THE REVENUE-EXPENDITURE NEXUS IN NIGERIA: ASYMMETRIC COINTEGRATION APPROACH

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Abstract

The study revisits the revenue-expenditure nexus in Nigeria using the asymmetric cointegration methods to study four hypotheses related to the revenue and expenditure nexus, namely: tax-spend, spend-tax, fiscal synchronisation and institutional separation hypotheses for state and FCT government in Nigeria, between 1981 and 2014, using the Asymmetric Cointegration Technique. Results show the following; first, the Engle–Granger, Gregory and Hansen (1996) and the Hatemi-J (2008) cointegration tests along with the cointegration tests associated with the TAR and MTAR models indicate there is a long-run equilibrium relationship between aggregate state and FCT government revenue and expenditures. Second, the M-TAR model provides evidence of asymmetries in the adjustment process towards budgetary equilibrium. Third, state and FCT government revenue has a statistically significant impact on state and local government expenditure in the short run, thus supporting the tax-spend hypothesis for the state and FCT government in Nigeria. In sum, the results obtained indicate that it was the state and FCT government revenue that was driving expenditure in Nigeria.

JEL Classification: C22, C52, E62, H71, H72
Keywords: State Revenue, State Expenditure, Asymmetric Cointegration, Threshold Autoregressive (TAR), Momentum-Threshold Autoregressive (M-TAR)

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1. Introduction

Empirical literature examining the revenue-expenditure nexus of the budget process has largely concentrated on the federal government level, while there are few studies examining the revenue-expenditure nexus at the state or local government levels. The few studies at the state level were largely centered on the United States; among them are those by Ram (1988), von Furstenburg *et al* (1995), Joulfaian and Mookerjee (1990), Zapf and Payne (2009) and Westerlund, Mahdavi and Firoozi (2011) with evidence supporting the four hypotheses in the revenue-expenditure literature. To the best of our knowledge, studies on the revenue-expenditure nexus in Nigeria have looked at the federal government level; this is why the main objective of our study is to examine the causality between revenues and expenditures at the Nigeria state and federal capital territory government level. The direction of causation is an empirical issue, although the majority of state governments operate under fiscal restrictions in the form of budget requirements and debt limits. These restrictions may infer tax-constrained spending decisions, the results of which are in conformity with the tax-spend hypothesis.

The study contributes to the existing tax-spend literature in the following ways: First, empirical evidence is based on state and federal capital territory government. Second, the study accounts for the fiscal imbalances witnessed during the structural adjustment programme of 1986. Third, the study examines the asymmetric cointegrating relationship in the budgetary process using the Enders and Siklos (2001) Threshold Autoregressive (TAR) and Momentum Threshold Autoregressive (M-TAR) cointegration frameworks. In particular, the study answers the following questions: (i) Is there a long-run equilibrium relationship between aggregate state and FCT government revenue and expenditures? (ii) Are there asymmetries in the adjustment process towards budgetary equilibrium? (iii) What is the relationship between revenue and expenditures in both the short and the long run?

Besides the introduction, this paper is divided into five more sections: Section two is the review of literature; Section three discusses the budgetary process in Nigeria; Section four centers on data and data sources; Section five discusses empirical results and findings, while the last section concludes the paper.

2. Literature Review

The theoretical relationship between public revenue and public expenditure can be explained by four main hypotheses in relevant literature: Institutional separation and fiscal synchronization hypotheses, spend-tax and tax-spend hypotheses. The first hypothesis is the fiscal synchronization hypothesis, which posits that the government's public revenue and spending decision to maximise the inter-temporal welfare of society is taken at the same time (Musgrave, 1966). The Government takes a joint spending and revenue decision in the budget at the same time; therefore, there

is bi-causality. However, a contrary view by the institutional separation hypothesis refuted the idea of fiscal synchronization. This hypothesis posits that public spending and public revenue decisions taken by the government are independent of each other. There is no inter-temporary causality between public revenue and public expenditure. The fiscal synchronization and institutional separation hypotheses have been challenged by the spend-tax and tax-spend hypotheses. The proponents of the spend-tax hypothesis are of the view that it is the expenditure that drives government tax decisions. The government first spends and then taxes later. But this view was later challenged by the position of the proponents of the tax-spend hypothesis. There were two competing views regarding the tax-spend hypothesis. The first view postulated by Friedman (1978) suggests that it is public revenue, such as taxes, that drives public expenditure. By implication, attempts to raise more revenue through taxes by the government increase rather than reduce fiscal deficits. However, Buchanan and Wagner (1977) are of a contrary opinion. They assert that tax increases can help reduce fiscal deficits provided this is combined with public spending reduction.

There is a plethora of empirical literature on the government revenue and expenditure nexus and the results could be classified into four strands, each supporting one of the four hypotheses explaining the revenue-expenditure nexus (Tax-Spend, Spend-Tax, Fiscal institutional separation and Fiscal synchronization hypotheses). One strand of studies supports Friedman's (1978) unidirectional causal relationship from public revenue to expenditure (Tax-Spend hypothesis). These studies include the works of Kollias and Makrydakis (2000) on Spain; Narayan (2005) on Indonesia, Singapore, Sri-Lanka and Nepal; Narayan and Narayan (2006) on Mauritius, El Salvador, Chile and Venezuela; Kollias and Paleologou (2006) on Italy and Spain; Afonso and Rault (2009) on Germany, Belgium, Austria, Finland and the UK, and on several EU New Member States; Ghartey (2009) on Kenya; Wolde-Rufael (2008) on Ethiopia, Ghana, Kenya, Nigeria, Mali and Zambia; Elyasi and Rahimi (2012) on Iran; Apergis, Payne and Saunoris (2012) on Greece; Mutascu (2016) on the Czech Republic, Hungary, and Slovenia.

The second strand of studies supports the Spend-Tax hypothesis, which posits unidirectional causality from expenditure to revenue. Indicatively, some empirical studies supporting this hypothesis are: Narayan and Narayan (2006) on Haiti; Kollias and Paleologou (2006) on Finland, France and the UK; Wolde-Rufael (2008) on Burkina-Faso; Afonso and Rault (2009) on Italy, France, Spain, Greece, and Portugal; Saysombath and Kyophilavong (2013) on Lao PDR and Mutascu (2016) on Bulgaria. The third strand supports the fiscal synchronization hypothesis (bi-directional causality). Empirical studies, such as those by Kollias and Paleologou (2006) on Denmark, Greece, Ireland, the Netherlands, Portugal and Sweden; Wolde-Rufael (2008) on Mauritius, Swaziland and Zimbabwe; Ghartey (2009) on South Africa and Nigeria; Aregbeyen and Insah (2013) on Nigeria and Ghana and Mutascu (2016) on the Slovak Republic, support this hypothesis.

The institutional separation hypothesis (no causality), which posits no causal relationship between public revenue and expenditure, has been supported by the empirical findings in the works of Kollias and Makrydakis (2000) on Portugal; Kollias and Paleologou (2006) on Austria, Belgium and Germany; Narayan and Narayan (2006) on Peru, South Africa, Guatemala, Uruguay and Ecuador; Wolde-Rufael, (2008) on Botswana, Burundi and Rwanda; Dada (2013) on Nigeria and Mutascu (2016) on Estonia, Latvia, Lithuania, Poland, and Romania.

In sum, studies in extant literature have employed different methodologies, such as cointegration, Granger causality, and panel estimators. Relevant studies covered a varied scope, but none of them specifically tested asymmetries in the expenditure revenue nexus while focusing on state collected revenue and expenditure. The majority of such studies, particularly concerning the context of Nigeria, centered on federally collected revenue and expenditure, without taking cognizance of asymmetries. This is the void filled by this study.

3. Budgetary Process in Nigeria

The budget process of the Federal government starts with the drafting stage, which begins with the articulation of government plans and vision for the economy. These plans are submitted to the Federal Ministry of Finance (hereinafter, FMOF) and coordinated by the Budget Office of the Federation (hereinafter, BOF). Government plans present, among others, details on how to boost economic growth through infrastructure provision, as well as poverty reduction and alleviation. The budget is based on the Medium-Term Fiscal Framework (MTFF) and reflects what the government projects concerning its revenue, expenditure, borrowing and fiscal balance. The revenue framework is a detailed government income statement prepared by the BOF. All Federal Government agencies that generate oil and non-oil revenue, submit their various income statements to the BOF, which collates and prepares the final document. The expenditure framework, similarly prepared by the BOF, presents details of the total sum the government plans to disburse. The process begins with the FMOF requesting Ministries, Departments and Agencies (MDA) to submit their budgets in form of a budget call circular.

After the entire sum of money to be spent has been determined, total expenditure is subtracted from total revenue to determine if this is a deficit or surplus budget case. If there is a budget deficit, the document gives detailed explanation on how the deficit is to be financed, either by borrowing or by printing money. In addition, if it is a surplus budget, the government explains how it will be utilised. In putting the budget together, the FMOF and BOF also introduce different stakeholders, such as the legislature – the National Assembly (hereinafter, NASS), the National Economic Council, the Organised Private Sector, Civic Society and the Public Sector - so that they may contribute during interactive sessions. After the preparation of the revenue and expenditure framework, the BOF makes a presentation to the Federal Executive Council (hereinafter, FEC) for consideration and approval. Once the FEC has approved the document, it is delivered to NASS, where it is considered and passed.

Following the drafting stage, comes the legislative approval. Upon presentation of the Appropriation Bill by the President to the NASS, the document is discussed by various committees of both the House of Representatives and the Senate. Committee recommendations are reviewed and organised by the Appropriation Committees of both Houses. Final recommendations are put forward by each House, in which the two bodies exchange views and then conclude, as each house passes the Appropriation Bill. If there are differences in their final figures of expenditure votes, the Senate and the House of Representatives meet to iron such differences out, before the final Bill is delivered to the President for his assent. He will then assent to the Appropriation Bill and by law, it becomes an Appropriation Act.

At the state level, it is the responsibility of the governor to submit the budget to the State House of Assembly. The revenue framework of the state government shows how revenue will be sourced and most state governments rely on revenue allocation by the federal government, with little internally generated revenue. The budget process commences with a call circular from the Director General of the Ministry of Budget and Planning to all state ministries, departments and agencies so that the latter may prepare estimates for the coming fiscal year. Subsequently, the commissioners in charge of each ministry prepare expenditure estimates in line with the goals and vision of the state. Expenditure estimates of the state are now submitted by each ministry and collated by the office of the Director General of Budget and Planning so that they may receive state executive council ratification and approval. After ratification by the state executive council, the executive governor presents the budget drafted to the state house of assembly for deliberations. Following thorough checking by the legislature and when all figures have been harmonised, the law makers will send the budget to the executive governor for his assent.

From the foregoing, it has been discovered that the budget process at both the federal and state government levels was somewhat similar, with the lawmakers being the major stakeholders in passing and implementing the budget. The major difference is that state governments heavily depend on federal government allocation to survive. In addition, the federal government budget is prepared and monitored for successful implementation by the BOF, while state government budgets are prepared by the Ministry of Budget and Planning and implemented by the commissioners appointed by the executive governors.

4. Data and Data Sources

This paper uses annual data from the Central Bank of Nigeria, Statistical Bulletins from the 1981-2014 period on total state and Federal Capital Territory[1] (hereinafter, FCT) government revenue and expenditure. To capture the effects of growth in the

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1. The Federal Capital Territory (FCT) is the seat of power and also receives allocation from the federal government like state governments. Thus, all thirty-six states of the country, including the federal capital territory, receive about 24 per cent of federally generated revenue.
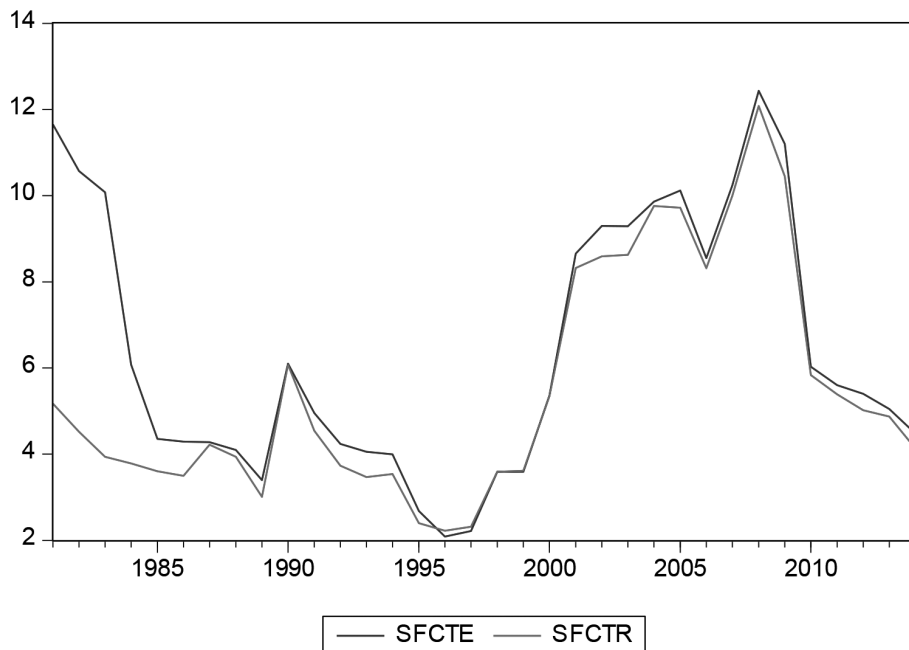
economy, state and FCT government revenue (SFCTR) and government expenditure (SFCTE) are expressed as a share of gross domestic product (GDP). A critical look at Figure 1 shows that state and FCT government expenditure is greater than government revenue in most cases. In the 1981-1985 period, there is a wide gap between government expenditure and revenue, and this is not unconnected to the end of the oil boom witnessed in the country. Before and during this period, government departments and agencies had embarked on white elephant projects, such as the Ajaokuta Steel Rolling Company, Jebba Sugar Company, etc., all of which are shadows of themselves. Coupled with this is the over-bloated wage bill of the government, which gave rise to the need for a call to reduce government activities; this culminated in the Structural Adjustment Programme (SAP) in Nigeria. The structural adjustment programme was conceived and born as a result of the debt crisis that struck most developing countries in the 1980s. The causes of the debt crisis in these countries are the following: the oil crisis of the 1970s, sloppy lending policies, increased interest rates in the United States, falling prices of commodities and large withdrawal of funds from indebted countries. The structural adjustment programme is a policy that places emphasis on the market system, as the main allocator of economic resources, and asks for lesser government participation.

The structural adjustment programme can be categorised into three major policy areas: First, foreign exchange with emphasis on currency devaluation, so as to deal with overvalued currencies, which generate an increase in import and domestic prices, as well as inflationary trends. Second, reduction in government spending with a focus on reducing budget deficits, as well as shifting economic activities and resources from the public to the private sector. Third, trade liberalisation and globalisation; emphasis is on the production of tradable over non-tradable goods, the purpose being to compete in international markets so as to resolve the debt crisis.

In sum, the structural adjustment programme represents deep economic and social changes amounting to: a) increasing productivity levels; b) eradicating government waste and inefficiency; c) achieving a higher degree of openness to foreign competition and integration in the global economy through trade and financial liberalisation, and d) achieving the objective of an acceptable level of economic growth and stability.

In addition, during the mid-1990s, government revenue and expenditure plunged to as low as 2 per cent, which is not unconnected with social unrest and protest that greeted the cancellation of the presidential election. However, government revenue and expenditure grew to about 12 per cent in the later period of 2000s. The major reason for this was the change in government from a military to a democratically elected government, which culminated in government size expansion. Furthermore, government expenditure and revenue fell immediately after 2008, and this is connected to the global financial crisis which hit most economies of the world.

Figure 1. Total State and Federal Capital Territory Government Revenues and Expenditures as a share of GDP 1981-2014

5. Estimation Strategy and Results

In order to examine the time series dynamics of state and FCT government revenues and expenditures in Nigeria, to differentiate between the four hypotheses related to the revenue-expenditure nexus and, also, to allow for the possibility of the existence of asymmetries in the budgetary process, we use the following steps in the estimation procedure:

Step 1 - We perform three standard unit root tests, namely the augmented Dickey–Fuller (ADF, 1979), the Phillips and Perron (PP, 1988), and the Ng-Perron (NP, 2001) on each series.

Step 2 - We proceed by examining the long-run relationship between revenues and expenditures only if individual series are found to be stationary at first difference [I(1)]. If no cointegration is found, we simply estimate an unrestricted vector autoregression (UVAR) model. If cointegration is found, then:

Step 3 - We utilise the adjusted threshold autoregressive (TAR) and momentum threshold autoregressive (MTAR) models, elaborated by Enders and Siklos (2001), as there could be some asymmetries in the adjustment process towards long-run equilibrium.

Step 4 - If TAR and MTAR cointegration is not found and the model is symmetric, we
proceed with our analysis using a standard VECM. In the opposite case, and given
there are asymmetries in the adjustment process towards the long-run equilibrium,
we proceed with a threshold VECM.

5.1 Unit Root Test

The study begins the presentation of empirical results with the stationarity properties
of the respective variables. The ADF, PP and the NP procedures test the null hypothesis
of a unit root and the results from the ADF, PP and NP unit root tests are shown in
Table 1 and indicate that state and FCT revenues and expenditures are non-stationary
at levels, but at first differences.

Table 1. Unit Root Tests

Variable	ADF	PP	NP
SFCTR	-1.509	-1.687	-4.998
ΔSFCTR	-4.803***	-4.813***	-15.558***
SFCTE	-2.211	-2.301	-3.859
ΔSFCTE	-4.327***	-4.243***	-14.832***

Notes: In this paper, we use the test statistic MZt for the NP test. Proper lag length for each test
was chosen by AIC.
*** Indicates significance at the 1% level.
** Indicates significance at the 5% level.

5.2 Symmetric Cointegration Test

Given that revenues and expenditures are integrated at order one, the long-run relation-
ship between state and FCT government revenues and expenditures is specified as:

$$SFCTR_t = \alpha_0 + \alpha_1 SFCTE_t + \varepsilon_t \tag{1}$$

where (SFCTR) is the state and FCT government revenue expressed as a percentage of
GDP, SFCTE is the state and FCT government expenditure expressed as a percentage
of GDP, α_0 to α_1 are parameters, and ε_t is the residual showing the disequilibrium
between government revenue and expenditure. After performing the long-run linear
regression in equation (1), the next step is to perform the unit root test on the residual
series ε_t, which might be serially correlated and expressed as,

$$\Delta \hat{\varepsilon}_t = \rho \hat{\varepsilon}_{t-1} + \upsilon_t \tag{2}$$

where $\{\varepsilon_t\}$ contains regression residuals from equation (1) assumed to be purely
white noise with a zero mean and constant variance and υ_t is an independent and
identically distributed disturbance with a zero mean.

Table 2. Cointegration Test

Panel A: Engle-Granger Cointegration Test		
Cointegrating Equation		ADF

$$SFCTR_t = 0.879 + 0.723SFCTE_t + \hat{\varepsilon}_t$$

	(1.404)	(8.180)***		-3.083**

Panel B:Gregory-Hansen and Hatemi-J Structural Breaks Cointegration Test				
	ADF	**Tb**	$\boldsymbol{Z_t^*}$	**Tb**
One Break	-6.593***	1990	-6.695***	1990
Two Breaks	-5.988*	1990, 2000	-6.792***	1990, 2000

Note: Engle-Granger refer to the non-cointegration tests advocated by Engle and Granger (1987), t-test are reported in parentheses. For the one -break test, the 1, 5 and 10 per cent critical values are -5.45, -4.99 and 4.72, respectively (Gregory and Hansen 1996). For the Two-break test, the corresponding 1, 5 and 10 per cent critical values are -6.50, -6.01 and -5.65 per cent, respectively (Hatemi-J 2008). The results are generated using the GAUSS10.0 software. The codes were obtained from Hansen's web page for the one-break test and from Hatemi-J for the two-break test. Tb denotes the structural break period.

***, ** and *indicate significance at the 1%, 5% and 10% levels, respectively.

Panel A of Table 2 reports the test result for non-cointegration between government revenue and expenditure, which rejects the non-cointegration null at the 1% significance level. In Panel B, we checked for the possibility of potential structural breaks because of the behaviour of the government revenue and expenditure series using the Gregory and Hansen (1996) and the Hatemi-J (2008) cointegration tests based on structural breaks in the constant and linear trends. Results provide evidence of cointegration with the rejection of the null at the 1 percent level of significance and break dates correspond with major occurrences, such as the trade and financial liberalisation of the late 1980s, which transcends into the early 1990s. The second break date is in year 2000 and this corresponds with the change in government from a military to a civilian government. Since there is presence of cointegration in both the Engle-Granger cointegration test and the Gregory and Hansen (1996) and the Hatemi-J (2008) cointegration tests with structural breaks, the study proceeds to test for the presence of asymmetric cointegration.

5.3 Enders and Siklos (2001) Asymmetric Cointegration

Under the Engle-Granger cointegration test, the alternative hypothesis implicitly assumes the adjustment process is symmetric around the budgetary disequilibrium, i.e., $\varepsilon_t = 0$. However, if the adjustment in state and FCT government revenues and expenditures in response to budgetary disequilibrium is asymmetric, then the

symmetric adjustment process assumed in the error correction model represents a misspecification. In light of the possibility of an asymmetric adjustment process, the TAR and MTAR models of Enders and Silkos (2001) are examined as follow:;

The threshold autoregressive (TAR) model modification of the Engle and Granger (1987) test is given as

$$\Delta\hat{\varepsilon}_t = I_t\rho_1\hat{\varepsilon}_{t-1} + (1 - I_t)\rho_2\hat{\varepsilon}_{t-1} + \upsilon_t \tag{3}$$

where I_t is the Heaviside indicator, such that

$$I_t = \begin{cases} 1 \text{ if } \hat{\varepsilon}_{t-1} \geq \tau \\ 0 \text{ if } \hat{\varepsilon}_{t-1} < \tau \end{cases} \tag{4}$$

The M-TAR model of Enders and Siklos (2001) is of the form:

$$\Delta\hat{\varepsilon}_t = M_t\rho_1\hat{\varepsilon}_{t-1} + (1 - M_t)\rho_2\hat{\varepsilon}_{t-1} + \upsilon_t \tag{5}$$

Where M_t is the Heaviside indicator, such that

$$M_t = \begin{cases} 1 \text{ if } \Delta\hat{\varepsilon}_{t-1} \geq \tau \\ 0 \text{ if } \Delta\hat{\varepsilon}_{t-1} < \tau \end{cases} \tag{6}$$

where τ is the value of the threshold and endogenously determined using the Chan (1993) method. The Chan method arranges values $(\hat{\varepsilon}_t)$ and $(\Delta\hat{\varepsilon}_t)$ for the TAR and the M-TAR models, respectively, in ascending order, and excludes the lowest and the highest 15%, while τ is the consistent estimate yielding the lowest residual sum of squares over the remaining 70%. As stated by Petruccelli and Woolford (1984), the necessary conditions for the stationarity of $\hat{\varepsilon}_t$ are that $\rho_1 < 0, \rho_2 < 0$ and $(1 + \rho_1)(1 + \rho_2) < 1.$

Equations (3) and (4) express the TAR model and capture the response of the disequilibrium to positive and negative away from the threshold. If $\hat{\varepsilon}_{t-1}$ is above long-run equilibrium value, then adjustment is at the rate ρ_1 and, if $\hat{\varepsilon}_{t-1}$ is below long-run equilibrium value, then adjustment is at the rate ρ_2. The M-TAR model, expressed in equations (5) and (6), is useful when adjustment exhibits more momentum in one direction than the other; in other words, the speed of adjustment depends on whether $\Delta\hat{\varepsilon}_{t-1}$ is increasing or decreasing. Thus, differential effects of the positive against the negative phases of changes in budgetary disequilibrium could be examined using the MTAR model. If $|\rho_1| < |\rho_2|$, then increases in $\Delta\hat{\varepsilon}_{t-1}$ tend to persist, whereas decreases revert to the threshold quickly.

If the errors in equations (3) and (5) are serially correlated, equations (3) and (5) are replaced by

$$\Delta\hat{\varepsilon}_t = I_t\rho_1\hat{\varepsilon}_{t-1} + (1 - I_t)\rho_2\hat{\varepsilon}_{t-1} + \sum_{i=1}^{p} \beta_i\Delta\hat{\varepsilon}_{t-i} + \upsilon_t \tag{7}$$

$$\Delta\hat{\epsilon}_t = M_t\rho_1\hat{\epsilon}_{t-1} + (1-M_t)\rho_2\hat{\epsilon}_{t-1} + \sum_{i=1}^{p}\gamma_i\Delta\hat{\epsilon}_{t-i}\,\upsilon_t \tag{8}$$

Equation (7) is for the TAR model and equation (8) is for the M-TAR model. Enders and Siklos (2001) propose to implement the two sets of tests using the null hypothesis $H_0: \rho_1 = \rho_2 = 0$ for both the TAR and MTAR models. Here, the F-statistic does not follow a standard distribution and it is compared with the ϕ_u for the TAR model tables and the ϕ_u^* tables for the M-TAR model computed through Monte Carlo simulation by Enders and Siklos (2001). If the null hypothesis is rejected, that is, if cointegration is established, it is possible to test for asymmetric adjustment. The F-statistic for the null hypothesis of symmetric adjustment is $H_0: \rho_1 = \rho_2$, and this is compared to the standard F-distribution. Since there is no presumption as to whether to use the TAR or M-TAR model, the recommendation is to use the AIC or SBC to select the best adjustment mechanism.

Table 3. Estimates for Asymmetric Cointegration

Parameters	TAR Consistent (ϕ_u)	MTAR Consistent (ϕ_u^*)
ρ_1	-0.090(-0.697)	-0.048(-0.471)
ρ_2	-0.345(-3.720**)	-0.523(5.337***)
Tests		
$H_0: F(\rho_1 = \rho_2 = 0)$	7.14	14.45***
$H_0: F(\rho_1 = \rho_2)$	2.52	13.15***
Threshold τ	-0.565	0.550
AIC	78.72	69.42
H_0: no serial correlation $Q_{LB}(4)$	9.47(0.05)	3.877(0.42)

Note: Results are from the estimation of Eqs. (3) and (5) for state and FCT government revenue and expenditure. Critical values from Wane et al. (2004). ***, ** and * denote significance at the 1, 5 and 10 per cent levels, respectively.

Table 3 reports the asymmetric cointegration tests. In the second column of Table 3, we could not reject the null of no cointegration for the TAR model, because the F-statistic of 7.14 is less than the critical value of 7.70 at the 10 per cent significance level. Similarly, we could not reject the null of symmetric conitegration under the TAR model at the 10 per cent significance level. Column three of Table 2 reports the MTAR model. Here, the null of no cointegration was rejected, because the F-statistic of 14.45 is greater than the critical value of 13.23, at the 1 per cent significance level. The null of symmetric cointegration was rejected at the 1 per cent level of significance. Therefore, we accept the MTAR model, because we found evidence of

symmetric and asymmetric cointegration and subsequent interpretation is based on the MTAR model.

Given that $|\rho_1|$ is not stationary and that $|\rho_1|<|\rho_2|$ that is -0.048 is less that -0.523 in absolute terms in the MTAR model, the speed of adjustment is higher when the state and FCT budget is worsening than when the budget is improving. This result is consistent with Aworinde (2013) on Nigeria, Saunoris and Payne (2010) on the United Kingdom and Ewing *et al.* (2006) on the United States. Since cointegration between state and FCT government revenue and expenditure, as well as evidence of asymmetric adjustment under the MTAR model are established, then the asymmetric version of the error correction model (ECM) is given as:

$$\Delta SFCTR_t = \rho_{11} M_t \hat{\varepsilon}_{t-1} + \rho_{12}(1 - M_t)\hat{\varepsilon}_{t-1} + \sum_{i=1}^{p} \delta_k \Delta SFCTR_{t-i} + \sum_{i=1}^{p} \eta_k \Delta SFCTE_{t-i} + v_{it} \quad (9)$$

$$\Delta SFCTE_t = \rho_{21} M_t \hat{\varepsilon}_{t-1} + \rho_{22}(1 - M_t)\hat{\varepsilon}_{t-1} + \sum_{i=1}^{p} \delta_k \Delta SFCTE_{t-i} + \sum_{i=1}^{p} \eta_k \Delta SFCTR_{t-i} + v_{it} \quad (10)$$

Equations 9 and 10 represent the M-TAR model and they describe the dynamic relationship between state and FCT government revenue and expenditure by examining the speed of adjustment back to equilibrium. Parameters ρ_{it} represent the error correction coefficients. If there is a deviation from long-run equilibrium, and the deviation happens to be positive, depending on the Heaviside indicator, then the speed of adjustment is given by ρ_{11} and ρ_{21} in equations 9 and 10. Similarly, for negative deviations defined by the Heaviside indicator, the speed of adjustment is given by ρ_{12} and ρ_{22}.

5.4 Short-run Error Correction Model Results

Having established asymmetric cointegrating relationships between state and FCT government revenue and expenditure, we can now estimate the ECMs, as described in Equations (9) and (10), using the M-TAR; these results are reported in Table 4.

Firstly, any deviation from the long-run budgetary disequilibrium is corrected solely by movements in state and FCT government revenue and expenditure. This can be seen by the significance of the error correction parameter ρ_{12} in the ECM for state and FCT government revenue at the 1% level and parameter ρ_{21} in the ECM for state and FCT government expenditure at the 5% level. What it means is that, if state and FCT government revenue were below what is expected in long-run equilibrium, such an error is corrected in the next period by a fall in government revenue rather than by a change in government expenditure. On the other hand, if state and FCT government revenue were above what is expected in long-run equilibrium, such an error is corrected in the next period by a rise in government expenditure rather than by a change in government revenue.

It should also be noted that the estimates of ρ_{11} and ρ_{22} are insignificant in both cases, which reiterates the point that there is very little tendency for budgetary disequilibrium to change in order to restore equilibrium when government revenue is higher and when government expenditure is lower, since there is no pressure from the state and FCT government to intervene when expenditure is lower and revenue higher.

Table 4. Results for M-TAR Error Correction Models

Parameter	Dependent Variable ΔSFCTR	Parameter	Dependent Variable ΔSFCTE
ρ_{11}	0.113	ρ_{21}	-0.451
	(0.616)		(-2.259)**
ρ_{12}	-3.437	ρ_{22}	-0.801
	(-3.780)***		(-0.756)
ΔSFCTR(-1)	-0.292	ΔSFCTR(-1)	0.222
	(-0.829)		(0.451)
ΔSFCTE(-1)	0.103	ΔSFCTE(-1)	-0.011
	(0.347)		(-0.024)
Constant	0.228	Constant	-0.267
	(0.963)		(-0.903)
$F_{5, 32}$	3.752**	$F_{5, 32}$	1.901

$F_{5, 32}$ is the overall F-statistic for the respective equations; t-statistics are reported in parentheses. Significance levels are denoted as follows: *** (1%), ** (5%) and * (10%).

In revenue equation 9, the F-statistic associated with state and FCT government expenditures, at the 5% level, have a statistically significant impact on state and FCT government in the short run. However, in expenditure equation 10, F-statistic is statistically insignificant, indicating that state and FCT government expenditures do not respond to budgetary disequilibrium with respect to state and local government revenue in the short run. These results lend support to the tax-spend hypothesis by Friedman (1978) concerning the state and FCT governments in Nigeria, which suggests that it is public revenue, such as taxes, that drives public expenditure. By implication, attempts by government to raise more revenue through taxes increases rather than reduces fiscal deficits. This finding aligns with similar findings in the works of Elyasi and Rahimi (2012), Wolde-Rufael (2008) and Magazzino (2013).

6. Conclusion

This study uses asymmetric cointegration methods to study four hypotheses related to the revenue and expenditure nexus: tax-spend, spend-tax, fiscal synchronisation and institutional separation hypotheses for state and FCT government in Nigeria; results have shed some interesting light on how government expenditure and revenue behave when they are above or below equilibrium. A major contribution to the

revenue and expenditure nexus literature is that the study considered the probability of asymmetric cointegrating relationship in the budgetary process using the Enders and Siklos (2001) TAR and M-TAR cointegration frameworks.

Study results show the following: first, the Engle–Granger cointegration test along with the cointegration tests associated with the TAR and MTAR models indicate there is a long-run equilibrium relationship between aggregate state and FCT government revenue and expenditures. Second, the M-TAR model provides evidence of asymmetries in the adjustment process towards budgetary equilibrium. Third, state and FCT government revenue have a statistically significant impact on state and local government expenditure in the short run, thus supporting the tax-spend hypothesis for the state and FCT government in Nigeria. In sum, the results obtained indicate that it was states and FCT government revenue that was driving expenditure in Nigeria. This is perhaps attributable to oil revenue dominance in Nigeria's government revenue profile and fiscal operations over time. In addition, state and FCT government in Nigeria should try to diversify into other sectors of the economy, such as agriculture and manufacturing, because of the volatility of oil prices and the fact that oil is a resource that is depletable. Future studies need to concentrate on each state government revenue and expenditure relationship, as relevant data become available.

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