), Wolde-Rufael (2008), and Fasano and Wang (2002) - is very important in promoting price stability and sustainable growth in output, income and employment. In spite of the significance of a proper understanding of the relationship between public revenue and public expenditure in formulating sound fiscal policy, empirical study on the subject in Nigeria is very scanty.

In light of the foregoing, this study examines the relationship between federal government revenue and expenditure in Nigeria, with a view to establishing the existence or otherwise of any long-run relationship and the direction of causality among the variables. The empirical findings should help in determining appropriate policy measures to address some of the fiscal challenges facing Nigeria. As stated by Sanni (2007), Nigeria's fiscal operations over the years have resulted in varying degrees of deficit; the financing of which has had tremendous implications for the economy. The study makes a modest contribution to the body of knowledge on the nexus between government revenue and government expenditure, using Nigerian data.

Following this introduction, section two reviews some of the relevant theoretical and empirical literature on the issue, while section three discusses developments

associated with government revenue, government expenditure and budget deficit in Nigeria. Section four presents the methodology used in the study and analyzes the results. Section five concludes the study and offers some recommendations.

II. Literature Review

The analysis of the nexus between government revenue and government expenditure has featured prominently in both theoretical and empirical literature. The theoretical literature contains many hypotheses that have been proposed to describe the inter-temporal/causal relationship between public revenue and public expenditure. These hypotheses can be grouped into four namely: tax-and-spend or revenue-spend hypothesis; spend-and-tax or spend-revenue hypothesis; fiscal synchronization hypothesis; and fiscal independence or institutional separation hypothesis (Chang, 2009). The tax-and-spend hypothesis, put forward by Friedman (1978), states that changes in government revenue bring about changes in government expenditure. It is characterized by unidirectional causality running from government revenue to government expenditure. According to Friedman, increases in tax or revenue will lead to increases in public expenditure, and this may result in the inability to reduce budget deficits (Chang, 2009).

The spend-and-tax hypothesis, advanced by Peacock and Wiseman (1961, 1979), states that changes in public expenditure bring about changes in public revenue. It is characterized by unidirectional causality running from public expenditure to government revenue. As argued by Peacock and Wiseman (1961, 1979), a severe crisis that initially makes government expenditure more than tax or public revenue has the potential to change public attitudes concerning the proper size of government. The upshot is that some of the tax increases, originally justified by the crisis situation, will eventually become permanent tax policies. Put differently, Peacock and Wiseman (1961, 1979) argued that temporary increases in government expenditures due to economic and political crises can lead to permanent increases in government revenues from taxation; this is often called the "displacement effect" (Bhatia, 2003; Chang, 2009).

The fiscal synchronization hypothesis, associated with Musgrave (1966) and Meltzer and Richard (1981), is based on the belief that public revenue and public expenditure decisions are jointly determined. It is, therefore, characterized by contemporaneous feedback or bidirectional causality between government revenue and government expenditure (Chang, 2009). It is opined that voters compare the marginal costs and marginal benefits of government services when

making a decision in terms of the appropriate levels of government expenditure and government revenue.

The fiscal independence or institutional separation hypothesis, advocated by Baghestani and McNown (1994), has to do with the institutional separation of the tax and expenditure decisions of government. It is characterized by non-causality between government expenditure and government revenue (Chang, 2009). This situation implies that government expenditure and government revenue are independent of each other.

From the foregoing, three major reasons why the nature of the relationship between government revenue and government expenditure is very important can be deduced. First, if the revenue-spend hypothesis holds (that is, if government revenue causes government expenditure) then budget deficits can be eliminated or avoided by implementing policies that stimulate or increase government revenue. Second, if the spend-revenue hypothesis holds (that is, if government expenditure causes government revenue), it suggests that government's behavior is such that it spends first and raises taxes later in order to pay for the spending. This situation can bring about capital outflow as a result of the fear of consumers paying higher taxes in the future (Narayan and Narayan, 2006; Eita and Mbazima, 2008). Third, if the fiscal synchronization hypothesis does not hold (that is, if there is no bidirectional causality between government revenue and government expenditure), it implies that government expenditure decisions are made without reference to government revenue decisions and vice versa. This situation can bring about high budget deficits if government expenditure increases faster than government revenue.

Empirical literature shows that there are mixed findings on the nature of the relationship or direction of causation between government expenditure and government revenue. Different studies have come up with findings that provide support for different hypotheses for different countries. Some studies provide support for the spend-and-tax hypothesis including the studies by: Von Furstenberg, et al (1986) for the United States of America; Hondroyiannis and Papapetrou (1996) for Greece; Wahid (2008) for Turkey; and Carneiro, et al (2004) for Guinea-Bissau. The studies that provide support for the tax-and-spend hypothesis include: Eita and Mbazima (2008) for Namibia; Darrat (1998) for Turkey; and Fuess, et al (2003) for Taiwan. In the study for Turkey, Wahid (2008) applied the standard Granger causality test whereas Darrat (1998) used the Granger causality test within an error correction modeling framework. With respect to the fiscal synchronization hypothesis, the studies that provide support for the

hypothesis include: Li (2001) and Chang and Ho (2002) for China; Maghyereh and Sweidan (2004) for Jordan. For the institutional separation hypothesis, the study by Barua (2005) supports the hypothesis at least in the short-run for Bangladesh.

Some researchers have examined the relationship between government revenue and government expenditure by considering a group of countries or states and also found support for different hypotheses for different countries or states. The study by Payne (1998), based on time series evidence from state budgets for forty-eight (48) contiguous states in the United States of America, supports the tax-and-spend hypothesis for twenty-four (24) states; the spend-and-tax hypothesis for eight (8) states; and the fiscal synchronization hypothesis for eleven (11) states. The remaining five (5) states were reported to have failed the diagnostic tests for error correction modeling. The study applied Granger causality test within an error-correction modeling framework. The study by Narayan (2005) for nine (9) Asian countries, using cointegration and Granger causality approach, supports the tax-and-spend hypothesis for Indonesia, Singapore and Sri Lanka in the short-run; and Nepal in both the short-run and the long-run. The results of the study also support the spend-and-tax hypothesis in the long-run for Indonesia and Sri Lanka; and show neutrality for the other countries.

The study by Narayan and Narayan (2006) for twelve (12) developing countries indicates that the tax-and-spend hypothesis is valid for Mauritius, El Salvador, Haiti, Chile, Paraguay and Venezuela; the spend-and-tax hypothesis is valid for Haiti, while there is evidence of neutrality for Peru, South Africa, Guyana, Guatemala, Uruguay and Ecuador. The study utilized the Granger causality test based on the procedure suggested by Toda and Yamamoto (1995) which allows for causal inference based on an augmented vector autoregression with integrated and cointegrated processes. Fasano and Wang (2002) examined the relationship between government spending and public revenue based on evidence from six (6) countries of the oil-dependent Gulf Cooperation Council (GCC) namely: Bahrain, Kuwait, Oman, Qatar, Saudi Arabia and the United Arab Emirates. The study, which used the Granger causality testing technique, showed that the tax-and-spend hypothesis is valid for Bahrain, the United Arab Emirates and Oman. The fiscal synchronization hypothesis is found to be true for Qatar, Saudi Arabia and Kuwait. For Kuwait and Saudi Arabia, however, the causality from revenue to expenditure shows higher significance than the reverse direction. Wolde-Rufael (2008) analyzed the public expenditure-public revenue nexus based on the experiences of thirteen (13) African countries. The study was carried out within a multivariate framework using Toda and Yamamoto (1995) modified version of the Granger causality test. The results of the study provided evidences supporting the

fiscal synchronization hypothesis for Mauritius, Swaziland and Zimbabwe; institutional separation hypothesis for Botswana, Burundi and Rwanda; the tax-and-spend hypothesis for Ethiopia, Ghana, Kenya, Nigeria, Mali and Zambia; and the spend-and-tax hypothesis for Burkina Faso.

From the foregoing studies, the use of time series data is found to be very popular among economic researchers/analysts in the analyses of the causal relationship between government revenue and government spending. However, pooled/panel data can also be used in analyzing the relationship. Thus, Ho and Huang (2009) used a panel data of thirty-one (31) Chinese provinces to analyze the interaction between public spending and public revenue. The results of the study based on multivariate panel error-correction models show that there is no significant causality between public revenue and public expenditure for the Chinese provinces in the short run; this supports the institutional separation hypothesis for the area. But in the long-run, there exists bidirectional causality between public revenue and public expenditure in the Chinese provinces, thus, supporting the fiscal synchronization hypothesis for the provinces over the sample period. Chang (2009) used a panel data of fifteen (15) countries in the Organization for Economic Co-operation and Development (OECD) in examining the inter-temporal relationship between government revenues and government expenditures. Among other things, the study performed panel Granger causality test and found evidence of bidirectional causality between government revenues and government expenditures, thus, validating the fiscal synchronization hypothesis for the OECD countries taken as a whole.

As observed by Narayan (2005), recent empirical literature can be categorized into two groups in terms of the methodology adopted. The first group of studies employed traditional econometric techniques based on vector autoregression (VAR). The second group of studies used modern econometric techniques based on cointegration and error correction models. As pointed out by Obioma and Ozughalu (2005), it has become fashionable in contemporary econometric analysis to consider issues of stationarity, cointegration and error correction mechanism/modeling (ECM) when dealing with models involving time series data. Stationarity assures non-spurious model estimates; cointegration captures equilibrium or long-run relationship between (co-integrating) variables; and error correction mechanism is a means of reconciling the short-run behavior of economic variables with their long-run behaviour (Gujarati and Porter, 2009). Tests for stationarity usually precede tests for cointegration; and cointegration may be said to provide the theoretical underpinning for error-correction mechanism. The concepts of stationarity, cointegration and error-correction mechanisms/models

are also applicable when panel data are used. In panel data analysis, we talk of panel stationarity, panel cointegration and panel error correction models (see Ho and Huang, 2009; Chang, 2009). As a digression, it is important to state here that tests for stationarity usually involve tests for unit root. When a variable has a unit root, it implies that it is not stationary. Economic variables are usually made stationary after differencing; and the order of integration of a variable is determined by the number of times the variable has to be differenced for it to achieve stationarity. If a variable has to be differenced d times before it becomes stationary, the variable is said to be integrated of order d . As observed by Gujarati and Porter (2009), most economic series become stationary after the first differencing. Thus, such variables are said to be integrated of order one (1). When a series is stationary without any differencing, that is, when it is stationary at level, such a variable is said to be integrated of order zero (0).

Modern econometrics has provided the platform for highly reliable and robust analyses on the causal relationship between public expenditure and public revenue. With regard to the form of the variables themselves, it is popular to work with their real values and not their nominal values (Fasano and Wang, 2002; Barua, 2005). The real values of the variables cater adequately for the problem of inflation. To get the real values, we simply deflate the nominal values by an appropriate price index such as the consumer price index (see Fasano and Wang, 2002).

III. Analysis of Movements in Real Government Revenue, Real Government Expenditure and Real Budget Deficit in Nigeria

Table 1 shows the average growth rates of real government revenue, real government expenditure and real budget deficit in Nigeria from 1971- 2007. As can be seen from the Table, real government revenue had its highest average growth rate in the period 1971-1975 followed by the period 1986-1990. These periods coincided with the early oil boom era and the structural adjustment program (SAP) era, respectively. This implies that government revenue profile in Nigeria performed best in the early oil boom era followed by the SAP era. Government revenue had its highest average decline rate in the period 1981-1985; this was the period that witnessed the collapse of the world oil market that made the Nigerian economy begin to show tremendous signs of distress; these signs were later followed by serious macroeconomic problems which initially led to the introduction of an economic stabilization package in 1981 and later to various rounds of budget-tightening austerity measures between 1982 and 1985.

Table 1: Average Growth Rates of Real Government Revenue, Real Government Expenditure and Real Budget Deficit: 1971 - 2007.

Period	Average Growth Rate of Real Government Revenue (in %)	Average Growth Rate of Real Government Expenditure (in %)	Average Growth Rate of Real Budget Surplus/Deficit (in %)
1971-1975	67.78	31.25	16.06
1976-1980	8.07	9.75	-131.08
1981-1985	-13.98	-15.21	33.77
1986-1990	26.22	11.37	-1213.77
1991-1995	-3.08	-6.31	354.30
1996-2000	-8.97	1.56	-59.98
2001-2005	10.25	5.27	18.42
2006-2007	-4.93	9.07	-11.66

Source: Computed by the Authors.

The period 1976-1980 recorded the lowest average growth rate in real government revenue while the period 1991-1995 recorded the lowest average decline rate in real government revenue. Coming to real government expenditure, the table shows that the period 1971-1975 recorded the highest average growth rate. This period coincided with the oil boom era of the 1970s and the early post-civil war period in which so much was spent on rehabilitation, reconstruction and reconciliation. The period 1981-1985 recorded the highest average decline rate in real government expenditure. With regard to real budget deficit, the table shows that the period 1991-1995 had the highest average growth rate, while the period 1986-1990 had the highest decline rate in real budget deficit.

Table 2 shows some basic descriptive statistics relating to the growth rate of real government revenue, growth rate of real government expenditure and growth rate of real budget deficit from 1970-2007. As shown in the Table, the mean growth rate of real government revenue is 8.098 per cent, the maximum is 136.363 per cent, the minimum is -99.812 per cent and the standard deviation is 43.112 per cent; the distribution is slightly positively skewed and it is leptokurtic.

Table 2: Some Basic Descriptive Statistics Relating to the Growth Rates of Real Government Revenue, Real Government Expenditure and Real Budget Deficit: 1970-2007

Descriptive Statistics	Growth Rate of Real Government Revenue (in %)	Growth Rate of Real Government Expenditure (in %)	Growth Rate of Real Budget Deficit (in %)
Mean	8.098417	5.581916	-133.3708
Median	-0.765405	1.111215	-30.93630
Maximum	136.3626	83.93903	1595.622
Minimum	-99.81220	-99.93082	-5684.519
Standard Deviation	43.11233	34.83015	1000.903
Skewness	0.627727	-0.118593	-4.624842
Kurtosis	4.378646	4.522670	27.30018
Coefficient of Variation	532.355027	623.981980	-750.466369

Source: Computed by the Authors

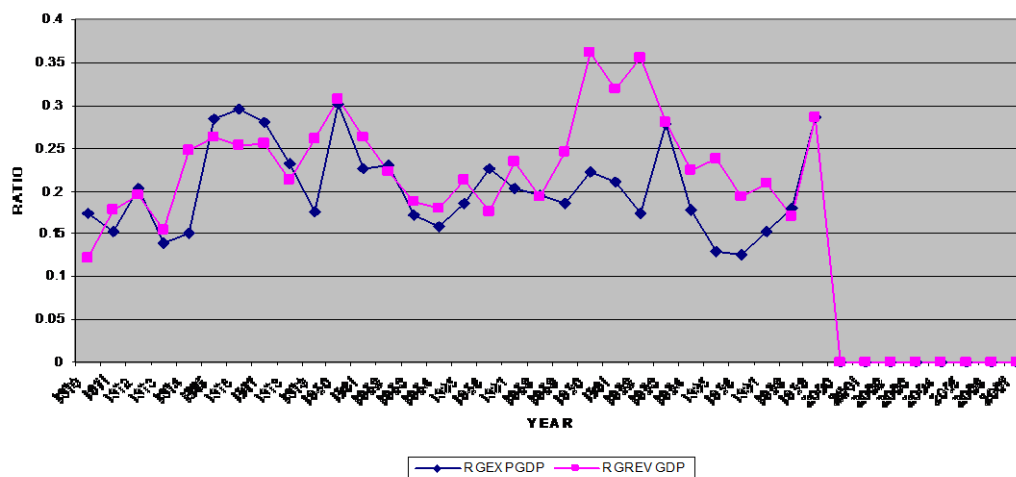
The table also shows that the mean growth rate of real government expenditure is 5.582 per cent, the maximum is 83.939 per cent, the minimum is -99.931 per cent and the standard deviation is 34.830 per cent; the distribution is slightly negatively skewed and it is leptokurtic. The table further shows that the mean growth rate of real budget deficit is -133.371 per cent, the maximum is 1595.622 per cent, the minimum is -5684.519 per cent and the standard deviation is 1000.903 per cent; the distribution is negatively skewed and it is highly leptokurtic. Looking at the three distributions, we will see that the mean growth rate of real government revenue is higher than the mean growth rate of real government expenditure. The mean growth rate of real budget deficit is highly negative. The standard deviation of the growth rate of real government revenue is higher than the standard deviation of the growth rate of real government expenditure.

The maximum growth rate of real budget deficit is the highest among the three distributions; the maximum growth rate of real government revenue is higher than the maximum growth rate of real government expenditure; the minimum growth rate of real budget deficit is the lowest among the three distributions; the minimum growth rate of real government revenue is slightly higher than the minimum growth rate of real government expenditure. The coefficient of variation associated with the growth rate of real government revenue is lower than the coefficient of variation associated with the growth rate of real government expenditure. This indicates that the growth rate of real government revenue is less

variable or more consistent, stable and homogenous than the growth rate of real government expenditure. The coefficient of variation associated with the growth rate of real budget deficit is negative.

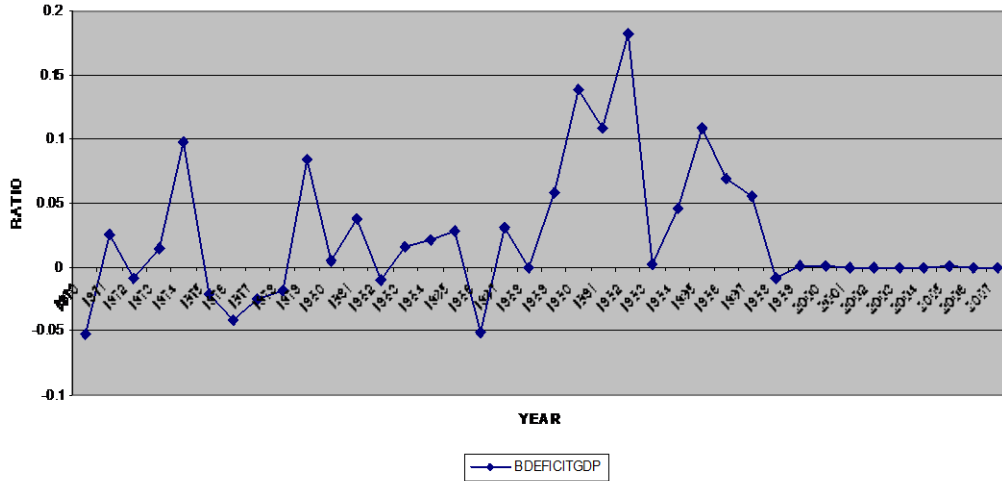
Figure 1 shows the ratios of real government expenditure and real government revenue to real gross domestic product from 1970-2007, while Figure 2 shows the ratio of real budget deficit to real gross domestic product from 1970-2007. The ratio of real government revenue to real gross domestic product was above 0.35 only in 1991 and 1993; it was below 0.35 in the other years; and from 2000 to 2007 it was below 0.05. The ratio of real government expenditure to real gross domestic product was 0.3 only in 1981; it was below 0.3 in the other years; it was far below 0.05 from 2000 to 2007. None of the two ratios was up to 0.4 in any of the years. The two ratios recorded both upward and downward swings in the period under reference. The ratio of real budget deficit to real gross domestic product was generally below 0.2 in the period under reference; the ratio was negative in some of the years in the period under reference; and the ratio recorded both upward and downward swings in the period in question.

Figure 1: Ratios of Real Government Expenditure and Real Government Revenue To Real Gross Domestic Product(1970-2007)



Note: RGEXPGDP is ratio of real government expenditure to real gross domestic product and RGREVGDP is ratio of real government revenue to real gross domestic product.

Figure 2: Ratio of Real Budget Deficit To Real Gross Domestic Product(1970-2007)



Note: BDEFICITGDP is ratio of real budget deficit to real gross domestic product.

IV. Methodology and Analysis of Results

The methodology for this study draws heavily from Fasano and Wang (2002), by using modern and robust econometric techniques based on cointegration and error correction modeling framework, and working with the real variables rather than their nominal values. Employing the Granger causality test, the initial econometric model is specified as follows:

$$RGEP_t = \alpha_0 + \alpha_1 RGREV_t + \mu_1 \tag{1}$$

$$RGREV_t = \beta_0 + \beta_1 RGEP_t + \mu_2 \tag{2}$$

where: $RGEP_t$ is real government expenditure; $RGREV_t$ is real government revenue; $\alpha_0, \alpha_1, \beta_0, \beta_1$ are parameters to be estimated; μ_1 and μ_2 are stochastic error terms. The a priori expectations are: α_0, α_1 and $\beta_0 > 0$; and $\beta_1 < or > 0$. Data on the variables (i.e. $RGEP_t$ and $RGREV_t$) were collected from Central Bank of Nigeria (2004, 2007).

In conducting stationarity tests of the variables in equations 1 and 2, we use the Augmented Dickey-Fuller (ADF) unit root test which is derived from Dickey and Fuller (1979, 1981). It is pertinent to state here that when the number of observations is relatively low, unit root tests have little power (Chebbi and

Lachaal, 2007). Thus, to complement the ADF unit root test, the KPSS stationarity test which is derived from Kwiatkowski, Phillips, Schmidt and Shin (1992) is carried out. Also, the Phillips-Perron unit root test (which comes from Phillips, 1987; Perron, 1988; and Phillips and Perron, 1988) is also used. While the Augmented Dickey-Fuller approach accounts for the autocorrelation of the first differences of a series in a parametric fashion by estimating additional nuisance parameters, the Phillips-Perron unit root test makes use of non-parametric statistical methods to take care of the serial correlation in the error terms without adding lagged difference terms (Gujarati and Porter, 2009). As pointed out by Idowu (2005), due to the possibility of structural changes that might have occurred during the period covered by this study, the Augmented Dickey-Fuller test might be biased in identifying variables as being integrated. But the Phillips-Perron test is expected to correct this short-coming.

The ADF test entails estimating the following equation:

$$\Delta G_t = b_1 + b_2 t + d G_{t-1} + \sum_{i=1}^m a_i \Delta G_{t-i} + \varepsilon_t \quad (3)$$

where: G_t is the variable of interest; ε_t is a pure white noise error term; t is time trend; Δ is difference operator; b_1, b_2, d and a_i are various parameters. In the ADF approach, we test whether $d=0$ ¹

The Phillips-Perron test is based on the following statistic:

$$\tilde{t}_\alpha = t_\alpha \left(\frac{\gamma_o}{f_0} \right)^{\frac{1}{2}} - \frac{T(f_o - \gamma_o)(se(\hat{\alpha}))}{2f_o^{\frac{1}{2}}s} \quad (4)$$

where: $\hat{\alpha}$ is the estimate; \tilde{t}_α is the t-ratio of α ; $se(\hat{\alpha})$ is the coefficient standard error; T is the sample size or number of observations; s is the standard error of the test regression; γ_o is a consistent estimate of the error variance in the standard Dickey-Fuller test equation [calculated as $(T-k)s^2/T$, where k is the number of regressors]; and f_0 is an estimator of the residual spectrum at frequency zero.

¹ In the ADF test, the null hypothesis is that the variable in question has a unit root (i.e. it is not stationary).

The Kwiatkowski, Phillips, Schmidt and Shin (KPSS) test differs from the unit root tests described above in that the series G_t is assumed to be trend stationary under the null hypothesis. The KPSS statistic is based on the residuals from the ordinary least squares (OLS) regression of G_t on the exogenous variables X_t :

$$G_t = X_t' \delta + \mu_t \quad (5)$$

The associated Lagrange Multiplier (LM) statistic is defined as:

$$LM = \sum_t S(t)^2 / (T^2 f_o) \quad (6)$$

Where f_o is an estimator of the residual spectrum at frequency zero and where $S(t)$ is a cumulative residual function:

$$S(t) = \sum_{r=1}^t \hat{\mu}_r \quad (7)$$

this is based on the residuals from equation 5.

The results of the stationarity test of the variables in equations 1 and 2 using the ADF unit root test are presented in table 3 below. The table shows that all the variables are stationary at first difference; thus they are integrated of order one.

Table 3: ADF Unit Root Test for the Variables in Equations 1 and 2

Variables	ADF Statistics (at first difference)	Order of Integration
RGEXP _t	-7.848054 (-4.234972)*	I(1)
RGREV _t	-7.949283(-4.234972)*	I(1)

Source: Computed by the Authors.

Note: (a) Mackinnon critical values for the rejection of unit root are in parentheses. (b) Tests include intercept and trend. (c) * implies 1 per cent level of significance.

The results of the Phillips-Perron (PP) test conducted to complement the ADF test are presented in Table 4 below. The table shows that all the variables are stationary at first difference and, therefore, are integrated of order one. This confirms the ADF results.

Table 4: PP Unit Root Test for the Variables in Equations 1 and 2

Variables	PP Statistics (at first difference)	Order of Integration
RGEXP _t	-10.26581(-4.234972)*	I(1)
RGREV _t	-8.126257(-4.234972)*	I(1)

Source: Computed by the Authors.

Note: (a) Mackinnon critical values for the rejection of unit root are in parentheses. (b) Tests include intercept and trend. (c) * implies 1 per cent level of significance.

The results of the KPSS stationarity test on the variables to further complement the ADF unit root test are presented in table 5 below.

Table 5: KPSS Stationarity Test for the Variables in Equations 1 and 2

Variable	KPSS Test Statistics (at first difference)	Order of Integrated
RGEXP _t	0.175472(0.216000)	I(1)
RGREV _t	0.065722(0.216000)	I(1)

Source: Computed by the Authors.

Note: (a) The figures in parentheses are the asymptotic critical values at 1 per cent. (b) Tests include intercept and trend.

The results of the KPSS Stationarity test, as shown in Table 5, indicate that the null hypothesis of stationarity for the variables cannot be rejected at first difference. Therefore, the KPSS test results further confirm the ADF unit root test results which show that the variables in question are all stationary at first difference, that is, they are integrated of order one.

Having found that all the variables are integrated of order one, cointegration tests are conducted to see if there is a long-run or equilibrium relationship between the variables. Two popular cointegration tests, namely, the Engel-Granger (EG) test and the Johansen test are used. The EG test is contained in Engel and Granger (1987) while the Johansen test is found in Johansen (1988) and Johansen and Juselius (1990). The EG test involves testing for stationarity of the residuals from equation 1 or equation 2. If the residuals is stationary at level, it implies that the variables under consideration are cointegrated. The EG approach could exhibit some degree of bias arising from the stationarity test of the residuals from the chosen equation (i.e. either equation 1 or equation 2). As pointed out by Idowu (2005), the EG test assumes one cointegrating vector in systems with more than two variables and it assumes arbitrary normalization of the

cointegrating vector. Besides, the EG test is not very powerful and robust when compared with the Johansen cointegration test. Thus, it is necessary to complement the EG test with the Johansen test. The Johansen cointegration test is a full information maximum likelihood approach; it is based on the following vector autoregressive (VAR) model of order p :

$$Y_t = A_1 Y_{t-1} + \dots + A_p Y_{t-p} + B X_t + e_t \quad (8)$$

where: Y_t is a k -vector of non-stationary $I(1)$ variables; X_t is a d -vector of deterministic variables; and e_t is a vector of innovations. One can rewrite this VAR as follows:

$$\Delta Y_t = \Pi Y_{t-1} + \sum_{i=1}^{p-1} \Gamma_i \Delta Y_{t-i} + B X_t + e_t \quad (9)$$

$$\text{Where: } \Pi = \sum_{i=1}^p A_i - I, \quad \Gamma_i = - \sum_{j=i+1}^p A_j \quad (10)$$

The Granger's representation theorem asserts that if the coefficient matrix Π has reduced rank $r < k$, then there exists $k \times r$ matrices α and β , each with rank r such that $\Pi = \alpha \beta'$ and $\beta' Y_t$ is $I(0)$; r is the number of cointegrating relations (i.e. the rank) and each column of β is the cointegrating vector. The elements of α are known as the adjustment parameters in the vector error correction model. The Johansen's approach is to estimate the Π matrix from an unrestricted VAR and to test whether we can reject the restrictions implied by the reduced rank of Π .

The results of the cointegration tests of the variables in equations 1 and 2 are presented hereunder, beginning with the EG test by testing for the stationarity of the residuals from equation 1. Table 6 shows that the residuals from equation 1 are stationary at level, that is, it is integrated of order zero. Thus, the EG cointegration test indicates that the variables in question are cointegrated.

Table 6: Stationarity Test of the Residual from Equation 1

Variable	ADF Test Statistic	PP Test Statistic	KPSS Test Statistic	Order of Integration
Residual	-6.534727(-4.226815)*	-6.556312(-4.226815)*	0.084732(0.216000)**	I(0)

Source: Computed by the Authors. Notes: (a) Mackinnon critical values for the rejection of unit root are in parentheses for columns 2 and 3. For column 4, the figure in parenthesis is asymptotic critical value. (b) Tests include intercept and trend. (c) * implies that they are statistically significant at 1 per cent level of significance; ** implies that it is not statistically significant at 1 per cent level of significance.

To complement the EG test, the Johansen test is conducted. Tables 7a and 7b present the Johansen cointegration test.

Table 7a: Johansen Cointegration Test for the Variables in Equations 1 and 2: Trace Test

Hypothesized No of CE(s)	Eigenvalue	Trace Statistic	5% Critical Value	Prob.**
None *	0.406173	22.81710	15.49471	0.0033
At most 1 *	0.122563	4.576257	3.841466	0.0324

Source: Computed by the Authors. Notes: (a) * indicates rejection of the hypotheses at the 5 per cent level of significance; (b) Trace test indicates 2 cointegrating equations (CEs) at 5 per cent level of significance; and (c) ** indicate Mackinnon-Haug-Michelis (1999) p-values.

Table 7b: Johansen Cointegration Test for the Variables in Equations 1 and 2: Maximum Eigenvalue Test

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	5% Critical Value	Prob.**
None*	0.406173	18.24084	14.26460	0.0112
At most 1*	0.122563	4.576257	3.841466	0.0324

Source: Computed by the Authors. Notes: (a) * indicate rejection of the hypotheses at 5 per cent level of significance; (b) Maximum Eigenvalue test indicates 2 cointegrating equations (CEs) at 5 per cent level of significance; and (c) ** indicates Mac Kinnon-Haug -Michelis (1999) p- values.

As can be seen from Tables 7a and 7b, the results of the Johansen cointegration tests (both the trace test and the Maximum Eigenvalue test) show that the variables in question are cointegrated, thereby, validating the results of the EG test. Therefore, we conclude that there is a long-run or equilibrium relationship between real government revenue and real government expenditure.

To carry out the Granger causality test within an error-correction modeling framework, we specify the following error-correction model equations since the variables are integrated of order one (1) and are cointegrated:

$$\Delta RGEP_t = \alpha_1 + \alpha_2 \Delta RGEP_{t-1} + \alpha_3 \Delta RGREV_{t-1} + \alpha_4 ecm1(-1) + \varepsilon_1 \tag{11}^2$$

$$\Delta RGREV_t = \beta_1 + \beta_2 \Delta RGREV_{t-1} + \beta_3 \Delta RGEP_{t-1} + \beta_4 ecm2(-1) + \varepsilon_2 \tag{12}^3$$

where *ecm1(-1)* and *ecm2(-1)* are one-period lagged values of the residuals from equations 1 and 2 respectively; and Δ is the operator for change.

We have used one-period lag in order to keep the model simple in obedience to Occam's razor principle⁴. Other lag lengths were tried but the one-period lag was found to be optimal based on consideration of a priori expectations vis-à-vis some statistical criteria including the Akaike Information Criterion (AIC). The estimates of equations 11 and 12 are presented in table 8 below.

Table 8: Results of the Estimates of Equations 11 and 12

$\hat{\Delta RGEP}_t = -203.2977 - 0.001740 \Delta RGEP_{t-1} - 0.100254 \Delta RGREV_{t-1} - 0.901779 ecm1(-1)$				
	(1120.339)	(0.347558)	(0.300040)	(0.443442)
	-0.181461*	-0.005007*	-0.334134*	-2.033588*
	0.8572**	0.9960**	0.7405**	0.050**
F-Statistic=3.743867; Prob(F-Statistic)=0.020612; Durbin-Watson Statistic=1.994933				
$\hat{\Delta RGREV}_t = -307.5042 - 0.018755 \Delta RGREV_{t-1} - 0.338536 \Delta RGEXP_{t-1} - 0.180872 ecm2(-1)$				
	(1359.354)	(0.293085)	(0.295402)	(0.333622)
	-0.226214*	-0.063990*	-1.146019*	-0.542146*
	0.8225**	0.9494**	0.2603**	0.5915**
F-Statistic=1.379011; Prob.(F-Statistic)=0.266911; Durbin-Watson Statistic=2.032279				

Source: Computed by the Authors. Notes: (a) The figures in parentheses are the various standard errors associated with the parameter estimates; (b) * are the associated t- statistics; and (c) ** are the associated probabilities

² In this equation, if α_3 or α_4 or both is/are statistically significant, it implies that real government revenue Granger-causes real government expenditure thus supporting the revenue-spend hypothesis.
³ In this equation, if β_3 or β_4 or both is/are statistically significant, it means that real government expenditure Granger-causes real government revenue thus supporting the spend-revenue hypothesis.
⁴ This is known as the principle of parsimony. It says that models/descriptions should be kept as simple as possible unless and until proved inadequate.

From the estimates of equation 11 as shown in the first segment of Table 8, only the parameter estimate associated with the error correction term is statistically significant at 5 per cent level of significance. The rest of the parameter estimates in the equation are not statistically significant at the conventional 1 per cent or 5 per cent level. The foregoing implies that real government revenue Granger-causes real government expenditure only in the long-run. From the estimates of equation 12, as presented in the second segment of Table 8, all the parameter estimates are not statistically significant at either 1 per cent or 5 per cent level. This implies that real government expenditure does not Granger-cause real government revenue.

Based on the results of the estimates of equations 11 and 12, as shown in Table 8, it is evident that there is a unidirectional causality running from real government revenue to real government expenditure. Thus, it is apparent that the revenue-spend hypothesis is the valid hypothesis for Nigeria. This is consistent with the findings of Wolde-Rufael (2008) on Nigeria. It should, however, be noted that Wolde-Rufael (2008) applied a modified version of Granger causality test developed by Toda and Yamamoto (1995) that does not require test for cointegration, whereas this current study tested for and established the existence of cointegration before applying the Granger causality test within the error correction modeling framework. Thus, in addition to identifying the direction of causality between government revenue and government expenditure, the current study established the presence of cointegration among the two variables.

V. Conclusion and Recommendations

This study has shown that there is a long-run or equilibrium relationship between government revenue and government expenditure. The direction of causation runs from government revenue to government expenditure, supporting the revenue-spend or tax-spend hypothesis for Nigeria. The findings indicate that changes in government revenue induce changes in government expenditure.

Empirical findings from this study suggest that: (i) controlling the swings in government revenue, particularly the oil revenue which constitutes over 80 per cent of government revenue, is very necessary in controlling government expenditure and avoiding unsustainable fiscal imbalances in Nigeria; (ii) to increase government spending, efforts should be made to enhance government revenue, but efforts to enhance government revenue should be accompanied with appropriate public expenditure reforms in order to achieve sustainable economic growth, since higher government revenue invites higher government expenditure while the quality of expenditure is central to achieving any

meaningful growth; and (iii) the efforts of government in protecting its spending plans from the swings in crude oil revenue, by using the Budget Benchmark price of oil that is considered to be more realistic and sustainable in the long run than the current market price of oil, are steps in the right direction. The extra revenue that is saved in the excess crude oil account when oil is sold above the Budget Benchmark price helps to sustain government spending when the price of oil falls below the Budget Benchmark price and ensures that the revenues on which spending is planned are not subject to the swings in oil prices (Budget Office of the Federation, 2009).

The plan of the Federal Government to establish a Sovereign Wealth Fund (SWF) is also commendable as that will provide a vehicle for excess crude oil revenue to be prudently invested and managed to yield returns for sustaining government expenditure in the rainy days. This will, however, require transparency, accountability and sound management of the fund. The government should go a step further in intensifying efforts at developing other sources of revenue in order to insulate the economy from the volatility associated with the oil revenue.

References

- Baghestani, H. and McNown, R. (1994), 'Do Revenues or Expenditures Respond to Budgetary Disequilibria?' *Southern Economic Journal*, 61(2), 311-322
- Barua, S. (2005), 'An Examination of Revenue and Expenditure Causality in Bangladesh: 1974-2004'. *Bangladesh Bank of Policy Analysis Unit Working Paper Series WP 0605*
- Bhatia, H.L. (2003), *Public Finance* (24th Revised Ed). New Delhi: Vikas Publishing House PVT Ltd.
- Budget Office of the Federation (2009), *A Citizens' Guide to Understanding the 2009 Federal Budget*, Federal Ministry of Finance, Nigeria
- Carneiro, F.G., Faria, J.R., and Barry, B.S. (2004), *Government Revenues and Expenditures in Guinea-Bissau: Causality and Cointegration*, *World Bank Group Africa Region Working Paper Series No. 65*.
- Central Bank of Nigeria (2004), *Statistical Bulletin*, Vol. 15, December
- _____ (2007), *Statistical Bulletin*, Vol. 18, December
- Chang, T. (2009), 'Revisiting the Government Revenue-Expenditure Nexus: Evidence from 15 OECD Countries based on the Panel Data Approach'. *Czech Journal of Economics and Finance*, 59(2), 165-172.
- Chang, T. and Ho, Y.H. (2002), 'A Note on Testing Tax-and-Spend, Spend-and-Tax or Fiscal Synchronization: The Case of China'. *Journal of Economic Development*, 27(1), 151-160.
- Chebbi, H.E. and Lachaal, L.(2007), 'Agricultural Sector and Economic Growth in Tunisia: Evidence from Cointegration and Error Correction Mechanism'. A paper presented at the I Mediterranean Conference of Agro-Food Social Scientists, Barcelona, Spain, April, 23-25.
- Darrat, A.F.(1998), Tax and Spend, or Spend and Tax? An Enquiry into the Turkish Budgetary Process, *Southern Economic Journal*, 64(4), 940-956.

- Dickey, D.A. and Fuller, W.A. (1979), Distribution of the Estimators for Autoregressive Time Series with a Unit Root. *Journal of the American Statistical Association*, 74, 427-431.
- _____ (1981), Likelihood Ratio Statistics for Autoregressive Time Series with a Unit Root. *Econometrica*, 49(4), 1057-1072.
- Eita, J. H. and Mbazima, D.(2008), The Causal Relationship between Government Revenue and Expenditure in Namibia, *Munich Personal Repec Archive (MPRA) Paper No. 9154*.
- Engel, R. F. and Granger, C.W.J. (1987), Cointegration and Error Correction: Representation, Estimation and Testing. *Econometrica*, 55(2), 251-276.
- Fasano, U. and Wang, Q. (2002), Testing the Relationship between Government Spending and Revenue: Evidence from GCC Countries, *IMF Working Paper WP/02/201*.
- Friedman, M. (1978), The Limitations of Tax Limitation. *Policy Review*, 5(78), 7-14.
- Fuess, S. M., Hou, J.W. and Millea, M. (2003), Tax or Spend, What Causes What? Reconsidering Taiwan's Experience, *International Journal of Business and Economics*, 2(2), 109-119
- Gujarati, D. N. and Porter, D.C. (2009), *Basic Econometrics* (5th Ed), New York: McGraw-Hill.
- Ho, Y. and Huang, C. (2009) Tax-Spend, Spend-Tax, or Fiscal Synchronization: A Panel Analysis of the Chinese Provincial Real Data. *Journal of Economics and Management*, 5(2), 257-272.
- Hondroyannis, G. and Papapetrou, E. (1996), An Examination of the Causal Relationship between Government Spending and Revenue: A Cointegration Analysis. *Public Choice*, 89(3/4), 363-374.
- Idowu, K. O. (2005), A Preliminary Investigation into the Causal Relationship between Exports and Economic Growth in Nigeria. *CBN Economic and Financial Review*, 43(3),29-50.

- Johansen, S.(1988), Statistical Analysis of Cointegrating Vectors. *Journal of Economic Dynamics and Control*, 12, 231-254.
- Johansen, S. and Juselius, K. (1990), Maximum Likelihood Estimation and Inference on Cointegration with Applications to the Demand for Money, *Oxford Bulletin of Economics and Statistics*, 52(2), 169-210.
- Kwiatkowski, D., Phillips, P. C. B., Schmidt, P. and Shin, Y. (1992), Testing the Null Hypothesis of Stationarity against the Alternative of a Unit Root. *Journal of Econometrics*, 54, 159-178.
- Li, X. (2001), Government Revenue, Government Expenditure and Temporal Causality: Evidence from China, *Applied Economics*, 33(4), 485-497.
- Maghyereh, A. and Sweidan, O. (2004), Government Expenditure and Revenue in Jordan, What Causes What? Multivariate Cointegration Analysis, *Social Science Research Network Electronic Paper Collection*.
- Meltzer, A. H. and Richard, S.F. (1981), A Rational Theory of the Size of Government. *The Journal of Political Economy*, 89(5), 914-927.
- Musgrave, R. (1966), Principles of Budget Determination. In: H. Cameron & W. Henderson (Eds) *Public Finance: Selected Readings*. New York: Random House.
- Narayan, P. K. (2005), The Government Revenue and Government Expenditure Nexus: Empirical Evidence from Nine Asian Countries. *Journal of Asian Economies*, 15(6), 1203-1216.
- Narayan, P. K. and Narayan, S. (2006), Government Revenue and Government Expenditure Nexus: Evidence from Developing Countries. *Applied Economics*, 38(3), 285-291
- Obioma, E. C. and Ozughalu, U.M. (2005), Industrialization and Economic Development: A Review of Major Conceptual and Theoretical Issues. In *Challenges of Nigerian Industrialization: A Pathway to Nigeria becoming a Highly Industrialized Country in the Year 2015*, selected papers for the Annual Conference of the Nigerian Economic Society(NES).

- Payne, J. E. (1998). The Tax-Spend Debate: Time Series Evidence from State Budget. *Public Choice*, 95(3-4), 307-320.
- Peacock, A. T. and Wiseman, J. (1961). *The Growth of Public Expenditure in the United Kingdom*. Princeton, NJ: Princeton University Press.
- _____ (1979). Approaches to the Analysis of Government Growth, *Public Finance Review*, 7(1), 3-23.
- Perron, P. (1988). Trends and Random Walks in Macroeconomic Times Series: Further Evidence from a New Approach. *Journal of Economic Dynamics and Control*, 12, 297-332.
- Phillips, P. C. B. (1987). Time Series with a Unit Root. *Econometrica*, 55(2), 277-301.
- Phillips, P. C. B. and Perron, P. (1988), Testing for a Unit Root in Time Series Regression. *Biometrika*, 75(2), 335-346.
- Sanni, H. T. (2007). Fiscal Dominance: Its Impact on Economic Management in Nigeria, A Paper Presented at the Course on Issues in Economic Management organised by the Central Bank of Nigeria (CBN) Learning Centre, Lagos, November.
- Toda, H. Y. and Yamamoto, T. (1995). Statistical Inference in Vector Autoregressions with Possibly Integrated Processes, *Journal of Econometrics*, 66, 225-250.
- Von Furstenberg, G. M., Green, R.J. and Jeong, J.H. (1986). Tax and Spend or Spend and Tax? *Review of Economics and Statistics*, 68(2), 179-188.
- Wahid, A. N. M. (2008). An Empirical Investigation on the Nexus between Tax Revenue and Government Spending: The Case of Turkey. *International Research Journal of Finance and Economics*, 16, 46-51.
- Wolde-Rufael, Y. (2008). The Revenue-Expenditure Nexus: The Experience of 13 African Countries. *African Development Review*, 20(2), 273-283.