Dynamic Nexus between Government Revenues and Expenditures in Nigeria: Evidence from Asymmetric Causality and Cointegration Methods

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Abstract

The incessant fiscal deficit being experienced in different countries across the world has raised concerns about the ability of government to properly manage its revenues and expenditures. This has necessitated a flurry of studies on the relationship between government revenues and government expenditures over time. However, empirical evidence appears to be mixed, even within a country, depending on the methodological approaches adopted by each researcher. In the light of this, this study examines the asymmetric causality and cointegration between revenues and expenditures using aggregated and disaggregated data. The results of linear causality tests of Granger (1969) and Toda-Yamamoto (1995) support fiscal synchronisation hypothesis while those of nonlinear causality test of Diks and Panchenko (2006) support revenue-spending hypothesis. The results further show the existence of asymmetric cointegration between revenues and expenditures in the short-run and the long-run. The final results obtained from the decomposition of revenues into the positive and negative components show that positive change in revenues has a positive effect on expenditures and vice versa for a negative change in revenues. Based on these findings, the panacea proposed to over-reliance in revenues, particularly oil revenues as a determinant of government expenditures, is the proper management of oil revenues and other sources of revenues. The government would also need to diversify the economy so that more revenues could be available to it from other sources to finance its expenditures.

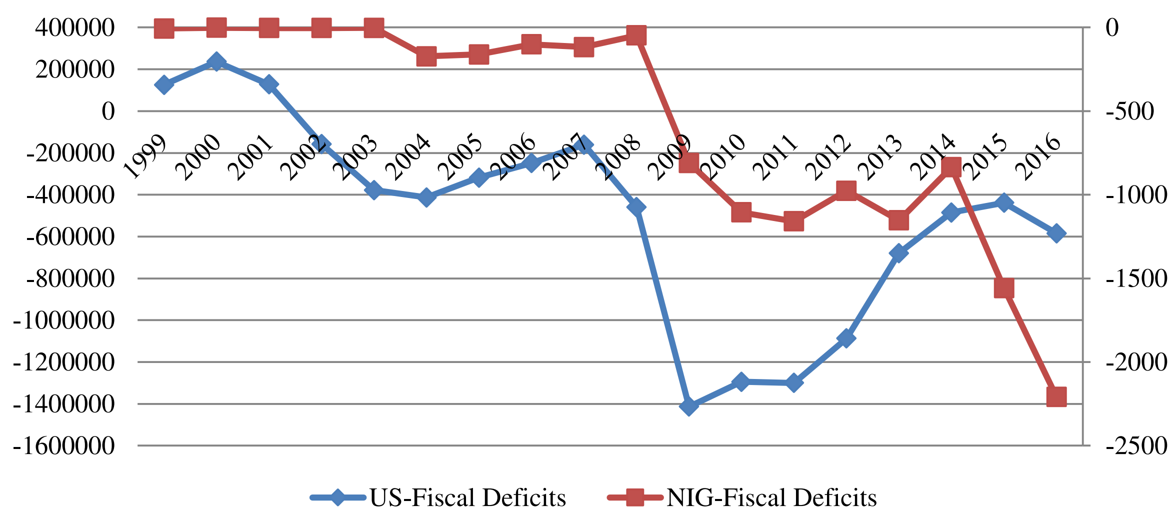
Keywords*: Government Revenues, Government Expenditures, Asymmetries, Causality, Cointegration*

JEL codes: C20; H27; H50

1 Introduction

The equilibrium of government revenues and expenditures determines its fiscal discipline-a term known as fiscal balance or balanced budget. In practice, this is the goal that every government, both in developed and developing countries, has always been striving to achieve. However, the experience has shown that many countries run fiscal deficits - a difference between government revenues and government expenditures over time, particularly a fiscal year.[1] Using the United States of America and Nigeria to represent developed and developing countries respectively, available statistics as depicted in Figure 1 show that the US has been recording fiscal deficits since 2002, which became worsened during the 2007-2009 financial crisis. Similarly, Nigeria has also been recording fiscal deficits since inception of the current democratic government, which began in 1999. Specifically, average fiscal deficits in the US and Nigeria between 1999 and 2016 stood at $495.82 and $3.37 million dollar, respectively.

Figure 1: Fiscal deficits in US and Nigeria (1999-2016)



Source: Computed by the Authors from fiscal deficit data obtained from US Federal Reserve of St Louis and Central Bank of Nigeria Statistical Bulletin, various years

Although overshooting of government expenditures over government revenues is the forerunner of fiscal or budget imbalance or deficit, the consequences thereof vary across countries. However, one immediate effect of fiscal deficits is the rising debt profile of a country

[1] *However, fiscal deficit is more pronounced in developing countries than developed countries.*

facing a chronic fiscal imbalance.[2] This is usually followed by the overwhelming social-economic crises such as rising inflation, slow growth, trade deficit, rising unemployment, crowding out of private investment and lots more (Bernheim, 1989; Ball and Mankiw, 1995; Stiglitz and Walsh, 2008, Nimani,2013; Tešić, Ilić and Đelić, 2014). The consequences of fiscal deficits, however, depend on the sources of fiscal deficit. If fiscal imbalance arises from expending of government expenditure on critical infrastructural facilities that are very germane to the current and future benefits of the economy; such infrastructural facilities can generate enough revenue that will repay the fiscal deficit in the future. This may not portend a danger to the economy in the long-run. However, if the fiscal deficit arises from a sudden fall in the prices of exporting commodities of a country or falling tax revenue or exuberant government spending aimed at securing political gains can spell a doom for a country.[3]

Due to the consequences of fiscal deficit accumulation, economists and policymakers have been interested in studying the dynamics of the relationship between government revenues and expenditures in developed, emerging and developing countries for a very long time. Four hypotheses have served as a compass guiding the direction of research activity in this area. The first hypothesis is known as a revenue-spending hypothesis (tax-spending hypothesis), propounded independently by Buchanan and Wagner (1977) and Friedman (1978). The hypothesis simply implies that getting more revenues by raising taxes will only induce government to increase its spending. Thus, increases in taxes that spur government revenues will eventual result in fiscal deficit. Empirically, this implies a unidirectional nexus running from government revenues to government expenditures. The second hypothesis is called spending-revenue hypothesis and it was postulated by Barro (1974) and Wiseman and Peacock, (1979). The hypothesis stipulates that government expenditures determine or cause government revenues. The underlying intuition behind this hypothesis is that, in times of economic downturn or crisis, government usually gears up its expenditure which may ultimately lead to permanent increase in tax revenue. In this context, the unidirectional causality exists between government revenues and expenditures with the direction of causality running from government expenditures to government revenues. The third hypothesis was proposed by Musgrave (1961) and Meltzer and Richard (1981) and it is called fiscal synchronisation hypothesis. The hypothesis states that both government revenues and expenditures are jointly determined. In other words, the

[2] *Many countries in Europe during and after the global financial crisis experienced rising debt of great magnitude. Some of these countries include Greece, Italy, Spain, Portugal and the host of others*

[3] *In 2014, the price of main exporting commodity of Nigeria, the crude oil price, fell in international market; this created an economic crisis for the country as the economy experienced a recession for the first time in 25 years.*

government takes decisions on revenues and expenditures simultaneously. In this case, fiscal synchronization implies that there is a bidirectional causality between government revenues and expenditures. The last hypothesis is the fiscal neutrality promoted by Baghestani and McNown, (1994). The fiscal neutrality states that there is no causal relation between government expenditures and revenues because institutions separate decisions on revenues and expenditures. In other words, the decisions on revenues are taken by the institution independent of government spending decision.

Along these theoretical propositions, several empirical studies have been conducted across countries in the world, applying different econometric techniques to examine the relationship between government revenues and expenditures (Payne, 2003 for an extensive review of the literature). From these studies, several natures of relationships between government revenues and expenditures have been examined. This ranges from linear to nonlinear causality or nexus between the two variables. With regard to linear relationship, most prominent issues addressed in the literature are the issues of causality and cointegration, using econometric techniques such as Granger causality, Toda-Yamamoto causality, panel causality, vector error correction model (VECM) based causality, Johansen system cointegration, Engle-Granger cointegration, error correction model (ECM), autoregressive distributed lag (ARDL) bounds testing and vector autoregressive method (VAR) and lots more. In the case of nonlinear modelling of revenue-expenditure nexus, researchers have used different nonlinear methods such as threshold autoregressive (TAR), Momentum TAR, threshold autoregressive error correction method and lots more. The use of different econometric techniques and other factors such as each country's economic characteristics such as size of the government, dynamics of economic environment, institutional structure, custom or culture among others, have been the driver of flurries of mixed empirical findings (see details in the table of literature review in the appendix).

The current study focuses on the Nigerian economy. As in the case of other countries, several empirical studies have been conducted to examine the relationship between government revenue and expenditure in Nigeria, albeit, with mixed findings (Ogujiuba and Abraham, 2012; Aregbeyen and Ibrahim, 2012a, 2012b; Aworinde, 2013; Nwosu and Okafor, 2014; Ibrahim, 2017; Abdulrasheed, 2017; Yinusa and Adedokun, 2017). Apart from the mixed findings, most of the studies conducted so far assume linear nexus between revenues and expenditures, applying different econometric techniques. Specifically, Aregbeyen and Ibrahim (2012a) used ARDL method to examine the relationship between government expenditure and revenue and found support for revenue-spending hypothesis. Aregbeyen and Ibrahim, (2012b), however, employed

Granger-causality test to document a fiscal synchronisation hypothesis. Fiscal synchronisation hypothesis was also reported by the study carried out by Ibrahim, (2017) using the causality approach with structural break. Applying ECM, Nwosu and Okafor (2014) established the existence of the spending-revenue hypothesis. The same spending-revenue hypothesis was documented by Abdulrasheed (2017) while Yinusa and Adedokun (2017), in line with Arugbeyen and Ibrahim (2012) also found support for revenue-spending hypothesis. The only study akin to our study is the study conducted by Aworinde, (2013), albeit his study is limited to testing the nonlinear causality between government revenues and expenditures only at the aggregate level. In our case, we do not only examine nonlinear causality but also consider the case of asymmetric cointegration between government revenues and expenditures at both aggregate and disaggregate levels.

As aforementioned, this study aims at examining the case of asymmetric causality and cointegration between government revenues and expenditures in Nigeria. In the economic parlance, it is believed that macroeconomic variables usually behave nonlinearly over the course of the economic cycle (Neftci. 1984). Based on this, Ewing et al. (2006) provides possible explanations for the existence of asymmetric relationship between government revenues and expenditures. Aside this, the movement of oil prices in the international market determines the behaviour of government revenues and expenditures in Nigeria. In Nigeria, the large part of revenues accrued to the government come from the sales of crude oil whose prices are subject to demand for and supply of crude oil in the international market. As the oil prices fluctuate (ups and downs), so also is the revenue realised from the sales of crude oil as well as the government expenditure (see Raifu and Raheem, 2018). Thus, it is expedient to re-examine the revenue-expenditure nexus nonlinearly or asymmetrically.

The study adds to the existing studies in the following ways. First, it considers the case of nonlinear causality and cointegration between government revenues and expenditures. In the case of causality, for thorough robustness, the study combines both linear and nonlinear causality tests using different estimation methods such as the usual Granger-causality test (Granger, 1969), Toda-Yamamoto non-causality (Toda and Yamamoto, 1995) and nonlinear causality test proposed by Diks and Panchenko in 2006. Although Diks and Pachenko, (2006) has been applied by Aworinde (2013) to model nonlinear causality between revenues and expenditures in Nigeria, albeit at aggregate level without taking into consideration the disaggregated data such capital expenditure, recurrent expenditure, oil revenue and nonoil revenue. Concerning the nonlinear cointegration, this study makes use of nonlinear cointegration method based on Shin, Yu and Greenwood-Nimmo (2014) nonlinear ARDL. This method has advantages over other cointegration methods previously used in the literature because apart from the fact that it is capable of performing asymmetric cointegration, it also captures asymmetric short-run and long-run impacts of revenue on expenditure and vice versa. Thus, the method helps in shedding light on whether any of the hypotheses hold in the short-run and the long-run asymmetrically. Our study is the first study that will employ NARDL to model the dynamic relationship between revenues and expenditures. Other studies have used TAR and MTAR (Zapf and Paynes, 2009; Saunoris and Payne, 2010; Tiwari and Mutascu, 2016; Phiri, 2016). Second, in this study, we also make use of both aggregated and disaggregated data on revenues and expenditures.[4] This is to prove the consistence of the results and to provide robustness for this study.

The rest of this study is structured as follows. Section 2 describes the data used and the methodology. Section 3 presents the empirical findings. Section 4 concludes with policy recommendations.[5]

2 Materials and Methodology

2.1 Materials

This study uses annual data from 1970 to 2011. The source of the data is the Central Bank of Nigeria. The main variables extracted include total government revenue, oil revenue, non-oil revenue, total government expenditure, recurrent expenditure, capital expenditure, consumer price index and real Gross Domestic Product. These variables (total government revenue, oil revenue, nonoil revenue, total government expenditure, recurrent expenditure and capital expenditure) are scaled by gross domestic product, measured in real term and in million naira. The descriptive statistics of these variables are presented in Table 1. Following the summary statistics is the Figure 2 that shows the trend of the government revenues and expenditures scaled by GDP over times. From the figure, it can be observed that both government revenues and expenditures co-move. In other words, when revenues increase, government expenditures tend to soar and vice versa.

Table 1: Descriptive Statistics Results

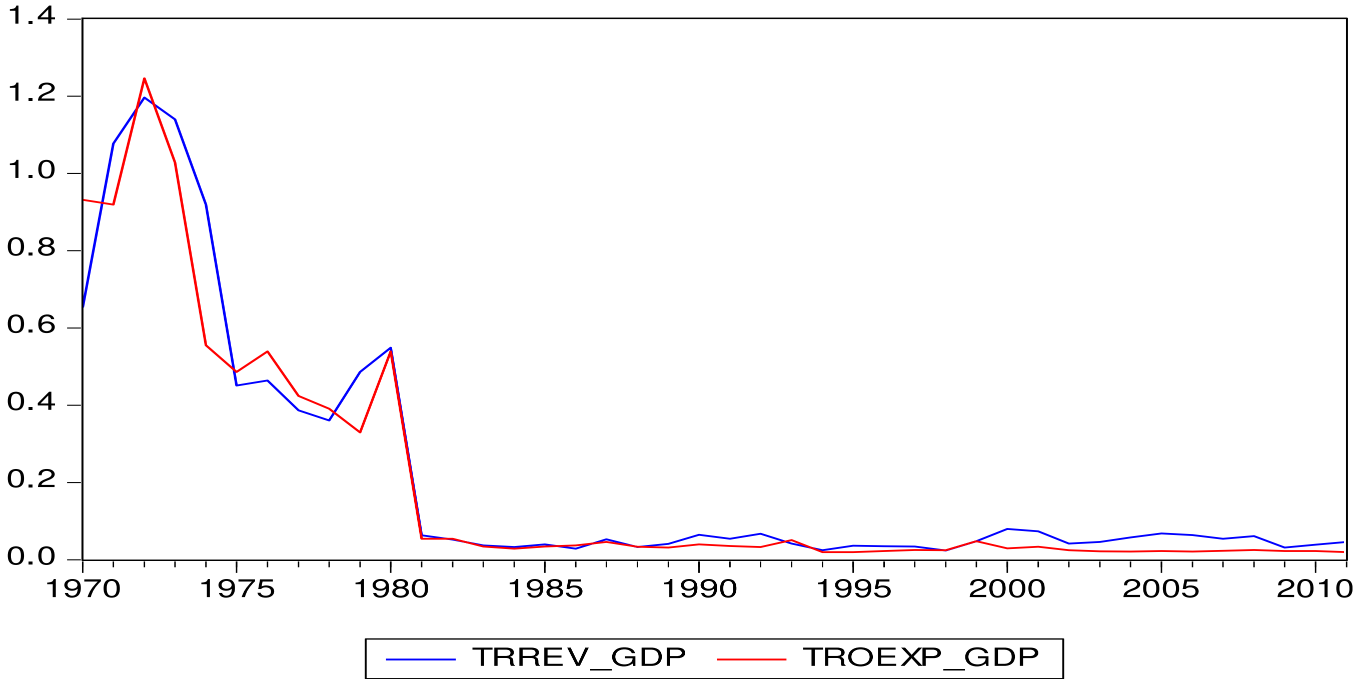
Variable	TRREV	TROEXP	ROILREV	RNONOILREV	RRECEXP	RCAPEXP	RGDP	ROSURPDEF
Mean	16156.69	10281.34	12590.37	3558.96	5916.10	4285.96	281644.80	-1997.64

[4] *Disaggregated data of revenues include oil and nonoil revenues while that of the expenditure include recurrent and capital expenditure.*
[5] *The literature review is summarised in the Table put in appendix to this study.*

Median	12579.14	10136.98	9570.59	2895.03	5284.10	3881.42	266464.60	-2141.28
Maximum	40844.19	17521.17	33907.74	7968.84	13828.82	11549.20	834161.80	5794.84
Minimum	2756.52	3930.00	724.35	1404.66	2414.83	754.78	4219.00	-6412.82
Std. Dev.	10482.87	3825.36	9232.74	1674.69	2707.44	2178.03	228538.70	2231.32
Skewness	1.02	0.26	1.11	1.16	0.92	1.02	0.73	0.83
Kurtosis	2.92	2.03	3.23	3.54	3.40	4.37	2.78	5.00
Jarque-Bera	7.27	2.09	8.78	10.00	6.26	10.54	3.80	11.85
Probability	0.03	0.35	0.01	0.01	0.04	0.01	0.15	0.00
Observations	42	42	42	42	42	42	42	42

Source: Authors' computation.
Note: TRREV, TROEXP, ROILREV, RNONOILREV, RRECEXP, RCAPEXP, RGDP and ROSURPDEF denote real total revenue, real total expenditure, real oil revenue, real nonoil revenue, real recurrent expenditure, real capital expenditure, real GDP and real overall fiscal surplus/deficit respectively. All variables are measured in Million Naira.

Figure 2: Trends of government revenues and expenditures from 1970-2011



2.2 Methodologies

2.2.1 Linear Granger Causality Test Framework

This study aims at examining nonlinear causality and contegration between government revenues and expenditures in Nigeria. To begin with, there is need to ascertain the stationarity properties of the variables by using appropriate unit root test methods. Thus, this study uses Augmented Dickey-Fuller and Phillips-Perron unit root tests. The basic requirement for estimating causality and cointegration is that the variables must be stationary, particularly integrated of order 1, however, the method we employ in this study allows for cointegration of any order except order 2. Assume that the variables are stationary, say R_t and E_t,[6] following Granger (1969), R_t strictly Granger causes E_t if and only if the past values R_t have significant power to predict, in linear form, the current values of E_t, from the past values of E_t. According to Diks and Panchenko, (2006) and Bekiros and Diks, (2008), if the past values R_s and E_s $\forall\ s \leq t$, contain the information sets denoted by $F_{R,t}$ and $F_{\mathrm{E},t}$ and that the equivalent in distribution is denoted as $\sim$, then that R_t will Granger-cause E_t if, $k \geq 1$ can be specified as:

$$(E_{t+1},...,E_{t+k}) \mid (F_{R,t}, F_{\mathrm{E},t}) \sim (E_{t+1},...,E_{t+k})\ F_{E,t} \quad (1)$$

Specifically, the estimable Granger causality test in the content of VAR framework can be re-specified as:

$$R_t = \sum_{i=1}^{n} \lambda_i R_{t-i} + \sum_{j=1}^{n} \delta_j E_{t-j} + \varepsilon_t \quad (2)$$

$$E_t = \sum_{j=1}^{n} \alpha_j E_{t-j} + \sum_{i=1}^{n} \beta_i R_{t-i} + u_t \quad (3)$$

In modern econometric software, the null hypothesis of Granger non-causality is either accepted or rejected based on the probability value or T-value or standard error. Using the probability value, if the probability value is less than 5%, the assumption of Granger non-causality is rejected, otherwise it is accepted. For robustness, this study complements the Granger causality method by using another causality test known as Toda-Yamamoto non causality test in the spirit of Toda and Yamamoto (1995). For advantages of Toda-Yamamoto approach to causality over Granger-causality, interested readers should see Toda and Yamamoto (1995, pp. 226 and 227).

2.2.2 Nonlinear Granger Causality Test Framework

In the case of nonlinear causality, we follow Diks and Panchenko (2006) framework religiously. The method is a nonparametric approach to causality. Suppose we are interested in testing the causality between R_s and E_s using appropriate p and q lags of the two variables. Consider the vectors of R_s and E_s given respectively as:

[6] Here R stands for revenues while E denotes expenditures except otherwise stated.

$$R_t^p = (R_{t-p+1},...,R_t)$$
$$E_t^q = (E_{t-q+1},...,\mathrm{E}_t) \quad (4)$$

Where $p,q \geq 1$. The null hypothesis here is that R_t^p does not Granger-cause E_t^q. In other words, the null hypothesis implies that R_t^p does not contain additional information about the future value of expenditure denoted as E_{t+1}. This null hypothesis is specified as:

$$H_o : E_{t+1} \mid (R_t^p; E_t^q) \sim E_{t+1} \mid E_t^q \quad (5)$$

According to Bekiros and Diks (2008), the null hypothesis is a statement about the invariant of the vector of random variables $W_t = (R_t^p, E_t^q, Z_t)$ where $Z_t = E_{t+1}$. If the time indexes are dropped and assume that $p = q = 1$, the joint probability density function of $f_{R,\mathrm{E},\mathrm{Z}}(\mathrm{r,e,z})$ and its marginals must satisfy the following relation:

$$\frac{f_{R,E,Z}(\mathrm{r,e,z})}{f_E(\mathrm{e})} = \frac{f_{R,\mathrm{E}}(r,e)}{f_E(e)} = \frac{f_{\mathrm{E,Z}}(\mathrm{e,z})}{f_E(e)} \quad (6)$$

The equation 6 implies that R and Z are independent conditionally on $E = e$ for each fixed value of e. Based on this, the null hypothesis can be re-specified as:

$$q = E(f_{R,E,Z}(R,E,Z) f_E(E) - f_{R,E}(R,E)\mathrm{f}_{E,Z}(\mathrm{E,Z}) \quad (7)$$

According to Diks and Panchenko (2006), q can be estimated using the equation 8 below.

$$T_n(\varepsilon_n) = \frac{(\mathrm{n}-1)}{n(n-2)} \sum_i (\hat{f}_{R,Z,E}(R_i, Z_i, \mathrm{E}_i) \hat{f}_Y(\mathrm{E}_i) - \hat{f}_{R,E}(R_i, E_i) \hat{f}_{E,Z}(E_i, Z_i) \quad (8)$$

Where n is the sample size and $\hat{f}_W$ is a local density estimator of a d_W - variate random vector W at W_i based on indicator functions $I_{ij}^W = I(\| W_i - W_j \| < \varepsilon_n)$ defined by

$$\hat{f}_W(\mathrm{W}_i) = \frac{(2\varepsilon_n)^{-d_W}}{n-1} \sum_{j.j \neq i} I_{ij}^W \quad (9)$$

Where $I(.)$ is the indicator function and ε_n is the bandwidth that depends on n, the sample size. If $p = q = 1$ and $\varepsilon_n = C\pi^{-\beta}(\mathrm{C} > 0, \frac{1}{4} < \beta \frac{1}{3})$, then the test statistics in equation satisfies

$$\sqrt{n}\frac{T_n(\varepsilon_n) - q)}{S_n} \xrightarrow{D} N(0,1) \quad (10)$$

According to Diks and Panchenko (2006) $\xrightarrow{D}$ is the convergence in distribution and S_n represents an estimator of the asymptotic variance of $T_n(.)$. Practically, the theoretical framework above is applied to the joint residuals of the variables in the estimated VAR model. It is believed that application of Granger causality method to the VAR residuals should be nonlinear as the linear relationship is contained in the estimated coefficients of VAR (Rocher, 2017).

2.2.3 Nonlinear Autoregressive Distributed Lag Framework

This study employs bounds testing approach to cointegration in NARDL framework. The NARDL framework was developed by Shin, Yu and Greenwood-Nimmo in 2014 to capture the asymmetric relationship between dependent variable and independent variable(s). The framework begins by first specifying the long-run model given as:[7]

$$E_t = \alpha_0 + \alpha_1(\mathrm{R}_t^+) + \alpha_2(\mathrm{R}_t^-) + \varepsilon_t \tag{11}$$

Where α_1 and α_2 are the coefficients of the long-run model to be estimated. R_i^+ and R_i^- are the partial sum of positive and negative change of government revenues. The partial decomposition of government revenues into positive and negative changes can be derived as:

$$\begin{aligned} R_t^+ &= \sum_{j=1}^{t} \Delta R_j^+ = \sum_{j=1}^{t} \max(\Delta R_j, 0) \\ R_t^- &= \sum_{j=1}^{t} \Delta R_j^- = \sum_{j=1}^{t} \min(\Delta R_j, 0) \end{aligned} \tag{12}$$

The NARDL model can then be specified as follows:

$$\Delta E_t = \beta_0 + \beta_1 E_{t-1} + \beta_2^+ R_{t-1}^+ + \beta_3^- R_{t-1}^- + \sum_{i=1}^{p} \delta_t \Delta E_{t-1} + \sum_{i=0}^{q} (\phi_t^+ \Delta R_{t-1}^+ + \phi_t^- \Delta R_{t-1}^-) + \upsilon_t \tag{13}$$

Where p and q are the lag orders, $\beta_0, \beta_1, \beta_2^+$ and β_3^- are the long-run coefficient parameters to be estimated, $\sum_{i=0}^{q} \phi_t^+$ and $\sum_{i=0}^{q} \phi_t^-$ are the short-run asymmetric distributed lag coefficients. The long-run positive and negative effects of government revenues on government expenditures are denoted as: $\eta_2 = -\frac{\beta_2^+}{\beta_1}$ and $\eta_3 = -\frac{\beta_3^-}{\beta_1}$ respectively. The null hypothesis of no long-run effects of positive and negative of government revenues on expenditures is tested by the equality relation

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[7] *The model specification rests on the assumption that there is unidirectional causality between government revenues and government expenditures with the direction of causality running from government revenues to government expenditures. However, this is subject to change based on the outcome of Granger causality results, particularly nonlinear Granger causality on the results.*

given as: $\frac{\beta_2^+}{\beta_1} = \frac{\beta_3^-}{\beta_1}$ against the alternative hypothesis given as: $\frac{\beta_2^+}{\beta_1} \neq \frac{\beta_3^-}{\beta_1}$. If the null hypothesis is rejected in favour of the alternative hypothesis, it implies that there is asymmetric long-run relationship between government revenues and expenditures. In same vein, the null hypothesis stipulating no short-run asymmetric effects of government revenues on expenditure can be specified as $\sum \phi_i^+ = \sum \phi_i^-$ against alternative hypothesis given as: $\sum \phi_i^+ \neq \sum \phi_i^-$. If the null hypothesis is rejected in favour of alternative hypothesis, it means that the short-run relation exists between government revenues and expenditures. To confirm both short-run and long-run, Wald test is used after estimation of NARDL. Post estimation tests such as normality test, ARCH LM heteroscedasticity test, serial autocorrelation test and Ramsey Reset test for the appropriate model specification are carried out. CUSUM and CUSUM squared for model stability are also performed.

3 Empirical Findings

This section presents the estimated results. We begin by conducting preliminary unit root tests with the goal to ascertain the stationarity properties of the variables used in this study. This is done so that spurious regression can be avoided. Apart from this, conducting cointegration test requires that the unit root must first be performed on the variables and they must be stationary at order one. Two unit root tests were performed and they include Augmented Dickey Fuller and Phillips-Perron unit root tests (Dickey and Fuller, 1981; Phillips and Perron, 1988). Both unit root tests have the same null hypothesis. They are only different in terms of statistical tests. While ADF uses the tau statistic test, PP uses the Z-statistic test. The null hypothesis is that the data series have unit roots against which the alternative hypothesis which states that the data series are stationary is tested. The results of the unit root tests are presented in Table 2. The results show that the variables of interest, revenues and expenditures, contain unit roots. This implies that the variables are not stationary. They are only made stationary after they are first differenced. Therefore, the cointegration test can be performed. However, the nonlinear cointegration we conducted based on bounds testing NARDL approach to cointegration permits the series to be integrated of any order, either order one or order two, and not necessarily order one.

Table 2: Results of Unit Root Tests

Variable	Augmented Dickey-Fuller		Phillips-Perron		Decision
	Level	**First Difference**	**Level**	**First Difference**	
TRREV_GDP	-1.60 (0.4758)	-6.17*** (0.0000)	-1.45 (0.5494)	-6.24*** (0.0000)	I(1)
TROEXP_GDP	-2.35 (0.1616)	-6.95*** (0.0000)	-3.95*** (0.0039)	-7.19*** (0.0000)	I(1)

ROILREV_GDP	-1.76 (0.3956)	-6.75*** (0.0000)	-1.82 (0.3656)	-7.82*** (0.0000)	I(1)
RNONOILREV_GDP	-2.87** (0.0577)	-4.96*** (0.0002)	-6.91*** (0.0000)	-5.28*** (0.0001)	I(0)
RRECEXP_GDP	-11.93 (0.0000)***	-2.98** (0.0461)	-8.61*** (0.0000)	-4.47*** (0.0009)	I(0)
RCAPEXP_GDP	-1.39 (0.5774)	-9.22 ***(0.0000)	-1.86 (0.3477)	-9.89*** (0.0000)	I(1)

Source: Authors' Computation
****, ** and * represent 1%, 5% and 10% level of significance respectively.***
The values in parentheses are probability values

3.1 Linear Causality Tests Results

The next test conducted is the causality test. The first causality test performed is the Granger causality test in the spirit of Granger (1969). The test is predicated on the assumption that there is no causality between the series. This is tested against the alternative assumption that there is causality between the series. Based on Akaike Information Criterion, 7 maximum lag lengths were used. The results show that there exists a bidirectional relationship between government expenditures and revenues both at aggregate and disaggregate levels. In other words, government expenditures and revenues tend to strengthen each other through bidirectional feedback (Roy, Sahoo and Kamaiah, 2000). This finding supports the fiscal synchronisation hypothesis. To test the robustness of these results, we employed Toda-Yamamoto (1995), the results are ditto as in the case of Granger-causality test. Thus, supporting the previous studies that found the existence of fiscal synchronisation in Nigeria and other countries (Ibrahim, 2017 Nigeria; Takumah, 2014 Ghana; Mehrara, Pahlavani and Elyasi, 2011 41 Asian countries; Chang and Chiang, 2009 15 OECD countries; Al-Zeaud, 2014 Jordan; Gounder, Narayan and Prasad, 2007 Fiji at aggregate level; Li, 2001 China; Phiri, 2016 South Africa; Owoye, 1995 G7 countries except for Japan and Italy). This implies that the decision to raise revenues and spending of the revenues are taken simultaneously. In other words, it implies that in Nigeria, when government designs spending programs either to pay workers' salaries or invest in infrastructural facilities such as roads, hospitals, schools and so on, it also simultaneously designs or chooses the revenues packages to finance the spending programs.

Table 3: Linear Causality: Granger Causality Test Results

Null Hypothesis	Granger-Causality	Toda-Yamamoto
TROEXP_GDP does not Granger Cause TRREV_GDP	32.50*** (0.0000)	229.40*** (0.0000)
TRREV_GDP does not Granger Cause TROEXP_GDP	50.77*** (0.0000)	46.27*** (0.0000)
RRECEXP_GDP does not Granger Cause TRREV_GDP	46.35*** (0.0000)	64.46*** (0.0000)
TRREV_GDP does not Granger Cause RRECEXP_GDP	19.56*** (0.0000)	28.22*** (0.0002)
RCAPEXP_GDP does not Granger Cause TRREV_GDP	27.93*** (0.0000)	233.08*** (0.0000)
TRREV_GDP does not Granger Cause RCAPEXP_GDP	37.75*** (0.0000)	299.57*** (0.0000)
TROEXP_GDP does not Granger Cause ROILREV_GDP	46.69*** (0.0000)	321.88*** (0.0000)
ROILREV_GDP does not Granger Cause TROEXP_GDP	94.65*** (0.0000)	23.41*** (0.0000)
RRECEXP_GDP does not Granger Cause ROILREV_GDP	52.62*** (0.0000)	104.65*** (0.0000)
ROILREV_GDP does not Granger Cause RRECEXP_GDP	26.23*** (0.0000)	56.15*** (0.0000)
RCAPEXP_GDP does not Granger Cause ROILREV_GDP	30.55*** (0.0000)	100.99*** (0.0000)

ROILREV_GDP does not Granger Cause RCAPEXP_GDP	117.46*** (0.0000)	267.21*** (0.0000)
TROEXP_GDP does not Granger Cause RNONOILREV_GDP	15.49*** (0.0000)	82.47*** (0.0000)
RNONOILREV_GDP does not Granger Cause TROEXP_GDP	105.79*** (0.0000)	525.13*** (0.0000)
RRECEXP_GDP does not Granger Cause RNONOILREV_GDP	7.42*** (0.0002)	56.40*** (0.0000)
RNONOILREV_GDP does not Granger Cause RRECEXP_GDP	19.31*** (0.0000)	94.91*** (0.0000)
RCAPEXP_GDP does not Granger Cause RNONOILREV_GDP	15.74*** (0.0000)	84.62*** (0.0000)
RNONOILREV_GDP does not Granger Cause RCAPEXP_GDP	177.55*** (0.0000)	395.83*** (0.0000)

Source: Authors' Computation
****, ** and * represent 1%, 5% and 10% level of significance respectively***
The values in parentheses are probability values

3.2 Nonlinear Causality Results

The results of nonlinear causality between revenues and expenditures at aggregated and disaggregated levels are presented in Table 4. The nonlinear is carried out on the residuals of the VAR model in the spirit of Diks and Panchenko (2006). Using Akaike Information Criterion, 7 maximum lags were selected. The results show in all the versions of the models we considered, there is only nonlinear unidirectional relationship between government revenues and expenditures with the direction of causality running from government revenues to expenditures. For instance, in the model of total government revenues and expenditures, the causality runs from total revenues to total expenditures, implying that government revenues nonlinearly Granger-causes expenditures. There is an absence of nonlinear causality between total government revenues and recurrent expenditures. However, there is a weak nonlinear bidirectional causality between government revenues and capital expenditures. The causality between capital expenditures and total government revenues is only significant at 10% level of significance while that between total government revenues and capital expenditures is significant at 1% level.

We also considered whether there is a nonlinear causality between oil revenues and total expenditures on the one hand and oil revenues and components of total expenditures (capital and recurrent expenditures) on the other hand. The results show that nonlinear unidirectional causality exists between oil revenues and total expenditures with the direction of causality running from oil revenues to total expenditures. As in the case of total revenues and recurrent expenditure, there is no nonlinear causality between oil revenues and recurrent expenditure. However, only nonlinear unidirectional causality exists between oil revenues and capital expenditures, with the direction of causality running from oil revenues to capital expenditure. With regard to nonlinear causality between nonoil revenues and total government expenditure and its components, there is unidirectional causality with the direction of causality running from nonoil revenues and total expenditures and its components. Thus, it can be submitted that when nonlinear causality is considered between government revenues and expenditures and their components, only revenue-spending hypothesis is valid. This finding corroborates the finding documented by Aworinde (2013) who examined the nonlinear causality between government revenues and expenditures on aggregated data in Nigeria. In fact, considering the nonlinear causality between revenues and expenditures reveals the reality of the Nigerian economy. As previously mentioned, government relies on the revenues to finance its expenditure. Since most of the revenues come from oil revenues realised from the sales of crude oil in the international market, whenever there is a shortage of revenues usually caused by falling oil prices, government expenditures also suffer.

Table 4: Nonlinear Causality Results

Null Hypothesis	Causality
TROEXP_GDP does not Granger Cause TRREV_GDP	0.74 (0.6434)
TRREV_GDP does not Granger Cause TROEXP_GDP	4.36** (0.0108)
RRECEXP_GDP does not Granger Cause TRREV_GDP	1.56 (0.2376)
TRREV_GDP does not Granger Cause RRECEXP_GDP	1.59 (0.2283)
RCAPEXP_GDP does not Granger Cause TRREV_GDP	2.52* (0.0669)
TRREV_GDP does not Granger Cause RCAPEXP_GDP	7.90*** (0.0006)
TROEXP_GDP does not Granger Cause ROILREV_GDP	0.24 (0.9684)
ROILREV_GDP does not Granger Cause TROEXP_GDP	5.05*** (0.0059)
RRECEXP_GDP does not Granger Cause ROILREV_GDP	0.63 (0.7263)
ROILREV_GDP does not Granger Cause RRECEXP_GDP	0.67 (0.6954)
RCAPEXP_GDP does not Granger Cause ROILREV_GDP	2.11 (0.1225)
ROILREV_GDP does not Granger Cause RCAPEXP_GDP	3.79** (0.0210)
TROEXP_GDP does not Granger Cause RNONOILREV_GDP	1.09 (0.4208)
RNONOILREV_GDP does not Granger Cause TROEXP_GDP	3.43** (0.0264)
RRECEXP_GDP does not Granger Cause RNONOILREV_GDP	1.54 (0.2388)
RNONOILREV_GDP does not Granger Cause RRECEXP_GDP	6.00** (0.0028)
RCAPEXP_GDP does not Granger Cause RNONOILREV_GDP	0.57 (0.7678)
RNONOILREV_GDP does not Granger Cause RCAPEXP_GDP	3.72** (0.0198)

Source: Authors' Computation
****, ** and * represent 1%, 5% and 10% level of significance respectively***
The values in parentheses are probability values

3.3. Nonlinear Cointegration Results

Having determined the stationarity properties of our variables and the issues of causality between them, we performed nonlinear cointegration test using a bounds testing approach to cointegration in NARDL framework developed by Shin, Yu and Greenwood-Nimmo, (2014). However, we base our cointegration test on the results obtained from the nonlinear causality test conducted above. Since in most of the nonlinear causality tests, we only documented revenue-spending hypothesis, the cointegration test, therefore, focuses on examining whether there is nonlinear long-run relationship between government revenues and expenditures (and their components). Using bounds testing approach to cointegration, Pesaran et al. (2001) provide criteria for determining whether the variables are cointegrated or not. The basic assumption based on this cointegration technique is that there is no long-run relationship between government revenues and expenditures against which the alternative hypothesis is tested postulating the existence of long-run relationship between the two variables. To make a decision, the computed F-statistic is compared with the lower bound and upper bound critical values provided in Pesaran et al.'s table. If the computed F-statistic value is less than the lower bound critical value, it means that there is no cointegration, that is, there is no long-run relationship between government revenues and expenditures. If it falls within the lower and upper bounds critical values, no precise decision can be made. However, if the computed F-statistic value falls above the upper bound critical value, then there is long-run relationship between government revenues and expenditures. The results of the cointegration test are presented in Table 5. In all the models we considered, it is evidence that there is long-run relation between the government revenues and expenditures because the calculated F-statistic values are greater than the upper bound critical values.

The next step after ascertaining the existence of the cointegration between government revenues and expenditures is to estimate the error correction model. The error correction model integrates the short-run dynamics into the long-run equilibrium to show how quickly the disequilibrium in the economy in the short-run adjusts towards the long-run equilibrium. A priori, the coefficient of the error correction term must be less than one, negatively signed and statistically significant. The results of error correction model are also presented in Table 5. The results corroborate the findings from the cointegration test. The coefficients of error correction terms in all the models are correctly signed and also statistically significant, albeit with varying degrees of convergence from the short-run towards the long-run equilibrium. However, as it is shown in the table by the values of the coefficients of the error terms in all models, the speed of adjustment from the short-run to the long-run is fast and take less than one and half years to restore the equilibrium. Several studies have also found the existence of cointegrating relationship between government revenues and expenditures (see Narayan, 2005; Mehrara, Pahlavani and Elyasi, 2011; Takumah, 2 014; Tiwari and Mutascu, 2016; Phiri, 2016; Baharumshah, Jibrilla, Sirag, Ali and Muhammad, 2016).

Having established that government revenues and expenditures are cointegrated and there is a possibility of adjusting towards the long-run equilibrium when there is disequilibrium in the economy, attention is herewith drawn to testing of the existence of asymmetries between government revenues and expenditures in the short-run and the long-run. This is done using a Wald test method after the estimation of NARDL. The results are also reported in Table 5. In all the models, the results show that there is short-run and long-run asymmetric relationship between government revenues and expenditures. The findings confirm the nonlinear Granger-causality test results documented above. Therefore, based on these findings, it can be submitted that the relationship between government revenues and expenditures is not linear in Nigeria, either at aggregate or disaggregate level. Our finding is supported by the finding documented by Irandoust, (2018) who found the asymmetric relationship between government expenditures and revenues and vice versa using a hidden cointegration technique proposed by Granger and Yoon, (2002). However, our results differ from the one documented by Zapf and Paynes, (2009) who did not find the asymmetric relationship between government revenues and spending using TAR and MTAR methods.

At this juncture, the results of impacts of positive and negative government revenues on government expenditures are considered in the short-run and the long-run. This is presented in Table 5. Beginning with total revenue and total expenditure model, it can be inferred that positive (an increase in) government revenue spurs its expenditure in the short-run and the long-run. However, the positive effect declines over time. Specifically, an increase in revenue by 1% will result in an increase in government expenditure by 3.12% and 0.43% in the short-run and the long-run respectively. As expected, negative government revenue reduces expenditure in both runs; however, the impact is greater in the long-run than the short-run. Precisely, if revenue accrued to government reduces by 1%, its expenditure will decline in the short-run and the long-run by 0.50% and 0.68% respectively. Because we did not find asymmetric Granger causality between total revenue and recurrent expenditure, we only considered the asymmetric relationship between total revenue and capital expenditure. The results, as presented in Table 5, show that an increase in revenue only has a positive effect on the capital expenditure in the short-run. In the long-run any increase in revenue to the government leads to a reduction in capital expenditure, albeit insignificant. However, in the short-run and the long-run, a reduction in revenue by 1% reduces its expenditure by 0.31% and 0.25% respectively.

With regard to the asymmetric effect of oil revenue on government expenditure and its components, particularly capital expenditure, the results show, as in the case of total revenue, that oil revenue also has a positive and significant effect on the government expenditure in the short-run and the long-run, with the impact being greater in the long-run. Precisely, government expenditure will rise by 2.11% and 0.87% in the short-run and the long-run respectively, if oil revenue realised by government surges up by 1%. On the other hand, a reduction in oil revenue also has a devastating effect on the government expenditure. As shown in the table, when the oil revenue contracts by 1%, government expenditure also contracts by 0.68% and 1.14% in the short-run and the long-run respectively. Similarly, positive and negative changes in oil revenue have opposite effect on capital expenditure. While positive change in oil revenue increases government expenditure, negative revenue reduces capital expenditure in both runs. Thus, an increase in oil revenue by 1%, capital expenditure will lead to increase in capital expenditure by 0.35% and 0.51% in the short-run and the long-run respectively. Conversely, when oil revenue reduces by 1%, there will be a reduction in capital expenditure by 0.57% and 0.83% in the short-run and the long-run respectively.

Concerning the nonoil revenue, we found the nonlinear unidirectional causality, running from nonoil revenue to expenditures (total expenditure, recurrent expenditure and capital expenditure). Therefore, we considered the asymmetric effects of nonoil revenue on all expenditures. As in the case of total revenue and oil revenue, positive change in nonoil revenue has a positive effect on the total expenditure, albeit only in the long-run. As shown in the table, an increase in nonoil revenue by 1% will result in an increase in total expenditure by 3.67% in the long-run. A negative change in nonoil revenue by 1% connotes a reduction in total expenditure by 5.19% and 4.06% in the short-run and the long-run respectively. When the case of asymmetric effect of nonoil revenue on recurrent expenditure is considered, it is found that a positive change in nonoil revenue has a negative and significant effect in the short-run. The effect is, however, turned positive in the long-run in which a change in positive nonoil revenue by 1% spurs the recurrent expenditure by 0.57% in the long-run. However, when nonoil revenue dwindles, it has a negative effect on the recurrent expenditure in both runs. More explicitly, when nonoil revenue declines by 1%, recurrent expenditure also declines by 1.46% and 1.40% in the short-run and the long-run respectively. Finally, a positive change in nonoil revenue only has a significant positive effect on the capital expenditure in the long-run while its reduction leads to a falling capital expenditure in both runs. Concisely, it is found that a 1% positive change in nonoil revenue gingers capital expenditure by 2.31% in the long-run. Contrariwise, a reduction in nonoil revenue by 1% results in capital expenditure dwindled by 2.98% and 2.57% in the short-run and long-run respectively.

Finally, the results of diagnostic tests are also presented in Table 5. The diagnostic tests performed include normality test, serial correlation test, arch LM test, Ramsey Reset test and CUSUM and CUSUM square test. The results yield mixed findings. However, in general term, none of the models suffers from serial correction and heteroskedasticity problems as shown by Breusch-Godfrey Serial Correlation LM and ARCH LM tests respectively. Most of the models are normally distributed and well specified as depicted by Jacque-Bera and Ramsey Reset test results respectively. CUSUM and CUSUM square tests also produce mixed results.

Table 5: NARDL Cointegration Results

	Total Revenues		**Oil Revenues**		**Nonoil Revenues**		
Variable	**Total Exp. (3 lags)**	**Cap. Exp. (2 lags)**	**Total Exp. (3 lags)**	**Cap. Exp. (3 lags)**	**Total Exp. (3 lags)**	**Recur. Exp. (1 lag)**	**Cap. Exp. (4 lags)**
	Short-run Results						
D(TROEXP_GDP(-1))			0.24*** (0.0000)		0.26*** (0.0000)		
D(TROEXP_GDP(-2))					0.11** (0.0100)		
D(RCAPEXP_GDP(-1))		-0.24** (0.0139)					0.17*** (0.0001)
D(TRREV_GDP_POS)	-0.07 (0.7350)	0.18 (0.5336)					
D(TRREV_GDP_POS(-1)	3.12*** (0.0000)	0.79*** (0.0044)					
D(TRREV_GDP_POS(-2))	-1.84*** (0.0000)						
D(TRREV_GDP_NEG)	0.50*** (0.0000)	0.31*** (0.0003)					
D(TRREV_GDP_NEG(-1))	-0.25*** (0.0000)						
D(ROILREV_GDP_POS)			-0.16 (0.2081)	0.35*** (0.0004)			
D(ROILREV_GDP_POS(-1)			2.11*** (0.0000)				
D(ROILREV_GDP_POS(-2))			-1.60*** (0.0000)				
D(ROILREV_GDP_NEG			0.68*** (0.0000)	0.57*** (0.0000)			
D(ROILREV_GDP_NEG(-1))			-0.57*** (0.0000)				
D(ROILREV_GDP_NEG(-2))			0.09*** (0.0365)				
D(RNONOILREV_GDP_POS					0.38 (0.4014)	-1.26** (0.0152)	0.31 (0.2784)
D(RNONOILREV_GDP_POS(-1)					-2.99*** (0.0000)		-3.20*** (0.0000)
D(RNONOILREV_GDP_POS(-2)					3.17*** (0.0000)		2.98*** (0.0000)
D(RNONOILREV_GDP_NEG)					5.19*** (0.0000)	1.46*** (0.0000)	3.15*** (0.0000)
D(RNONOILREV_GDP_NEG(-1))					-0.12 (0.3009)		-0.22*** (0.0002)
D(RNONOILREV_GDP_NEG(-2))					-0.58*** (0.0000)		
ECM_{t-1}	-0.71*** (0.0000)	-0.74*** (0.0001)	-0.88*** (0.0000)	-0.69*** (0.0000)	-1.15*** (0.0000)	-1.05*** (0.0000)	-0.96 (0.0000)
	Long-run Results						
$cons\tan t$	0.66*** (0.0000)	0.44*** (0.0000)	0.44*** (0.0000)	-1.68*** (0.0000)	2.02*** (0.0000)	0.85*** (0.0000)	1.28*** (0.0000)
TRREV_GDP_POS	0.43*** (0.0019)	-0.09 (0.5899)					
TRREV_GDP_NEG	0.68*** (0.0000)	0.25*** (0.0002)					
ROILREV_GDP_POS			0.87*** (0.0000)	0.51*** (0.0004)			

ROILREV_GDP_NEG			1.14*** (0.0000)	0.83*** (0.0000)			
RNONOILREV_GDP_POS					3.67*** (0.0000)	0.57*** (0.0038)	2.31*** (0.0000)
RNONOILREV_GDP_NEG					4.06*** (0.0000)	1.40*** (0.0000)	2.57*** (0.0000)
$WALD-SR$	64.90*** (0.0000)	60.29*** (0.0000)	71.16*** (0.0000)	86.18*** (0.0000)	94.05*** (0.0000)	76.12*** (0.0000)	105.11*** (0.0000)
$WALD-LR$	22.79*** (0.0000)	23.07*** (0.0000)	49.09*** (0.0000)	43.83*** (0.0000)	38.15*** (0.0000)	53.23*** (0.0000)	29.36*** (0.0000)
Bound-Testing F-Test	22.08***	6.86***	18.33***	4.65*	210.56***	10.02***	225.65***
	Diagnostic Results						
R^2	0.9851 (98.51%)	0.9193 (91.93%)	0.9926 (99.26%)	0.9401 (94.10%)	0.9963 (99.63%)	0.9885 (98.85%)	0.9928 (99.28%)
$AdjR^2$	0.9810 (98.10%)	0.9011 (90.11%)	0.9898 (98.98%)	0.9352 (93.52%)	0.9947 (99.47%)	0.9872 (98.72%)	0.9904 (99.04%)
$F-stat$	240.12 (0.0000)	50.45 (0.0000)	360.71 (0.0000)	193.53 (0.0000)	629.75 (0.0000)	755.27 (0.0000)	427.03 (0.0000)
DW	2.32	1.54	2.51	1.96	1.81	1.95	2.02
NMT	1.27 (0.5287)	1.27 (0.5295)	8.29 (0.0158)	1.14 (0.5655)	5.90 (0.0522)	6.69 (0.0352)	0.63 (0.7281)
SCT	1.16 (0.3271)	2.81 (0.0768)	2.44 (0.1076)	0.46 (0.6364)	0.55 (0.5831)	1.25 (0.2992)	0.04 (0.9589)
LMT	0.64 (0.4279)	2.46 (0.0512)	0.23 (0.6369)	3.55 (0.0672)	0.73 (0.3971)	1.07 (0.3084)	0.74 (0.3947)
RRT	2.38 (0.1338)	1.39 (0.2470)	0.70 (0.4094)	0.72 (0.4021)	44.87 (0.0000)	1.07 (0.3062)	64.87 (0.0000)
$CS(CS2)$	NS (S)	NS (S)	NS (S)	S(S)	S(S)	NS (S)	S(S)

Source: Authors' computation
*******, ** and * represent 1%, 5% and 10% level of significance respectively****
CS and CS2 represent CUSUM and CUSUM square respectively

4 Conclusion and Policy Implications

This study examines the asymmetric relationship between government revenues and expenditures over the period of 1970-2011. By applying nonlinear causality and cointegration in the spirit of Diks and Panchenko, (2006) and Shin, et al (2014) respectively, it is found that revenue-spending hypothesis prevailed over fiscal synchronisation hypothesis when the nonlinear causality approach is applied on aggregated and disaggregated data. The finding is corroborated by cointegration technique based on a NARDL approach to cointegration. In fact, decomposing the revenues into positive and negative components and examining their impacts on the expenditures reveal that positive revenues have positive impacts on the expenditures and as expected, negative revenues have negative effects on the expenditures. These findings show the asymmetric nexus between government revenues and expenditures in Nigeria whether the aggregated or disaggregated data are considered. The findings further confirm the dependence of government on the revenues it is able to realise to finance its expenditures on social-economic facilities. A cursory observation of the trend of revenue and expenditure data over time depicts this asymmetric behaviour between the two variables. When government revenues decline, government expenditures also decline in Nigeria and vice versa. This situation occurs because about 90% of government revenues come from the sales of crude oil in the international market.[8] When the oil prices nosedive due to whatever reasons, government expenditures also decline. This ultimately constrains the government in terms of its financing capacity because the government budget formation and implementation rest almost on the availability of revenues from the sales of crude oil (Raifu and Raheem, 2018). The over-reliance on oil revenues has been the bane of economic growth and development over the years in Nigeria. Thus, diversification of the economy to other neglected sectors of the economy that can generate more revenues to government appears to be a panacea to the precarious economic conditions that the country is usually subjected to whenever there is oil price crisis in the international market. Besides, oil revenues should be judiciously utilised during the oil price booms when oil revenues pour-in like the rain as it is usually done in some oil-producing countries such as Norway, United Arab Emirates, Saudi Arabia and Qatar to mention but a few.

[8] *Even though non-oil revenues contribute meagerly to the overall total revenues in Nigeria, this does not, however, connote that non-oil revenues are not important to the Nigerian economy. Whenever oil revenues suffer devastating blow due to a decline in oil prices in the international market, non-oil revenues play a supportive or cushioning role in the economy, attenuating the negative effect of oil revenue shortage on the economy.*

A Table of Summary of Literature Review

S/N	Author	Topic	Scope	Method	Finding
1	Zapf and Paynes, 2009	Asymmetric modelling of the revenue-expenditure nexus: evidence from aggregate state and local government in the US 1959 to 2005	US aggregate state and local government data	TAR and MTAR cointegration methods	No asymmetric relationship between revenues and spending. However, asymmetric error correction method support spending-tax revenue hypothesis
2	Westerlund, Mahdavi and Firoozi, 2011	The tax-spending nexus: Evidence from a panel of US state–local governments	Panel of 50 US State-local government. 1963-1997	Panel error correction model	Support tax-spending hypothesis meaning that the size of state and local governments are driven by resources not expenditure demand
3	Holtz-Eakin, Newey and Rosen, 1989	The revenues-expenditures nexus: Evidence from local government data	171 municipal governments. 1972-1980	VAR	Revenue-tax hypothesis
4	Tiwari and Mutascu, 2016	The revenues-spending nexus in Romania: a TAR and MTAR approach	Romania 1999:1-2012:1	TAR and MTAR	Spending-Tax hypothesis with long-run cointegration adjustment
5	Garcia, 2012	The Revenues-Expenditures Nexus: a Panel Data Analysis of Spain's Regions (Running title: Tax - Expenditure, Expenditure-tax or Fiscal Synchronization)	Spain's Regions 1987-2003	VAR	Revenue-spending hypothesis
6	Aregbeyen and Ibrahim, 2012	Testing the Revenue and Expenditure Nexus in Nigeria: An Application of the Bound Test Approach	Nigeria 1970-2008	ARDL	Tax-Spending Hypothesis
7	Fasano and Wang, 2002	Testing the Relationship Between Government Spending and Revenue: Evidence from GCC Countries	Oil Producing GCC Countries 1975-2000	Cointegration and error correction model	Revenue-spending hypothesis
8	Saunoris and Payne, 2010	Tax more or spend less? Asymmetries in the UK revenue–expenditure nexus	UK, 1955-2009	MTAR	Spending-Tax Hypothesis
9	Owoye, 1995	The causal relationship between taxes and expenditures in the G7 countries: cointegration and error-correction models	G7 Countries 1961-1990	Cointegration and ECM	Fiscal synchronisation hypothesis except Japan and Italy (Tax-Spending Hypothesis)
10	Mutascu, 2017	The tax–spending nexus: evidence from Romania using wavelet analysis	Romania 1991:M1-2015:M5	Wavelet approach	Individual taxes methods under reforms should be employed to counter budget deficit in the short-run
11	Mutascu, 2016	Government revenues and expenditures in the East European economies: A bootstrap panel granger causality approach	Bulgaria, Czech Republic, Hungary, Slovania, Estomia, Slovak Republic, Lativa, Lithuania, Poland and Romania 1995-2012	bootstrap panel granger causality	Bulgaria: expenditure-spending hypothesis Czech Republic, Hungary and Slovania: Spending-Revenue Hypothesis, Slovak Republic: Fiscal synchronization hypothesis. Lativa, Lithuania, Poland and Romania: Institutional Hypothesis
12	Phiri, 2016	Asymmetries in the revenue–expenditure nexus: new evidence from South Africa	South Africa 1960:1-2016:2	MTAR-TEC	Fiscal synchronisation hypothesis Long-run elasticity between revenue and expenditure is less than1
13	Li, 2001	Government revenue, government expenditure, and temporal causality: evidence from China	China 1950-1997	VECM and VAR	Fiscal Synchronisation Hypothesis
14	Joulfaian and Mookerjee, 1991	Dynamics of government revenues and expenditures in industrial economies	22 Industrial economies (OECD Countries) 1961-1986	VAR	Spending reduction is important to reducing budget deficits and controlling government size
15	Gounder, Narayan and Prasad, 2007	An empirical investigation of the relationship between government revenue and expenditure: The case of the Fiji Islands	Fiji Island	Granger Causality and Johansen Cointegration	Short-run cointegration exist between revenue and expenditure At aggregate level: expenditure-revenue hypothesis At disaggregate level: fiscal synchronisation hypothesis
16	Dahlberg and Johansson,1998	The revenues-expenditures nexus: panel data evidence from Swedish municipalities	256 Swedish municipalities 1974-87	PVAR	Expenditure-Revenue Hypothesis
17	Mohanty and Mishra, 2017	Cointegration between government expenditure and revenue: Evidence from India	India 1980-81-2013-14	Jonansen cointegration method	Revenue-Expenditure hypothesis
18	Al-Zeaud, 2014	The Causal Relationship between Government Revenue and Expenditure in Jordan	Jordan 1990-2011	Granger causality and VECM test	Fiscal synchronisation hypothesis
19	Chang and Chiang, 2009	Revisiting the government revenue-expenditure nexus: Evidence from 15 OECD countries based on the panel data approach	15 OECD Countries 1996-2006	Panel Cointegration and Causality	Fiscal-Policy synchronisation
20	Ibrahim, 2017	*Government expenditure-revenue nexus reconsidered for Nigeria: Does structural break matter*	Nigeria 1970-2015	Lee and Strazicich (2003 & 2004) unit root test; Toda-Yamamoto modified Wald causality test	Causality method without structural break: Fiscal synchronization hypothesis Causality method with structural break: spending-revenue hypothesis
21	Narayan and Narayan 2006	Government revenue and government expenditure nexus: evidence from developing countries	12 developing countries Vary based on each country	Toda-Yamamoto Causality test	Tax-and-spend hypothesis: Mauritius, El Salvador, Haiti, Chile and Venezuela. Spend-Tax hypothesis: Haiti No causality: Peru, South Africa, Guatemala, Uruguay and Ecuador

22	Narayan, 2005	The government revenue and government expenditure nexus: empirical evidence from nine Asian countries	Asian Countries Vary based on each country	ARDL and VECM	Cointegration exists in three out of nine countries considered. Indonesia, Singapore, Sri Lanka: Tax-spending hypothesis for short-run Nepal: Tax-spending hypothesis both short-run and long-run Indonesia and Sri Lanka: spending-tax hypothesis in the long-run India, Malaysia, Pakistan, Philippines and Thailand: Neutrality (Insitution Separation Hypothesis
23	Abdulrasheed, B., 2017	Causality between government expenditure and government revenue in Nigeria	Nigeria 1986-2015	ECM	Spending-Revenue hypothesis
24	Mehrara, Pahlavani and Elyasi, 2011	Government revenue and government expenditure nexus in Asian countries: Panel cointegration and causality	40 Asian Countries 1995-2008	Kao Panel Cointegration	Cointegration exist between revenue and expenditure Fiscal synchronization hypothesis
25	Yinusa and Adedokun, 2017	Fiscal Synchronisation or Institutional Separation: An Examination of Tax-Spend Hypothesis in Nigeria	Nigeria 1980-2014	Granger-Causality Block exogeneity VECM	Tax-Spending hypothesis
26	Obeng, 2015	*A Causality Test of the Revenue-Expenditure Nexus in Ghana*	Ghana 1980-2013	OLS, VAR and Granger-causality test	Revenue-expenditure hypothesis
27	Takumah, 2 014	*The Dynamic Causal Relationship between Government Revenue and Government Expenditure Nexus in Ghana*	Ghana 1986-2012	ARDL	Cointegrated Fiscal synchronization hypothesis

Source: Compiled by the Author

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