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Evaluation of government income-spending hypothesis nexus in Nigeria: Application of the bound test approach

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Abstract

This study is a review of the relationship and dynamic interactions between government revenue and expenditure in Nigeria over the period 1981 to 2012. The analytical technique of Autoregressive Distributed Lag (ARDL) bound test as was exploited. From the results, it is obvious that there is evidence of fiscal synchronization between the fiscal variables. The policy implication of the findings of this study is that government should diversify its sources of revenue. This would ensure moving away from a single product economy to a multi product economy. It is believed if this is done, returns and impact of the non oil sector on government spending and the economy in both the short and long run would be much significant. Furthermore, the government should not make spending-tax decisions in isolation of tax-spend decisions. This is because the joint determination of revenues and expenditures is appealing as long as it effectively restrains the budget deficit. This means that efforts to enrich sources of revenue should be complemented by reductions in spending by Nigeria.

Keywords

Revenue, Expenditure, Government, Bound Test, Nigeria

1. Introduction

Modern governments provide a variety of services through the budget. Such include the provision of economic and social infrastructure, defence, maintenance of law and order, establishment of pension schemes, etc. The extent of government involvment in providing goods and services is subject to spatia-temporal variations. The scope of its functions depends, among other things, on the political and economic orientation of the members of a particular society at a given point in time, as well as their needs and aspirations (Adesola 1995: 13). The performance or discharge of these functions engenders governmental fiscal operations.

The fiscal operation of government is basically a concept in duality. On the one hand, the provision of goods and services invariably entails commitment of expenditures. On the other, government has to raise revenues in order to meet its expenditure requirements. Thus, revenue and expenditure describe the gamut of government fiscal operations. However, when fiscal out-turns manifest deficits, public borrowing becomes inevitable. Borrowing, therefore, is a supplementary instrument of government finances.

In Nigeria, government expenditures have in the main consistently exceeded government revenues throughout most of the past decades since 1970 except for 1971, 1973-74, 1979, and 1995-96 periods. The government's purportedly commitment in pursuing rapid economic development programmes as embodied in various developmental plans in Nigeria largely accounts for the fiscal deficits incurred. The expanded role of the public sector resulted in rapid growth of government expenditures. Government budget deficits over the years have not impacted positively on the economy. Such fiscal deficits tend to reduce national savings which invariably affect economic development. The options available to the government to stimulate economic growth in this situation are to reduce government expenditures or raise revenues through increase in tax. These two options can help to reduce the budget deficit(s).

Hence, a sound fiscal policy is important to promote price stability and sustain growth in output and employment. Fiscal policy is regarded as an instrument that can be used to lessen short-run fluctuations in output and employment in many debates of macroeconomic policy. It can also be used to bring the economy to its potential level. If policymakers understand the relationship between government expenditure and government revenue, without a pause government deficits can be prevented. Hence, the relationship between government expenditure and government revenue has attracted significant interest; due to the fact that the relationship between government revenue and expenditure has an impact on the budget deficit. The causal relationship between government revenue and expenditure has remained an empirically debatable issue in the field of public finance, (Eita & Mbazima, 2008). Over the Past three decades, a large number of studies have investigated the relationship between government revenue and government expenditure. This is not surprising given the importance of the subject matter in public economics; particularly the direction of causality has important implications for budget deficits. Thus, understanding the relationship between government revenue and government expenditure is important from a policy point of view, especially for a country like Nigeria, which is suffering from persistent budget deficits.

The focus of this research therefore, is to evaluate the relationship between federal government revenue composition and spending composition in Nigeria. To achieve this broad objective, the long-run relationships and dynamic interactions between the government revenues and expenditures in Nigeria over the period 1981-2012 was examined. This study employed annual data that covers the period from 1981-2012 for Nigeria. The data were sourced from the Central Bank of Nigeria Statistical Bulletin (volume 23) 2012. For the avoidance of doubt, the variables of interest are government capital expenditure, government recurrent expenditure, government oil revenue and non oil revenue revenues.

2. Theoretical and Empirical Literature Review

2.1. Theories of Expenditure Growth and Government Revenue

The relationship between government expenditure and revenue can be categorized under five major hypotheses which are being examined as follows:

(a) The tax-and-spend hypothesis: The causal relationship between revenues and government expenditure is a classic problem of Public Economics. The tax-spend hypothesis was initially formulated by Friedman (1978) and Buchanan and Wagner (1978), but these authors differed in their perspectives. While Friedman argues that changes in government revenues lead to changes in government expenditures, thereby having a positive relationship or direction, Buchanan and Wagner (1978) postulate that the causal relationship is negative. Friedman suggests that tax increases will only lead to expenditure increases resulting in the inability to reduce budget deficits. In order words; raising taxes will lead to more government spending and hence to fiscal imbalances. Cutting taxes is, therefore, the appropriate remedy to budget deficits.

(b) Buchanan and Wagner hypothesis (1978): share the same view that tax lead government expenditure but that the direction of causal relationship is negative as earlier stated. Their point of view is that, with a cut in taxes the public will perceive that the cost of government programs has fallen. As a result they will demand more programs from the government which if undertaken will result in an increase in government spending. Higher budget deficits will then be realized since tax revenue will decline and government spending will increase. Their remedy for budget deficits is therefore an increase in taxes, (Moalusi, 2004).

(c) Peacock-Wiseman's Model: The displacement effect hypothesis expounded by T. Peacock and Jack Wiseman in their well-known 1961 monograph "The Growth of Public Expenditure" in the United Kingdom remains one of the most reliable explanations. According to Peacock and Wiseman's hypothesis, government spending tends to evolve in a step-like pattern, coinciding with social upheavals, notably wars. This spend-tax hypothesis suggests that changes in government expenditures lead to changes in government revenues. Peacock and Wiseman (1979) argue that temporary increases in government expenditures due to "crises" can lead to permanent increases in government revenues often called the "displacement effect".

(d) The Fiscal Synchronization hypothesis: The third hypothesis known as fiscal synchronization suggests bidirectional causation between revenues and spending (Musgrave, 1966; Meltzer and Richard, 1981). The fiscal synchronization hypothesis which was suggested by Meltzer and Richard (1981), asserts that there is a feedback relationship between revenue and expenditure and both interact interdependently. It postulates that governments take decisions about revenues and expenditures simultaneously by analyzing costs and benefits of alternative programs. Therefore, this view precludes unidirectional causation from revenue to spending or from spending to revenue.

(e) The fiscal neutrality school: Proposed by Baghestani and McNown (1994) believe that none of the above hypotheses describes the relationship between government revenues and expenditure. Government expenditure and revenues are each determined by the long run economic growth reflecting the institutional separation between government revenues and expenditure that infers that revenue decisions are made independent so as expenditure decisions.

2.2. Empirical Literature Review

Considerable empirical works have been done using different econometric methods, studies have reached different results. Different studies have focused on different countries, time periods, and have used different proxy variables for government revenue and expenditure.

Tan Juat Hong (2009), investigates the causal relationships between government spending and revenue for Malaysia. The study uses annual data, a Johansen cointegration test and an error-correction model. A preliminary test shows that government revenue and expenditure are cointegrated. While empirical results support the spend-and-tax hypothesis for Malaysia. Thus, concluding that fiscal policy may not be effective enough to curb the rising budget deficits over the long term and may even reduce private saving and investment. Extensive expenditure reforms through fiscal synchronisation were suggested.

Yaya Keho (2009), uses annual data for the period of 1960 - 2005 to investigate the causal relationship between government revenues and spending in Côte d'Ivoire and adopting a cointegration test analysis. The empirical findings reveal a positive long-run unidirectional causality running from revenues to expenditures.

Zapf and Payne (2009), evaluated the long-run association between aggregate state and local government revenue and expenditures in the case of US by using Engle Granger cointegration test associated with the Threshold Autoregressive (TAR) and Momentum Threshold Autoregressive (MTAR) cointegration techniques and error correction model (ECM). They indicated that state and local government expenditures reflect the budget disequilibrium in the long run, while in the short run; state and local government expenditures have a significant effect on the state and local government revenues.

Gil-Alana (2009), examined the association between the US government expenditures and revenues applying fractional cointegration and ECM techniques. His result found no evidence of cointegration at any degree while at a structural break in 1973 fractional cointegration is found.

Hong (2009), for Malaysia, uses a Johansen cointegration test and an error-correction model for causality and annual data over the period 1970 to 2007. His results show that government revenue and expenditure are cointegrated and the spend-and-tax hypothesis is confirmed.

Chaudhuri and Sengupta (2009), by using an error-correction model and Granger causality test for southern states in India reported that the tax-spend hypothesis is supported by the analysis and also the spend-tax hypothesis is valid for some states.

Ho and Huang (2009), tested the hypothesis of tax-spend, spend-tax, or fiscal synchronization applies to the 31 Chinese provinces using panel data covering 1999 to 2005. Their results based on multivariate panel error correction models show that there is no significant causality between revenues and expenditures in the short run. However, in the long-run, bidirectional causality exists between revenues and expenditures, thus supporting the fiscal synchronization hypothesis for Chinese provinces over this sample period. Recently for developed country,

Afonso and Rault (2009), investigated causality between government spending and revenue in the EU by adopting new econometric technical bootstrap panel analysis in the period 1960-2006. Spend and-tax causality is found for Italy, France, Spain, Greece, and Portugal, while tax-and-spend evidence is present for Germany, Belgium, Austria, Finland and the UK, and for several EU New Member States.

Chang and Chiang (2009) consider a sample of 15 OECD countries test for the long-run relationship between government revenues and government expenditures over the period 1992-2006. They find evidence of bidirectional causality between government revenues and expenditures, supporting the fiscal synchronization hypothesis by using panel cointegration, and panel Granger causality test techniques.

Stallmann and Deller (2010), analyzed the impact of constitutional Tax and Expenditure Limits (TELs) on growth rates of convergence using a panel techniques in a case of US data from 1987 to 2004, suggested that state revenue and expenditure limits have negatively affected income growth and slowed down convergence.

Khalid .I. Bataineh (2010), examined the causal relationship between government revenues and expenditures of the Jordan government over the period from 1980 to 2008 using cointegration and error-correction methodology. The empirical results showed a unidirectional causality running from expenditures to revenues (spend–revenue hypothesis), suggesting the preference of controlling or reducing expenditures.

Mohsen Mehrara et al. (2011), Investigate the relationship between government revenue and government expenditure in 40 Asian countries for the period of 1995 to 2008. A cointegration relationship between government revenue and government expenditure by applying Kao panel cointegration test was adopted. The causality tests indicate that there is a bidirectional causal relationship between government expenditure and revenues in both the long and the short run confirming fiscal synchronization hypothesis.

Omo Aregbeyen and Taofik Mohammed (2012), examines the long-run relationships and dynamic interactions between the government revenues and expenditures in Nigeria over the period 1970 to 2008. And adopting the technique of Autoregressive Distributed Lag (ARDL) bound test in their study. From their results, it was evident that there is the existence of a long run relationship between government expenditures and revenues when government expenditure is made the dependent variable.

However, when revenue was made the dependent variable, no evidence of a long run relationship was found. The tax-spend hypothesis was therefore confirmed. Attributing this perhaps, to oil revenue dominance in Nigeria's government revenue profile and fiscal operations over time.

Emelogu C. Obioma, and Uche M. Ozughalu (2012), empirically analyzed 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). They employed 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.

Samson A. A. and Ani E.C. (2012), examined the structure of federal government revenue and expenditure in Nigeria, from 1961-2010. Using Granger causality test through cointegrated vector autoregression (VAR) methods; their result shows that there is a bi-directional causality between government revenue and government expenditure. The outcome of the bi-directional causality between government revenue and expenditure supports the fiscal synchronization hypothesis. They therefore, suggest that the federal government should not make spending-tax decisions in isolation of tax-spend decisions. This is because the joint determination of revenues and expenditures is appealing as long as it effectively restrains the budget deficit. They therefore recommend that efforts at enhancing sources of revenue should be accompanied by reductions in government spending for Nigeria.

3. Methodology and Estimation Technique

The study method adopted in this work is the new Auto-Regressive Distributed Lag (ARDL) bounds testing approach developed by Pesaran *et al*. (2001). The justification for the selection of this approach is base on the advantages of the ARDL for testing the existence of a cointegrating relationship either in the short-run or long-run. Pesaran *et al*. (2001) developed a new Auto-Regressive Distributed Lag (ARDL) bounds testing approach for testing the existence of a cointegration relationship.

The bound testing approach has certain econometric advantages in comparison to other single cointegration procedures (Engle and Granger, 1987; Johansen, 1988). Firstly, endogeneity problems and inability to test hypotheses on the estimated coefficients in the long-run associated with the Engle-Granger (1987) method are avoided. Secondly, the long and short-run parameters of the model in question are estimated simultaneously. Thirdly, the econometric methodology is relieved of the burden of establishing the order of integration amongst the variables and of pre-testing for unit roots. The ARDL approach to testing for the existence of a long-run relationship between the variables in levels is applicable irrespective of whether the underlying regressors are purely $I(0)$, purely $I(1)$, or fractionally integrated. Finally, as put forward in Narayan (2005), the small sample properties of the bounds testing approach are believed to be superior to that of multivariate cointegration. The approach, therefore, is a modification of the Auto-Regressive Distributed Lag (ARDL) framework while overcoming the inadequacies associated with the presence of a mixture of $I(0)$ and $I(1)$ regressors in a Johansen-type framework.

3.1. Data Descriptions

In this study, GREXP is defined as Government Recurrent Expenditure: this can be referred to as the running cost the government incurs every year. They include expenses on defence and internal security, education, health, transfers, communication, etc. GCEXP is Government Capital Expenditure; this includes expenses such as: construction of roads, bridges, power plants, houses, etc. NOREV is Non OIL revenue the government makes from sectors other than oil such as: agriculture, mining, tourism, manufacturing, etc. OREV is the Oil Revenue accruing annually to the government every year. It encompasses all revenue the government makes from the mining of crude oil by its agencies and multinational corporations and private indigenous investors in the oil sector. Such of the revenue are in form of royalties and licences fees on the exploration of crude oil. The annual time series data used is sourced from the Central Bank of Nigeria Statistical Bulletin volume 23, December 2012 and covers the period from 1981 to 2012.

3.2. Estimation Technique

To obtain healthy results, we utilize the ARDL approach to determine the existence of long and short-run relationships. ARDL is extremely useful because it allow us to analyze the presence of equilibrium in terms of long-run and short-run dynamics without losing long-run information. Following the literature review above, the relationship between government spending and revenue can be expressed in four functional forms as shown below. The rationale is to show how the various disaggregated components of revenue and expenditure are interrelated. Thus, there are four possible functional forms which are expressed as:

$$GREXP = f(GCEXP, NOREV, OREV) \quad (1)$$

$$GCEXP = f(GREXP, NOREV, OREV) \quad (2)$$

$$NOREV = f(GREXP, GCEXP, OREV) \quad (3)$$

$$OREV = f\,(GREXP,\ GCEXP,\ NOREV) \tag{4}$$

Where:

GREXP = Government Recurrent Expenditure

GCEXP = Government Capital Expenditure

NOREV = Non Oil Revenue

OREV = Oil Revenue

To empirically analyze the above functional forms, the ARDL model specification is used to show the long-run relationships and dynamic interactions between government spending and government expenditure using Autoregressive Distributed Lag (ARDL) co-integration test popularly known as the bound test. This method is adopted for this study for three reasons. Firstly, compare to other multivariate co-integration methods, the bounds test is a simple technique because it allows the co-integration relationship to be estimated by OLS once the lag order of the model is identified. Secondly, adopting the bound testing approach means that pretest such as unit root test is not required. This implies that the regressors can be either I(0), purely I(1) or mutually co-integrated. Thirdly, the long-run and short run parameters of the models can be simultaneously estimated. The procedure will however crash in the presence of I(2) series.

This study apply the bounds test procedure by modelling the long-run equation first as a general vector autoregressive (VAR) model of order *p,* in z_t :

$$Z_t = \mu_0 + \Psi_t + \sum_{i=1}^{p} \partial_i Z_{t-1} + \varepsilon_t, \quad t = 1, 2 \ldots\ldots\ldots\ldots, T \tag{1}$$

Where:

μ_0 = vector of intercepts

The corresponding Vector Error Correction Model (VECM) for Eq. (1) is derived as:

$$\Delta Z_t = \mu_0 + \Psi_t + \gamma_i Z_{t-1} + \sum_{i=1}^{p} \lambda_i Z_{t-1} + \varepsilon_t \tag{2}$$

Where; Δ represent the first difference operator, γ and λ represents vector matrices that contain the long-run multipliers and short-run dynamic coefficients of the VECM respectively. Z_t is a vector of X_t and Y_t variables respectively. Y_t ($GREXP_t$, $GCEXP_t$, $NOREV_t$, $OREV_t$,) is the regressand and X_t ($GREXP_t$, $GCEXP_t$, $NOREV_t$, $OREV_t$,) is a vector matrix of a set of regressors. As a condition, Y_t must be an I(1) variable, while X_t regressors can either be I(0) and I(1). ε_t is a stochastic error term. Assuming unrestricted intercepts and no trends, Eq. (2) becomes an unrestricted error correction model (UECM) as:

$$\Delta Z_t = \mu_0 + \gamma_i Z_{t-1} + \sum_{i=1}^{p} \lambda_i Z_{t-1} + \varepsilon_t \tag{3}$$

Incorporating the variables of interest, the UECM of Eq. 3 becomes:

$$\Delta GREXP_t = \alpha_0 + \beta_1 GREXP_{t-1} + \beta_2 GCEXP_{t-1} + \beta_3 NOREV_{t-1} + \beta_4 OREV_{t-1} + \sum_{i=1}^{p} \lambda_{1i} \Delta GREXP_{t-i} + \sum_{i=0}^{p} \lambda_{2i} \Delta GCEXP_{t-i} + \sum_{i=0}^{p} \lambda_{3i} \Delta NOREV_{t-i} + \sum_{i=0}^{p} \lambda_{4i} \Delta OREV_{t-i} + q_t \tag{4}$$

$$\Delta GCEXP_t = \alpha_0 + \beta_1 GCEXP_{t-1} + \beta_2 GREXP_{t-1} + \beta_3 NOREV_{t-1} + \beta_4 OREV_{t-1} + \sum_{i=1}^{p} \lambda_{1i} \Delta GCEXP_{t-i} + \sum_{i=0}^{p} \lambda_{2i} \Delta GREXP_{t-i} + \sum_{i=0}^{p} \lambda_{3i} \Delta NOREV_{t-i} + \sum_{i=0}^{p} \lambda_{4i} \Delta OREV_{t-i} + u_t \tag{5}$$

$$\Delta NOREV_t = \alpha_0 + \beta_1 NOREV_{t-1} + \beta_2 GREXP_{t-1} + \beta_3 GCEXP_{t-1} + \beta_4 OREV_{t-1} + \sum_{i=1}^{p} \lambda_{1i} \Delta NOREV_{t-i} + \sum_{i=0}^{p} \lambda_{2i} \Delta GREXP_{t-i} + \sum_{i=0}^{p} \lambda_{3i} \Delta GCEXP_{t-i} + \sum_{i=0}^{p} \lambda_{4i} \Delta OREV_{t-i} + v_t \tag{6}$$

$$\Delta OREV_t = \alpha_0 + \beta_1 OREV_{t-1} + \beta_2 GREXP_{t-1} + \beta_3 GCEXP_{t-1} + \beta_4 NOREV_{t-1} + \sum_{i=1}^{p} \lambda_{1i} \Delta OREV_{t-i} + \sum_{i=0}^{p} \lambda_{2i} \Delta GREXP_{t-i} + \sum_{i=0}^{p} \lambda_{3i} \Delta GCEXP_{t-i} + \sum_{i=0}^{p} \lambda_{4i} \Delta NOREV_{t-i} + w_t \tag{7}$$

Where:
β = long run coefficients
λ = short run coefficients
p = lag length for the Unrestricted Error-Correction Model (UECM)
Δ = first differencing operator
q, u, v, w = white noise disturbance error term.

3.3. ARDL Testing Approach

The testing procedure of the ARDL bounds test is performed in three steps. First, OLS is applied to Eq. (4, 5, 6 and 7) to test for the existence of a cointegrating long-run relationship normalized on the regressands based on the Wald test (F-statistics) for the joint significance of the lagged levels of the variables (i.e., H_0: $B_1 = B_2 = B_3 = B_4 = B_5 = 0$) as against the alternative (H_1:$B_1 \neq B_2 \neq B_3 \neq B_4 \neq$

$B_5 \neq 0$). The computed F-statistic is then compared with the non-standard critical bounds values as reported in Pesaran *et al*. (2001). The lower and upper bounds critical values assumes that the regressors are purely I(0), purely I(1), respectively. If the F-statistic is above the upper critical value, the null hypothesis of no long-run relationship can be rejected irrespective of the orders of integration for the time series. Conversely, if the test statistic falls below the lower critical value the null hypothesis cannot be rejected. Finally, if the statistic falls between the lower and upper critical values, the result is inconclusive. Once cointegration is established, the second step involves estimating the long-run ARDL model for equations 4, 5, 6 and 7 respectively:

$$GREXP_t = \alpha_0 + \sum_{i=1}^{p}\beta_1 REXP_{t-i} + \sum_{i=0}^{p}\beta_2 GCEXP_{t-i} + \sum_{i=0}^{p}\beta_3 NOREV_{t-i} + \sum_{i=0}^{p}\beta_4 OREV_{t-i} + q_t \quad (8)$$

$$GCEXP_t = \alpha_0 + \sum_{i=1}^{p}\beta_1 GCEXP_{t-i} + \sum_{i=0}^{p}\beta_2 GREXP_{t-i} + \sum_{i=0}^{p}\beta_3 NOREV_{t-i} + \sum_{i=0}^{p}\beta_4 OREV_{t-i} + u_t \quad (9)$$

$$NOREV_t = \alpha_0 + \sum_{i=1}^{p}\beta_1 NOREV_{t-i} + \sum_{i=0}^{p}\beta_2 GREXP_{t-i} + \sum_{i=0}^{p}\beta_3 GCEXP_{t-i} + \sum_{i=0}^{p}\beta_4 OREV_{t-i} + v_t \quad (10)$$

$$OREV_t = \alpha_0 + \sum_{i=1}^{p}\beta_1 OREV_{t-i} + \sum_{i=0}^{p}\beta_2 GREXP_{t-i} + \sum_{i=0}^{p}\beta_3 GCEXP_{t-i} + \sum_{i=0}^{p}\beta_4 NOREV_{t-i} + w_t \quad (11)$$

The final step involves estimating an Error Correction Model (ECM) as derived from Eqs. 8, 9, 10 and 11 respectively to obtain the short-run dynamic parameters as specified below:

$$\Delta GREXP_t = \alpha_0 + \sum_{i=1}^{p}\lambda_{1i}\Delta GREXP_{t-i} + \sum_{i=0}^{p}\lambda_{2i}\Delta GCEXP_{t-i} + \sum_{i=0}^{p}\lambda_{3i}\Delta NOREV_{t-i} + \sum_{i=0}^{p}\lambda_{4i}\Delta OREV_{t-i} + \delta_1 ecm_{1t-1} + q_t \quad (12)$$

$$\Delta GCEXP_t = \alpha_0 + \sum_{i=1}^{p}\lambda_{1i}\Delta GCEXP_{t-i} + \sum_{i=0}^{p}\lambda_{2i}\Delta GREXP_{t-i} + \sum_{i=0}^{p}\lambda_{3i}\Delta NOREV_{t-i} + \sum_{i=0}^{p}\lambda_{4i}\Delta OREV_{t-i} + \delta_2 ecm_{2t-1} + u_t \quad (13)$$

$$\Delta NOREV_t = \alpha_0 + \sum_{i=1}^{p}\lambda_{1i}\Delta NOREV_{t-i} + \sum_{i=0}^{p}\lambda_{2i}\Delta GREXP_{t-i} + \sum_{i=0}^{p}\lambda_{3i}\Delta GCEXP_{t-i} + \sum_{i=0}^{p}\lambda_{4i}\Delta OREV_{t-i} + \delta_3 ecm_{3t-1} + v_t \quad (14)$$

$$\Delta OREV_t = \alpha_0 + \sum_{i=1}^{p}\lambda_{1i}\Delta OREV_{t-i} + \sum_{i=0}^{p}\lambda_{2i}\Delta GREXP_{t-i} + \sum_{i=0}^{p}\lambda_{3i}\Delta GCEXP_{t-i} + \sum_{i=0}^{p}\lambda_{4i}\Delta NOREV_{t-i} + \delta_4 ecm_{4t-1} + w_t \quad (15)$$

Where:

ecm_{t-1} = the error correction mechanism lagged for one period

δ = the coefficients for measuring speed of adjustment

4. Empirical Results

4.1. Unit Roots Tests

Before proceeding with the ARDL bounds test, the stationarity status of all variables to determine their order of integration is carried out. This is to ensure that the variables are not I(2) stationary so as to avoid spurious results. In the presence of I(2) variables the computed F-statistics provided by Pesaran *et al*. (2001) are not valid because the bounds test is based on the assumption that the variables are I(0) or I(1). Therefore, the implementation of unit root tests in the ARDL procedure might still be necessary in order to ensure that none of the variables is integrated of order 2 or beyond.

This study applied a more efficient univariate DF-GLS test for autoregressive unit root recommended by Elliot, Rothenberg, and Stock (ERS, 1996). The test is a simple modification of the conventional Augmented Dickey-Fuller (ADF) *t*-test as it applies generalized least squares (GLS) de-trending prior to running the ADF test regression. Compared with the ADF tests, the DF-GLS test has the best overall performance in terms of sample size and power. It "has substantially improved power when an unknown mean or trend is present" (ERS, p.813). The test regression included both a constant with no trend and a constant with trend for the first differences of the variables as all the variables were found not to be stationary at level form. The DF-GLS unit root tests results for the variables reported in Table 1 indicate that all variables are I(1). The Phillips Perron (PP) unit root test was also employed as a means of verifying the order of integration of the variables.

Table 1. *Unit Root Test for the Variables.*

DF-GLS Unit Root Tests on Variables				
Variables	AIC lag	Constant	Constant & trend	Decision rule
GREXP	1	2.384652**	6.921236***	I(1)
GCEXP	2	6.468409***	6.721496***	I(1)
NOREV	2	2.289389**	7.447325***	I(1)
OREV	2	5.150035***	6.288725***	I(1)

Phillips-Perron Unit Root Tests on Variables			
Variables	Constant	Constant & trend	Decision rule
GREXP	5.026381***	7.088044***	I(1)
GCEXP	6.477828***	6.511896***	I(1)
NOREV	5.372030***	7.255956***	I(1)
OREV	7.068894***	11.39974***	I(1)

Note: ***, ** represents significance at 1% and 5% respectively.
AIC represents the Akaike Information Criterion on which the lag length of the variables was decided
Source: Computed by Author

The result in table 1 shows that the variables are stationary at 1st differencing. Therefore we reject the null hypothesis of a unit root for the variables and accept the alternative of no unit root process with the variables. Thus, concluding that the variables are stationary at their 1st difference.

4.2. Bounds Tests for Cointegration

In the first step of the ARDL testing procedure, Eq.4, 5, 6 and 7 were tested respectively for a cointegrating long-run analysis with normalization on the dependent variables. To select the appropriate lag length for the first differenced variables, we adopted a general-to-specific approach using an unrestricted VAR by means of Akaike Information Criterion (AIC). For brevity, the results of the lag selection are not reported; however, a maximum of 3 lags was used. As argued by Pesaran and Pesaran (1997), variables 'in first difference are of no direct interest' to the bounds cointegration test. Hence, any result that supports cointegration in at least one lag structure provides evidence for the existence of a long-run relationship. The F-statistic tests the joint null hypothesis that the coefficients of the lagged level variables are zero (i.e. no long-run relationship exists between them). Table 2 reports the results of the calculated F-statistics when each variable is considered as a dependent variable (normalized) in the ARDL-OLS regressions.

Table 2. *Results from Bounds Tests on Eqs. (4, 5, 6 and 7).*

Dependent Variable (K=4, N=32)	AIC Lags	F-Statistic	Probability	Outcome
F_{GREXP}(GREXP\GCEXP,NOREV,OREV)	3	7.624646	0.0034***	Cointegration
F_{GCEXP}(GCEXP\GREXP,NOREV,OREV)	3	4.632284	0.0195**	Cointegration
F_{NOREV}(NOREV\GREXP,GCEXP,OREV)	3	2.505947	0.1027*	Inconclusive
F_{OREV}(OREV\GREXP,GCEXP,NOREV)	3	81.15435	0.0000***	Cointegration

Note: ***, ** represents significance at 1% and 5% respectively.
AIC represents the Akaike Information Criterion on which the lag length of the variables was decided
K= number of variables, N= number of observations
Source: Computed by Author

The calculated F-statistics F_{GREXP} (GREXP\ GCEXP, NOREV, OREV) = 7.624646 is higher than the upper bound critical value of 5.763 at the 1 per cent level. Also F_{GCEXP}(GCEXP\GREXP,NOREV,OREV)= 4.632284 is also higher than the upper-bound critical value 4.150 at the 5 per cent level. Thus, the null hypotheses of no cointegration are rejected for equations 4 and 5 respectively. This implies the existence of long-run cointegration relationships amongst the variables when the regressions are normalized on both GREXPt and GCEXPt variables respectively. However, the calculated F–statistics for equation 6 F_{NOREV}(NOREV\GREXP,GCEXP,OREV) = 2.505947 although significant, falls between the lower and upper bound critical value of 2.493 and 3.497 at 10 per cent level of significance. This signifies the absence of cointegration in the relationship. Finally, the cointegration result for equation 7 with the calculated F-statistics of F_{OREV}(OREV\GREXP,GCEXP,NOREV) = 81.15435, shows the existence of long run relationship in the model at 1 percent level of significance.

Once we established that a long-run cointegrating relationship existed, equations 8, 9 and 11 were estimated using the following ARDL (1, 0, 0, 0, 0) specification. The results obtained by normalizing on Government Recurrent Expenditure ($GREXP_t$) and Government Capital Expenditure ($GCEXP_t$), and Oil Revenue ($OREV_t$) in the long run are reported in Tables 3, 4 and 5 respectively.

Table 3. *Estimated Long Run Coefficients using the ARDL Approach for Eq.8.*

Equation (8): ARDL(1,0,0,0,0) selected based on AIC. Dependent variable : $GREXP_t$				
Regressor	Coefficient	Standard Error	T- value	Probability
C	-11830.24	34511.96	-0.320454	0.7512
GCEXP	0.828030	0.210476	3.677781	0.0011***
NOREV	0.113513	0.235960	0.449776	0.6566
OREV	-0.07205	0.031413	-2.144272	0.0415**

Note: ***, ** represents significance at 1% and 5% respectively. Source: Computed by Author

Table 3 shows the ARDL long run estimation of Eq.8. The result reveals that in the long run, a one percent increase in government capital has a positive impact on the growth of government recurrent expenditure by 0.83 respectively. This behaviour is plausible given government investment on capital projects such as: construction of health care centres, schools, air-ports, agriculture, etc of which jobs would be created by such investment, which in turn results in increase vacancies in the various sectors. Filling these various vacancies by the government would result in increase in the value of recurrent expenditure of the government. However, negative but significant relationships exist between oil revenue and government recurrent expenditure. In the long run, a percentage increase in oil revenue would bring about a fall of 0.07 percent in recurrent spending growth. This outcome is likely because it is expected that the government would channel its proceeds from oil sales to capital infrastructural development in the long term; thereby reducing amount allocated to recurrent spending.

Table 4. *Estimated Long Run Coefficients using the ARDL Approach for Eq.9.*

Equation (8): ARDL(1,0,0,0,0) selected based on AIC. Dependent variable : $GCEXP_t$				
Regressor	Coefficient	Standard Error	T- value	Probability
C	29430.68	23400.58	1.176372	0.2501
GREXP	0.040066	0.142712	6.554069	0.0000***
NOREV	-0.28649	0.159991	-1.674885	0.1059
OREV	0.072373	0.021299	3.178289	0.0038***

Note: *** represents significance at 1%. Source: Computed by Author

Table 4 above is an outcome of the estimated ARDL long run relationship for equation 9. The result shows that in the long run capital outlay respond positively to growth in recurrent outlays of the government as well as growth in oil revenues respectively. The result shows that in the long run, government capital expenditure would rise by 0.04 percent to a one percent increase in recurrent outlay growth. This is plausible in the sense that government investment on human capital can have a long term effect on improved and quality productivity of labour. Thus, making the government less dependent on foreign labour for high skilled technical duties. Similarly, capital spending would grow by 0.07 percent with a 1 percent increase in oil revenue. This is also likely given that capital expenditure in Nigeria depends almost entirely on proceeds from oil revenue of the government.

Table 5. *Estimated Long Run Coefficients using the ARDL Approach for Eq.11.*

Equation (8): ARDL(1,0,0,0,0) selected based on AIC. Dependent variable : $OREV_t$				
Regressor	Coefficient	Standard Error	T- value	Probability
C	1340541.49	218436.8	0.823496	0.4177
GREXP	22.0366	1.064582	2.777613	0.0100***
GCEXP	1.3258	1.332168	0.133547	0.8948
NOREV	-7.5961	1.493467	-0.682497	0.5010

Note: *** represents significance at 1%. Source: Computed by Author

Table 5 is a long run estimation of model 11 which shows only recurrent expenditure being the sole fiscal variable in the long run to impact on oil revenue of the government. The result shows that a percentage increase in recurrent spending would result in oil revenue growing by 22 percent. This result means that government expenditure on human capital development, through various funding agencies such as: the Tertiary Education Trust Fund (TETfund), Nigerian National Petroleum Company (NNPC), Petroleum Tertiary Development Fund (PTDF), etc would reduce the sector's reliance on foreign high skilled labour. Thereby, increasing the oil revenue earnings to the government.

Following the determination of the long run relationships between the variables above, the short run results for equations 12, 13 and 14 are presented below respectively. The study found no existing short run relationship in equation 15. This therefore means that oil revenue growth is a long run phenomenon rather than short run.

Table 6. *Error Correction Representation for Equation 12.*

ARDL(1,0,0,0,0) selected based on AIC. Dependent variable : d($GREXP_t$)				
Regressor	Coefficient	Standard Error	T- value	Probability
C	-57812.27	42633.09	-1.356042	0.1928
dOREV(-1)	-0.141442	0.025292	-5.592333	0.0000***
dGREXP(-2)	0.838232	0.182696	4.588121	0.0003***
dNOREV(-3)	-0.215742	0.108056	-1.996564	0.0621*
dOREV(-3)	0.118445	0.046997	2.520295	0.0220**
ECM(-1)	-0.027595	0.038671	-0.713594	0.4852

R-Squared: 0.95. F-Statistic: 32.91770 Adjusted R-Squared: 0.92.
Prob(F-Statistic): 0.0000. D-Watson stat: 2.245163

Diagnostic Tests of Residual

Test Statistic	**LM Version**	**F Version**
Serial correlation	$CHI^2(3)$=4.574426 [0.2057]	F(3,14) = 0.911283 [0.4606]
Normality	$CHI^2(3)$=3.955993 [0.138346]	Not Applicable
Heteroscedasticity	$CHI^2(10)$= 8.133975 [0.6158]	F(10,17) = 0.696051 [0.7158]

Note: ***, **, * represents significance at 1%, 5%, and 10% respectively.
Source: Computed by Author

Table 6 gives the short run relationship captured by equation 12. From the estimated result presented above, an interesting find is the inverse relationship between oil proceeds and government recurrent expenditure. The result showed that a percentage increase in oil revenue in the previous year would bring about a fall of 0.14 percent in government recurrent outlay. This relationship can be plausible judging from the fact that the government of Nigeria is aware of the inverse impact of increase recurrent outlay towards growth of the economy in the short run as to capital outlay. Thus, fiscal authorities may choose to lower recurrent spending by concentrating more on capital outlay for developmental purposes; a point which is backed up by the short run result in table 6.

Furthermore, recurrent outlay for the past two year period tends to have positive impact on current level of recurrent expenditure. The result showed that a percentage increase in the two period lagged recurrent expenditure would lead to 0.84 percentage rise in current recurrent spending.

Also from the result, it is gathered that non oil revenue for three year lagged period show a positive relationship with current recurrent spending. The result showed a 0.22 percentage increase in current recurrent spending when the three year lagged value increase by one percent.

Similarly, oil revenue for three year lagged period also show a positive impact on current recurrent spending. A 0.12 percent rise in recurrent spending would occur with a rise in the previous three year lagged value of oil revenue.

The ECM result shows the amount of distortion from the previous period which is being corrected for in the current period. The ECM of this model is correctly signed showing how much of distortion from the previous period that is being corrected for in the current period. With the ECM value of -0.03, this translates to mean that about 3 percent of distortion in the previous period is being corrected for in the present period. Thus, it would take the economy about thirty-three years and three months for equilibrium to be restored in the system in the eventualities of shocks to the explanatory variables in this model. It should be noted that though the ECM is correctly signed, it is however not significant and as such its effect can be ignored.

From the statistical point of view, the diagnostic test on the residual of the model reveals the validation of the null hypothesis that the residual is normally distributed at a 5 percent level of significance as observed from the normality result. This outcome is necessary since normality test is valid to justify hypothesis testing. Furthermore, the residual was found not to be serially correlated with the explanatory variables at a 5 percent level of significance. Also, the heteroskedasticity test reveals that at a 5 percent level of significance, the residual is homoskedastic.

Figure 1 above shows a plot of the recursive residuals about the zero line. Plus and minus two standard errors are also shown at each point. Residuals outside the standard error bands suggest instability in the parameters of the equation. Ensuring that the parameters in the model satisfies the stability test, the cumulative sum of recursive residuals (CUSUM) and CUSUM of squares (CUSUMSQ) test proposed by Brown *et al.* (1975) to the residual of the error-correction model were employed. Figure 1 present plots of CUSUM test statistics that fall inside the critical bounds of 5% significance. The CUSUMSQ test statistics however, reveal a portion of the parameters lying outside standard error bands. These are parameters between years 2001 to 2008. This behaviour is justified by the international fluctuations in prices of crude oil experienced mainly during these periods; a major determinant of government revenue in Nigeria, as well as a major determinant of government spending outlay. According to Bobai (2012), "the persistent instability of crude oil prices in the global market has adversely affected all the sectors of the Nigerian economy negatively. This is because Nigeria is a monoculture economy". Also the global economic recession that commenced from 2008 which saw values of exportable fall internationally can also be attributed to this behaviour.

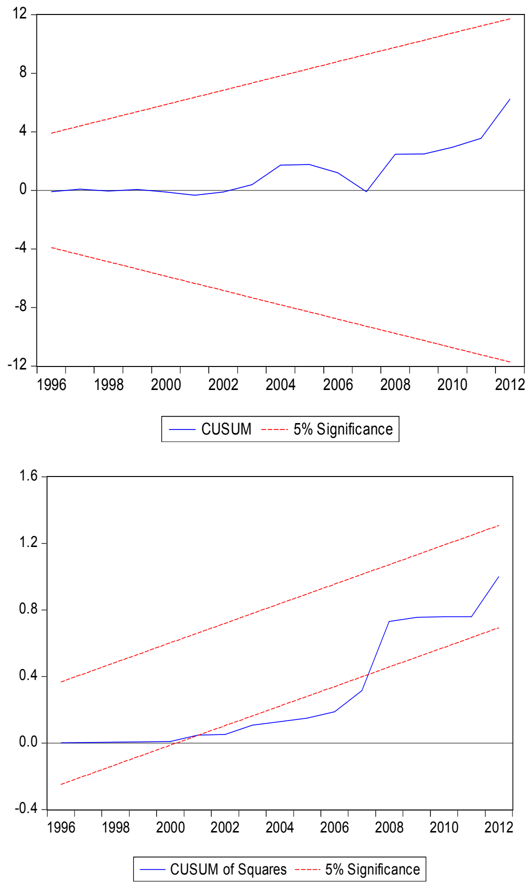


Figure 1. *Stability Test of residual for short run model 12.*

Table 7. *Error Correction Representation for Equation13.*

ARDL(1,0,0,0,0) selected based on AIC. Dependent variable : d(GCEXP$_t$)				
Regressor	Coefficient	Standard Error	T- value	Probability
C	19792.11	19061.58	1.038325	0.3129
dGREXP(-1)	-0.526356	0.237068	-2.220271	0.0395**
dOREV(-1)	0.052908	0.022095	2.394525	0.0277**
dGREXP(-2)	1.049689	0.225520	4.654535	0.0002***
dNOREV(-2)	-0.442005	0.116764	-3.785442	0.0014***
dOREV(-2)	-0.116753	0.044674	-2.613431	0.0176**
dOREV(-3)	0.224178	0.037870	5.919621	0.0000***
ECM(-1)	-0.238381	0.139052	-1.714328	0.1036*

R-Squared: 0.74 F-Statistic: 5.926248 Adjusted R-Squared: 0.62
Prob(F-Statistic): 0.000685 D-Watson stat: 2.384815

Diagnostic Tests of Residual.

Test Statistic	**LM Version**	**F Version**
Serial correlation	$CHI^2(3)$ =3.644712 [0.3025]	F(3,15) = 0.748238 [0.5401]
Normality	$CHI^2(3)$ =5.389023 [0.067575]	Not Applicable
Heteroscedasticity	$CHI^2(9)$ = 6.394404 [0.6999]	F(9,18) = 0.591921 [0.7873]

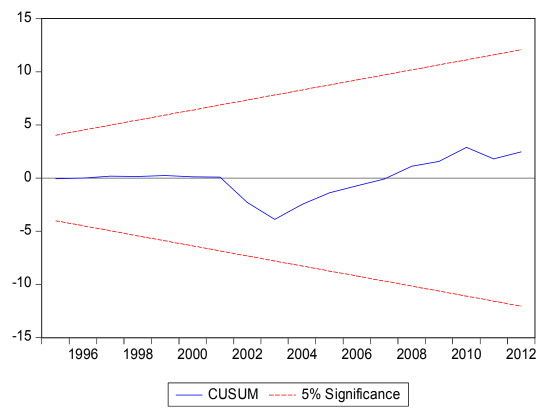
Note: ***, **, * represents significance at 1%, 5%, and 10% respectively.
Source**:** Computed by Author

The ECM result above shows that the one period lagged values of GREXP and OREV affects the current levels of GCEXP respectively. As expected, GREXP is inversely related to GCEXP. From the result; it is obvious that a percentage rise in GREXP in the previous year would lead to 0.53 percentage fall in GCEXP in the present period. This behaviour is true since an increase in either of GCEXP OR GREXP in the short run, would cause a fall in the other and vice versa. Also, a percent rise in OREV in the previous period would yield a 0.05 percentage rise in GCEXP for the current year. This behaviour is also true since in Nigeria, government outlay for each year is being determined by its oil sale revenue.

Furthermore, GREXP for the second year shows a positive relationship with GCEXP which is unlike the lagged by one result. From the result, it can be deduce that a percentage increase in GREXP would yield 1.05 percentage rise in current level of GCEXP. Also, previous two year value of NOREV shows an inverse relationship with CEXP. This means a percentage increase NOREV in the past two year would result in GCEXP falling by 0.44 percent in the current year. Furthermore, OREV for the past two years show an inverse relationship with CEXP. The result reveals that a percentage rise in the past two year value of OREV would result in current level of CEXP falling by 0.12 percent. This result is plausible given that in government budgetary process in Nigeria, capital outlays of government is being determined mostly by revenue generated from immediate previous year oil sales.

For the three year lagged relationship between the variables, it can be observed that an inverse relationship exist between GREXP and GCEXP, and NOREV and GCEXP respectively. Though both results are not significant, the results reveals that a percentage increase in GREXP would lead to a fall of 0.28 percent in GCEXP for the current year. Likewise a percentage increase in NOREV would result in 0.17 percent fall in GCEXP. However, OREV in the third period shows a positive relationship with GCEXP. The result reveals that an increase in OREV by a percentage would lead to 0.22 percent rise in GCEXP in the current year.

The ECM result shows the amount of distortion from the previous period which is being corrected for in the current period. The ECM of this model is correctly signed showing how much of distortion from the previous period that is being corrected for in the current period. With the ECM value of -0.24, this translates to mean that about 24 percent of distortion in the previous period is being corrected for in the present period. Thus, it would take the economy about four years and two months for equilibrium to be restored in the system in the eventualities of shocks to the explanatory variables in this model.



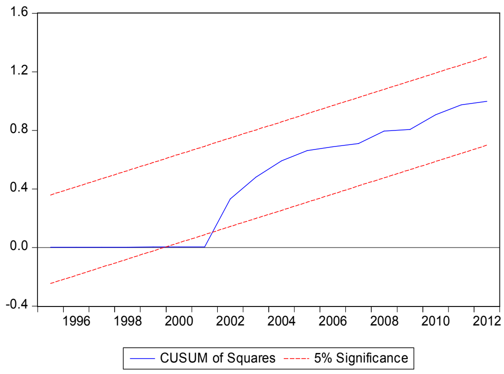


Figure 2. *Stability Test of residual for short run model 13.*

From the statistical point of view, the diagnostic test on the residual of the model reveals the validation of the null hypothesis that the residual is normally distributed at a 5 percent level of significance as observed from the normality result. Furthermore, the residual was found not to be serially correlated with the explanatory variables at a 5 percent level of significance. Also, the heteroskedasticity test reveals that at a 5 percent level of significance, the residual is homoskedastic.

Figure 2 above shows a plot of the recursive residuals about the zero line. Plus and minus two standard errors are also shown at each point. Residuals outside the standard error bands suggest instability in the parameters of the equation. Ensuring that the parameters in the model satisfies the stability test, the cumulative sum of recursive residuals (CUSUM) and CUSUM of squares (CUSUMSQ) test proposed by Brown *et al*. (1975) to the residual of the error-correction model were employed. Figure 1 present plots of both CUSUM and CUSUMSQ test statistics that fall inside the critical bounds of 5% significance. This implies that the estimated parameters are stable over the period 1981- 2012.

Table 8. *Error Correction Representation for Equation14.*

ARDL(1,0,0,0,0) selected based on AIC. Dependent variable : d($NOREV_t$)				
Regressor	Coefficient	Standard Error	T- value	Probability
C	-6353.227	12544.58	-0.5068452	0.6194
dGREXP(-1)	0.446704	0.210525	2.121857	0.0498**
dCEXP(-1)	-0.653133	0.121120	-5.392450	0.0001***
dGREXP(-2)	1.037050	0.167187	6.202951	0.0000***
dCEXP(-2)	0.885488	0.127613	6.938843	0.0000***
dNOREV(-2)	-0.453386	0.076584	-5.920143	0.0000***
dREXP(-3)	-0.842153	0.176877	-4.761240	0.0002***
dCEXP(-3)	0.764734	0.144447	5.294216	0.0001***
dNOREV(-3)	-0.595548	0.088701	-6.714134	0.0000***
dOREV(-3)	0.121412	0.032639	3.719824	0.0019***
ECM(-1)	-0.029179	0.022504	-1.296616	0.2132

R-Squared: 0.97 F-Statistic: 45.28858 Adjusted R-Squared: 0.95
Prob(F-Statistic): 0.0000 D-Watson stat: 2.170189

Diagnostic Tests of Residual

Test Statistic	**LM Version**	**F Version**
Serial correlation	$CHI^2(3)$ =3.644712 [0.6332]	F(3,13) = 0.123022 [0.7307]
Normality	$CHI^2(3)$ =4.349660 [0.113627]	Not Applicable
Heteroscedasticity	$CHI^2(9)$ = 7.653832 [0.7439]	F(11,16) = 0.547172 [0.8431]

Note: ***, **, * represents significance at 1%, 5%, and 10% respectively.
Source: Computed by Author

From table 8, it could be gathered that in the short run, government recurrent and capital outlay impact on non oil revenue of the government up to the three year lagged value. The result lay credence to the fact that investment in human capital as well as capital infrastructure, have the capacity to improve the non oil revenue profile of the government. it can also be gathered that lagged non oil revenue for two and three year period; while three year lagged oil revenue also exact influence on current levels of non oil revenue. This is true from the view point of re-investing previous years proceeds from the oil and non oil sector into the development of the non oil sector with the main objective of improving returns from the sector.

From the statistical point of view, the diagnostic test on the residual of the model reveals the validation of the null hypothesis that the residual is normally distributed at a 5 percent level of significance as observed from the normality result. Furthermore, the residual was found not to be serially correlated with the explanatory variables at a 5 percent level of significance. Also, the heteroskedasticity test reveals that at a 5 percent level of significance, the residual is homoskedastic.

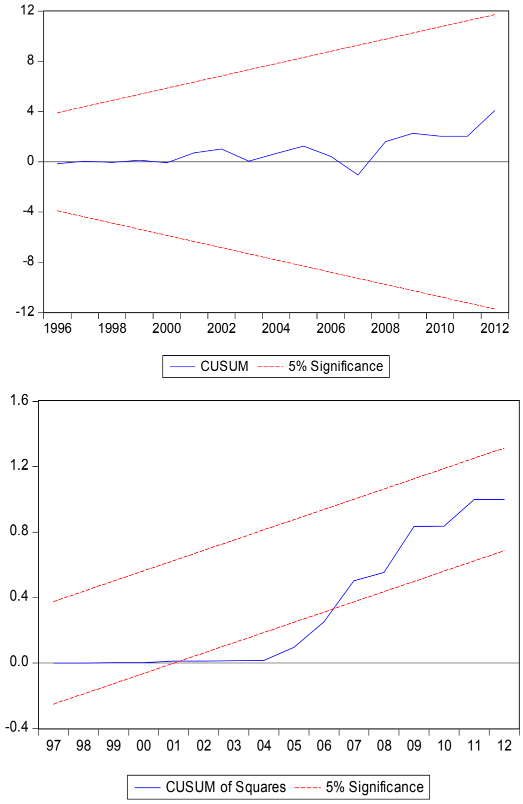


Figure 3. *Stability Test of residual for short run model 14.*

Figure 3 above shows a plot of the recursive residuals about the zero line. The behaviour of the parameters as observed in the figure is similar to that of figure 1. Figure 3 present plots of CUSUM test statistics that fall inside the critical bounds of 5% significance. The CUSUMSQ test statistics however, reveal a portion of the parameters lying outside standard error bands. These are parameters between years 2001 to 2006. According to Bobai (2012), “the persistent instability of crude oil prices in the global market has adversely affected all the sectors of the Nigerian economy negatively. This is because Nigeria is a monoculture economy”.

5. Conclusion and Policy Implication

Based on the study findings, this research therefore concludes that although the impact of non oil revenue on government capital and recurrent outlay in the long run appears to be insignificant, as against the significant impact oil revenue has on the outlays. This is obviously due to the monocultural nature of the Nigerian economy. In the short run however, the impact of non oil revenue as well as oil revenue on the outlays proved to be significant. Furthermore, the result also revealed that both in the long and short run, government expenditure also impact on the growth of oil and non oil revenues respectively. In order words, while government spending impact on growth in oil revenue in the long run, growth in non oil revenue was being influenced by government spending in the short run.

This result therefore validates the fiscal synchronization hypothesis in the relationship between government spending and revenue for Nigeria. Put differently, the result reveals a bi-directional interaction between government’s spending and revenue for Nigeria. This study therefore align with Samson A. A. and Emmanuel .A.(2012) who also found the fiscal synchronization hypothesis to be valid for Nigeria.

The policy implication of the findings of this study is that diversification of government sources of revenue should be given utmost priority by policy makers. This would ensure moving away from a single product economy to a multi product economy and guarantee rise and increase in the revenue base of the government. It is believed if this is done, returns and impact of the non oil sector on government spending and the economy in both the short and long run would be much significant. Furthermore, the government should ensure that spending-tax decisions are not made in isolation of tax-spend decisions. This is because the joint determination of revenues and expenditures is appealing as long as it effectively restrains the budget deficit in the fiscal process. This means that efforts to enrich sources of revenue by the government should be complemented by reductions in spending for Nigeria.

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