Government Spending and Economic Growth: A Revisit of the Nigerian Experience

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2014

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Abstract

Given the continued debate surrounding the effectiveness and efficiency of government spending in Nigeria, this study adopts a modified Autoregressive Distributed Lag Model in order to investigate the impact of federal government spending on economic growth between 1961 and 2010. The main findings are that government total expenditure and recurrent expenditure have insignificant effect on real GDP growth irrespective of the lag period. However, capital expenditure has significant positive effect in the second lagged period. Nevertheless, the long run multiplier of government spending whether total expenditure, capital expenditure or recurrent expenditure, is negative. This means that in the long run real GDP growth is slowed by the negative government expenditure multiplier. The policy implication of the findings is that the quality and efficiency of government spending remains an issue in Nigeria as theory posits that the multiplier effect of government spending should be positive even if it is, as usual, lower than private sector investment multiplier.

Introduction

The effectiveness and efficiency of government spending in Nigeria remains a topical issue since the public sector remains a key driver of the economy. The formulation and implementation of the federal government budget, apart from helping to provide the platform on which government provides the necessary public goods, also helps the private sector to plan its activities in line with government's fiscal policies. Although there is the debate as to the optimum level of government's spending needed to boost growth, the consensus is that at some level of development, the government is needed to facilitate developmental process especially by way of infrastructure provision. Given the developmental challenges facing Nigeria as a nation, the government's drive at encouraging private sector participation through its various reforms should be complemented with effective and efficient public sector spending. Figure 1 shows that change in total government expenditure between 1961 and 2010 averaged 27.2%, higher than average inflation rate of 17.3% in same period. Similarly, the change in total government capital expenditure averaged 29.5% which is also higher than the average inflation rate in the period. This implies that in real terms government spending has increased between 1961 and 2010.

Despite this real increase in government spending Nigeria still faces huge infrastructure challenges. Therefore, because some aspects of government spending may affect the economy with a lag, this study aims to empirically investigate the impact of government expenditure on economic growth using a modified Autoregressive Distributed Lag Model. This approach differs from most empirical studies on Nigeria that were reviewed in this study as they mostly applied the cointegration and causality methodologies. A key brickbat of these approaches remains the implicit assumption of an instantaneous response mechanism of economic growth to variations in public expenditure. Hence, a more nuanced view, which we empirically pursue in this paper, is that economic activity reacts to fiscal policy stimulus in a rather delayed manner. Thus, contemporaneous output realizations are more likely linked to immediate historical rather than current spending patterns. To dig further into this line of thought, therefore, the crux of our paper is to re-investigate the government spending-economic growth nexus in Nigeria, while inventively making allowance for possible delay effects.

Sequel to this opening section, the rest of the paper is mapped out as follows. Section two discusses the empirical literature review on the most recent and entirely Nigerian studies. The methodology is what section three summarises while section four presents the results. Section five discusses the policy implications of the findings.

Empirical literature review

This section reviews some of the studies that have been conducted on the relationship between government spending and economic growth in Nigeria. As obtains in the wider literature, the conclusions from the studies on Nigeria remain inconclusive as the rest of this section demonstrates.

Chimobi (2009) conducted causality and cointegration tests and found no long-run relationship between government expenditure and national income, while causality runs from government expenditure to national Income. Babalola and Aminu (2011) also applied the cointegration approach and investigated the impact of fiscal policy on economic growth in Nigeria in the period 1977 to 2009. Their key finding was that productive expenditure positively impacted economic growth with a long-run relationship existing between them as confirmed by the cointegration test. Usman (2011) employed a reduced form model in addition to Beta coefficient, Theil's inequality and Root Means Square Error (RMSE) techniques to investigate the stability and effectiveness of fiscal policy in Nigeria. The results reveal that government spending is a major factor which influences macroeconomic activity in Nigeria.

Taiwo and Abayomi (2011) examined the trends as well as effects of government spending on the growth rate of real GDP in Nigeria using the Ordinary Least Square (OLS) technique. The study found that there is a positive relationship between real GDP growth and government spending. Olaiya *et al.* (2012) examined the causal relationships among economic growth, government expenditure and inflation rate in Nigeria in the period 1970 to 2010. The study found evidence of co-integration among the variables, while there is bi-directional causality between government expenditures and economic growth both in the short run and in the long run. Also, it was revealed that in the short run a unidirectional causality existed from economic growth and government expenditure to inflation rate while no feedback from inflation rate was observed.

While looking at specific government spending, Nurudeen and Usman (2010) investigated the effect of government expenditure on economic growth by employing a disaggregated analysis. The results reveal that government total capital expenditures, total recurrent expenditures and government expenditure on education have negative effect on economic growth. The effect of rising government expenditure on transport and communication and health results in an increase in economic growth. Similarly, Usman *et al.* (2011) investigated the effect of expenditure on a disaggregated level by focusing on education, health, transport, and administration using a multivariate time series framework. The results showed that in the short run public spending has no impact on growth but the cointegration show that there is long run relationship between public expenditure and growth.

Amassoma *et al.* (2011) also examined the relationship between the components of government expenditure (agriculture; education; health and transport and communication) and economic growth. They found that expenditure on agriculture had a significant influence on economic growth while expenditure on education, health and transport and communication had insignificant influence on economic growth. Nasiru (2012) employed the Bounds test approach to co-integration based on unrestricted error correction model and pair wise granger causality tests. The results indicate that there exists no long-run relationship between government expenditure and economic growth in Nigeria. In addition, the causality results reveal that government capital expenditure granger causes economic growth, while no causal relationship was observed between government recurrent expenditure and economic growth.

In summary, the review of some of the studies on Nigeria with respect to government spending and economic growth shows mixed results. Therefore, this study aims to contribute to the literature and the methodological approach to doing this is explained in the next section.

Methodology and data sources

This sections business centre on briefly explicating the adopted methodology for the purpose of capturing the influence of lagged effects in economic relationships in the first instance. Thereafter, brisk comments on model variables, estimation procedure and data sources make an appearance.

To kick-off, an explanatory variable may affect a dependent variable with a time lag while the dependent variable may also be correlated with lags of itself, suggesting that lags of the dependent variable should also be included in the regression. These considerations motivate the application of the Autoregressive Distributed Lag (ARDL) model which includes lags of both the dependent and the explanatory variables as follows:

$$Yt = \alpha + \partial t + \Phi 1Yt\text{-}1 + \ldots + \Phi pYt\text{-}p + \beta 0Xt + \beta 1Xt\text{-}1 + \ldots + \beta qXt\text{-}q + et \quad (1)$$

In this model the dependent variable Y depends on *p* lags of itself, the current value of an explanatory variable X, as well as *q* lags of X. The model also allows for a deterministic trend ∂t. Therefore, since the model contains *p* lags of Y and *q* lags of X we denote it by ARDL (p, q). Koop (2009) explained that a variant of the ARDL model can be estimated as stated in equation (2) below;

$$\Delta Yt = \alpha + \partial t + \beta Yt\text{-}1 + \lambda 1\Delta Yt\text{-}1 + \ldots + \lambda p\text{-}1\Delta Yt\text{-}p\text{+}1 + ØXt$$
$$+ \theta 1\Delta Xt + \ldots + \theta q\Delta Xt\text{-}q\text{+}1 + et \quad (2)$$

Where:

ΔYt = first difference of the dependent variable

Yt-1 = the lagged value of the dependent variable

ΔYt-1 = the lagged value of the first difference of the dependent variable

Xt = the explanatory variable at time t

ΔXt = first difference of the explanatory variable at time t

ΔXt-1 = the lagged value of the first difference of the explanatory variable

∂t = the deterministic time trend

A key advantage of this variant of the ARDL (p, q) model is that the problem of multicollinearity is minimized. Both the marginal and long-run effects of the coefficients can be interpreted using the concept of the multiplier. The long-run multiplier which measures the effect of a change in the explanatory variable on the dependent variable can be established by the ratio of the coefficients of Xt and Yt-1 which is - Ø/β.

Estimation of this model depends on whether the series are stationary or not. We therefore apply the Augmented Dickey–Fuller (ADF) test to ensure that the variables do not have unit root. The variables of interest in estimating the model are real GDP growth (RGDPG) which is the dependent variable and total government expenditure (TEXP), total capital expenditure (CAPEX) as well as total recurrent expenditure (RECU) which are the explanatory variables. However, each of the variables enters the model separately in order to provide a more focused impact analysis on their effect on real GDP growth.

While there is no general convention about lag selection (Koop 2009:165), we think the estimation of the ARDL model up to three lags for each of the explanatory variables will provide an insight into the effectiveness of government spending. The estimation of up to two and three lags will not significantly reduce the degree of freedom since the study uses annual data from 1961 to 2010 and are sourced mainly from the Central Bank of Nigerian (CBN) statistical bulletin.

Results

The result section covers mainly the treatment of stationarity and the growth impact regressions of aggregate, capital and recurrent expenditures in that order. Precisely, the results of the Augmented Dickey Fuller (ADF) mean-reversion test and the various ARDL models of the growth-spending association are presented and then discussed, while also pointing out the reliability of estimated models via a series of standard regression diagnostics.

Unit root test

One of the conditions for estimating the variant of the ADRL (p, q) model described in the previous section is that the variables must be stationary. Therefore, using the Augmented Dickey Fuller (ADF) test, table 1 shows that TEXP, CAPEX and RECU all have unit roots at level. However, all the variables become stationary after first differencing.

Table 1: Augmented Dickey Fuller test

	Level		1st Difference	
Variables	Intercept	Intercept and trend	Intercept	Intercept and trend
RGDPG	0.0001	0.0019	0.0013	0.0001
TEXP	0.1080	0.1034	0.0088	0.0023
CAPEX	0.2923	0.1826	0.0072	0.0033
RECU	0.1303	0.1669	0.0303	0.0074

Note: Only the probability values are reported here.

Effects of total expenditures on real GDP growth

Table 2 shows the results of the first estimated ARDL model in which the dependent variable is the real GDP growth while the explanatory variables are the lagged value of real GDP growth, lagged value of the first difference of real GDP growth, total government expenditure, first difference of total government expenditure and lagged value of the first difference of total government expenditure. The R-square shows that the model is able to explain approximately 38% of the variation in real GDP while the DW statistic of 1.9478 indicates that the model does not suffer from the problem of autocorrelation. With respect to the specific impacts of TEXP on real GDP, the coefficients have mixed signs and are all insignificant.

Table 2: Real GDP growth and total expenditure (1-lag model)

	Coefficient	Std. Error	t-ratio	p-value
const	5.5601	3.9715	1.4000	0.1694
RGDPGt-1	-0.8223	0.1768	-4.6502	0.0004
ΔRGDPGt-1	0.2559	0.1546	1.6563	0.1057
TEXPt	-0.1498	0.1967	-0.7617	0.4508
ΔTEXPt	0.0480	0.2482	0.1935	0.8476
ΔTEXPt-1	0.0269	0.2262	0.1191	0.9058
time	0.0155	0.0825	0.1876	0.8522
R-squared	0.3773			
Adj. R-sq	0.2815			
DW	1.9478			

*Dependent variable is real GDP growth

The long-run multiplier effect of total spending on real GDP growth is given by the ratio of TEXPt and RGDPGt-1 which is -0.18. This means that TEXP has a negative multiplier effect on real GDP growth. Because real GDP growth averaged 4.17% in the period (see summary statistics in Appendix A), in the long-run real GDP growth should increase by 4.17% plus the long-run multiplier of -0.18 which is 3.99%. In other words, the negative multiplier will reduce average real GDP growth from 4.17% to 3.99%.

The validity of these results is tested by conducting three post estimation tests which include normality test, specification test using the Ramsey's RESET test and heteroskedasticity test using White's (1980) test. The rationale for using White's test is that it eliminates the problems associated with other tests such as the Breusch-Pagan test. This is because it does not depend on the normality assumption and also does not assume prior knowledge of heteroskedasticity. The results of the tests in Appendix 1B shows that we fail to reject the null hypotheses that the errors are normally distributed. Moreover, the specification is adequate and that there is no heteroskedasticity.

Given that a one-year lag may not be sufficient for government spending to start impacting economic growth in some cases, we take the second lag of total government expenditure. The results as shown in table 3 are not significantly different from the earlier estimation. This is because the coefficients of total government expenditure remain insignificant. However, the explanatory power of the model improved with R-square of approximately 41%. The negative long-run multiplier of -0.26 suggests that, in the long-run, real GDP will only increase by the sample average of 4.17% plus the long-run multiplier. This amounts to some 3.91%. Therefore, as in the earlier estimation the negative multiplier slows down long run real GDP growth. Appendix 2B confirms the validity of these results as we again fail to reject the null hypotheses with respect to normality, specification and heteroskedasticity tests.

Table 3: Real GDP growth and total expenditure (2-lag model)

	Coefficient	Std. Error	t-ratio	p-value
const	5.8174	4.3268	1.3445	0.1867
RGDPGt-1	-0.8395	0.1772	-4.7373	0.0000
ΔRGDPGt-1	0.2705	0.1553	1.7422	0.0897
TEXPt	-0.2224	0.2129	-1.0444	0.3031
ΔTEXPt	0.1467	0.2587	0.5671	0.5741
ΔTEXPt-1	0.2128	0.2597	0.8195	0.4178
ΔTEXPt-2	0.3332	0.2283	1.4593	0.1529
time	0.0541	0.0872	0.6206	0.5387
R-squared	0.4093			
Adj. R-squared	0.2975			
Durbin-Watson	1.9155			

*Dependent variable is real GDP growth

We probe further into the lagged effect of total government expenditure on real GDP by taking a third lag. Again, the results as shown in table 4 depict insignificant effect of total government expenditure on the real GDP growth. The negative long run

Table 4: Real GDP growth and total expenditure (3-lag model)

	Coefficient	Std. Error	t-ratio	p-value
Const	6.2879	4.8209	1.3043	0.2007
RGDPGt-1	-0.8300	0.1842	-4.5067	0.0000
ΔRGDPGt-1	0.2751	0.1597	1.7227	0.0938
TEXPt	-0.2264	0.2351	-0.9633	0.3419
ΔTEXPt	0.1289	0.2868	0.4498	0.6556
ΔTEXPt-1	0.1917	0.2837	0.6760	0.5035
ΔTEXPt-2	0.2975	0.2735	1.0875	0.2843
ΔTEXPt-3	-0.0634	0.2435	-0.2604	0.7961
Time	0.0401	0.0965	0.4156	0.6803
R-squared	0.4095			
Adj. R-squared	0.2746			
Durbin-Watson	1.9243			

multiplier of 0.27 means that average real GDP growth will slow to 3.9% from 4.17% between 1961 and 2010. Table 3, in appendix B, also shows that we fail to reject the null hypotheses that the errors are normally distributed, specification is adequate and there is no presence of heteroskedasticity.

Effects of capital expenditures on real GDP growth

Given that total government expenditure includes both capital and recurrent expenditure, the earlier results may not tell us the specific effect of each of these on economic growth. Therefore, the need to have a disaggregated estimation becomes necessary. Table 5 shows that the coefficients of CAPEX are mixed and insignificant. The long-run multiplier given by the ratio -(-0.4788/-0.8647) is -0.55 and implies that average real GDP growth of 4.17% in the period will slow to 3.62%. Table 1 in appendix B shows that while this model fails the normality test, we accept the null hypotheses of adequate specification and absence of heteroskedasticity.

We take the second lag of CAPEX in order to ascertain the effect on real GDP since capital projects take some time to be completed. Table 6 shows that the explanatory power of the model improved with R-square and adjusted R-square of approximately

Table 5: Real GDP growth and capital expenditure (1-lag model)

	Coefficient	Std. Error	t-ratio	p-value
const	6.8354	3.0586	2.2348	0.0312
RGDPGt-1	-0.8647	0.1797	-4.8119	0.0000
ΔRGDPGt-1	0.2681	0.1503	1.7823	0.0825
CAPEXt	-0.4788	0.2769	-1.7290	0.0917
ΔCAPEXt	0.0756	0.3858	0.1960	0.8456
ΔCAPEXt-1	-0.1729	0.3477	-0.4971	0.6219
time	0.0087	0.0777	0.1124	0.9111
R-squared	0.4321			
Adj. R-squared	0.3447			
Durbin-Watson	1.8855			

Table 6: Real GDP growth and capital expenditure (2-lag model)

	Coefficient	Std. Error	t-ratio	p-value
const	7.3673	3.1462	2.3417	0.0247
RGDPGt-1	-0.9032	0.1746	-5.1721	0.0000
ΔRGDPGt-1	0.3503	0.1505	2.3288	0.0254
CAPEXt	-0.6651	0.2849	-2.3340	0.1251
ΔCAPEXt	0.2279	0.3782	0.6026	0.5505
ΔCAPEXt-1	0.2666	0.3882	0.6868	0.4965
ΔCAPEXt-2	0.7531	0.3357	2.2434	0.0309
time	0.0467	0.0787	0.5946	0.5557
R-squared	0.4973			
Adj. R-squared	0.4022			
Durbin-Watson	1.9131			

50% and 40% respectively, while the DW test also improved. The coefficient of CAPEX after second lag is positive and significant. The long-run multiplier of -0.74% implies that real GDP growth in the long run will slow by 0.74% from average 4.17% to 3.43%. Table 2 in appendix C equally shows that while this model also fails the normality test, we accept the null hypotheses of adequate specification and absence of heteroskedasticity.

When we consider the third lag of capital expenditure, Table 7 shows that the model is again able to explain approximately 50% of the variation in real GDP. Also, the effect of the second lag of capital expenditure remains positive and significant while the third lag has insignificant negative effect. The long-run multiplier given by the ratio of

Table 7: Real GDP growth and capital expenditure (3-lag model)

	Coefficient	Std. Error	t-ratio	p-value
Const	7.7084	3.4019	2.2659	0.0297
RGDPGt-1	-0.8916	0.1794	-4.9713	0.0000
ΔRGDPGt-1	0.3656	0.1552	2.3558	0.0242
CAPEXt	-0.6370	0.3115	-2.0452	0.1484
ΔCAPEXt	0.1819	0.3996	0.4552	0.6518
ΔCAPEXt-1	0.2276	0.4037	0.5636	0.5766
ΔCAPEXt-2	0.6602	0.3867	1.7072	0.0966
ΔCAPEXt-3	-0.1816	0.3445	-0.5271	0.6015
time	0.0269	0.0847	0.3171	0.7530
R-square	0.5026			
Adj. R-squared	0.3889			
Durbin-Watson	1.9253			

the coefficients -(-0.6370/-0.8916) is -0.72% and implies that real GDP growth in the long run will slow to 3.45% from the average 4.17% recorded in the period 1961 to 2010. Appendix 3C shows that while this model also fails the normality test, we accept the null hypotheses of adequate specification and absence of heteroskedasticity.

Effects of recurrent expenditures on real GDP growth

The recurrent expenditure is that component of government spending that is mostly used for payments of wages and salaries and other settlements. The result of the estimation as presented in the table 8 shows that the model is able to explain approximately 41% of the variation in real GDP. However, while the signs of the coefficients of RECU are mixed, they generally have insignificant effects on the real GDP as expected. The long run multiplier which is given by the ratio -(-0.4858/-0.8563) is -0.75. This implies that in the long run, the average real GDP of 4.17% recorded in the period under review will slow to 3.42%. Appendix 1D shows that model passed the normality, specification and heteroskedasticity tests.

Table 8: Real GDP growth and recurrent expenditure (1-lag model)

	Coefficient	Std. Error	t-ratio	p-value
Const	-1.4742	4.2535	-0.3466	0.7308
RGDPGt-1	-0.8563	0.1799	-4.7598	0.0003
ΔRGDPGt-1	0.2562	0.1523	1.6824	0.1005
RECUt	0.4858	0.4209	1.1542	0.2555
ΔRECUt	-0.1875	0.5108	-0.3661	0.7162
ΔRECUt-1	0.3829	0.4913	0.7794	0.4405
Time	0.0047	0.0798	0.0587	0.9535
R-squared	0.4130			
Adj. R-squared	0.3226			
Durbin-Watson	1.8855			

Taking the second lag did not significantly affect the pattern of the result as the effects of recurrent expenditure still has mixed signs and insignificant effects on real GDP as shown in table 9. The model however is able to explain approximately 43% of the variation in real GDP. The long run multiplier effect on real GDP, given by the ratio –(-0.5915/-0.8628) is -0.68. This implies that in the long run real GDP growth will slow to 3.49% from 4.17%. Appendix 2D shows that model passed the normality and heteroskedasticity tests but failed the specification test.

Table 9: Real GDP growth and recurrent expenditure (2-lag model)

	Coefficient	Std. Error	t-ratio	p-value
Const	-3.1839	4.8258	-0.6598	0.5135
RGDPGt-1	-0.8628	0.1823	-4.7327	0.0003
ΔRGDPGt-1	0.2448	0.1563	1.5653	0.1263
RECUt	0.5915	0.4758	1.2433	0.2216
ΔRECUt	-0.2256	0.5343	-0.4223	0.6752
ΔRECUt-1	0.3756	0.5191	0.7236	0.4739
ΔRECUt-2	0.0765	0.5057	0.1513	0.8805
Time	0.0254	0.0848	0.2989	0.7667
R-squared	0.4254			
Adj. R-squared	0.3166			
Durbin-Watson	1.9507			

Table 10: Real GDP growth and recurrent expenditure (3-lag model)

	Coefficient	Std. Error	t-ratio	p-value
Const	-4.4443	5.5396	-0.8023	0.4278
RGDPGt-1	-0.8706	0.1908	-4.5618	0.0006
ΔRGDPGt-1	0.2427	0.1607	1.5108	0.1398
RECUt	0.7064	0.5371	1.3153	0.1969
ΔRECUt	-0.31816	0.5861	-0.5428	0.5906
ΔRECUt-1	0.31778	0.5463	0.5817	0.5645
ΔRECUt-2	0.0293	0.5363	0.0546	0.9567
ΔRECUt-3	-0.1322	0.5147	-0.2569	0.7987
Time	0.0289	0.0910	0.3185	0.7520
R-squared	0.4273			
Adj. R-squared	0.2964			
Durbin-Watson	1.9160			

Again, as shown in Table 10, taking the third lag of recurrent expenditure also shows that the effects on real GDP growth are insignificant with the coefficients having mixed signs. This model explains approximately 43% of the variation in the real GDP growth. The long run multiplier of -0.81 implies that the average real GDP growth of 4.17% in the period slows to 3.36% in the long run. Appendix 3D shows that model passed the normality, specification and heteroskedasticity tests.

Conclusion and policy implications of findings

The study investigated the impact of government spending on real GDP growth in Nigeria over the period 1961 to 2010 using a special variant of the ARDL model. The main findings are that total government spending has insignificant effect on real GDP even when lags are taken for up to three periods. However, when disaggregated into capital and recurrent expenditure, the former had significant positive effect after second lag while the latter expectedly had insignificant effects on real GDP. In the long run, real GDP growth is slowed down by the negative multiplier effect of total government spending on one hand and the disaggregated capital and recurrent expenditures components on the other. However, on average, recurrent spending has the most negative multiplier effect of -0.75% on real GDP growth.

The broad policy implication of the findings is that government spending has not improved economic growth in Nigeria despite the enormous amounts that have been expended. Factors responsible for this may include the high proportion of recurrent component of the budget, poor capital budget implementation and associated leakages and the market distortion cost as government financing of its spending hinder resource allocation oftentimes. It therefore means that there is need for government to be more prudent and efficient in its spending as this will ensure provision of basic infrastructure that will boost rather than slow real GDP growth.

To strengthen the budget implementation process, the Nigerian fiscal authorities have gravitated towards performance-based budgeting as against the erstwhile line budgeting, while attempts have also been made in recent times to link the budget estimates of ministries, departments and parastatals with clearly outlined sectorial priorities through a medium-term expenditure framework (MTEF). These, along with other ongoing fiscal reforms, should work to ensure that the potential positive effects of government spending on economic growth materialize in line with Nigeria's aspiration to break into the league of the biggest global economic players (top 20) by the year 2020.

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Appendices

Appendix A: Summary Statistics

	Mean	Median	Minimum	Maximum
RGDPG	4.1736	4.7556	-15.7436	25.0072
TEXP	17.3041	17.2694	6.4475	30.5161
CAPEX	7.2875	6.6500	2.3000	20.0000
RECU	9.6083	9.9177	3.9887	14.8696

Appendix B1: Post estimation tests for ARDL for total expenditure

	Null hypothesis	P-value	Decision
Normality test	Error is normally distributed	0.1306	Accept null hypothesis
Specification test	Specification is adequate	0.2563	Accept null hypothesis
Heteroskedasticity test	No presence of heteroskedasticity	0.5317	Accept null hypothesis

Appendix B2: Post estimation tests for ARDL for total expenditure

	Null hypothesis	P-value	Decision
Normality test	Error is normally distributed	0.2561	Accept null hypothesis
Specification test	Specification is adequate	0.3198	Accept null hypothesis
Heteroskedasticity test	No presence of heteroskedasticity	0.7485	Accept null hypothesis

Appendix B3: Post estimation tests for ARDL for total expenditure

	Null hypothesis	P-value	Decision
Normality test	Error is normally distributed	0.2545	Accept null hypothesis
Specification test	Specification is adequate	0.3367	Accept null hypothesis
Heteroskedasticity test	No presence of heteroskedasticity	0.1538	Accept null hypothesis

Appendix C1: Post estimation tests for ARDL for capital expenditure

	Null hypothesis	P-value	Decision
Normality test	Error is normally distributed	0.0285*	Reject null hypothesis
Specification test	Specification is adequate	0.6579	Accept null hypothesis
Heteroskedasticity test	No presence of heteroskedasticity	0.4966	Accept null hypothesis

*Reject null hypothesis at 5% level of significance

Appendix C2: Post estimation tests for ARDL for capital expenditure

	Null hypothesis	P-value	Decision
Normality test	Error is normally distributed	0.0759*	Reject null hypothesis
Specification test	Specification is adequate	0.6251	Accept null hypothesis
Heteroskedasticity test	No presence of heteroskedasticity	0.7708	Accept null hypothesis

*Reject null hypothesis at 10% level of significance

Appendix C3: Post estimation tests for ARDL for capital expenditure

	Null hypothesis	P-value	Decision
Normality test	Error is normally distributed	0.0723*	Reject null hypothesis
Specification test	Specification is adequate	0.4921	Accept null hypothesis
Heteroskedasticity test	No presence of heteroskedasticity	0.1629	Accept null hypothesis

*Reject null hypothesis at 10% level of significance

Appendix D1: Post estimation tests for ARDL for recurrent expenditure

	Null hypothesis	P-value	Decision
Normality test	Error is normally distributed	0.2486	Accept null hypothesis
Specification test	Specification is adequate	0.1585	Accept null hypothesis
Heteroskedasticity test	No presence of heteroskedasticity	0.3069	Accept null hypothesis

Appendix D2: Post estimation tests for ARDL for recurrent expenditure

	Null hypothesis	P-value	Decision
Normality test	Error is normally distributed	0.2555	Accept null hypothesis
Specification test	Specification is adequate	0.0980*	Reject null hypothesis
Heteroskedasticity test	No presence of heteroskedasticity	0.3467	Accept null hypothesis

*Reject null hypothesis at 10% level of significance

Appendix D3: Post estimation tests for ARDL for recurrent expenditure

	Null hypothesis	P-value	Decision
Normality test	Error is normally distributed	0.22366	Accept null hypothesis
Specification test	Specification is adequate	0.665242	Accept null hypothesis
Heteroskedasticity test	No presence of heteroskedasticity	0.233056	Accept null hypothesis