Public Debt Sustainability Measures and Its Growth Implications for the Nigerian Economy

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Abstract

This study utilises the linear and nonlinear autoregressive distributed lag (ARDL) models to investigate the impact of public debt sustainability measures and its growth implications for the Nigerian economy from 1981 and 2021. The results suggest that public debt-to-oil revenue ratio (PDOR) has a significantly negative effect on economic growth both in the long- and short-run. It also shows that public debt-to-non-oil revenue ratio has an asymmetric effect in the short-run and a positive relationship on economic growth in the long-run. The study concludes that economic growth needs to be enhanced through improved government non-oil revenue. Therefore, to bolster economic growth, the Nigerian government needs to improve revenue generation through non-oil industry by encouraging private investments and widening the tax net.

Keywords: economic growth, nonlinear, non-oil revenue, oil revenue, sustainability
JEL Classification : F34; F40; F43; H63

I. Introduction

A country's debt profile is stable if past and present conditions of its creditworthiness predict the future condition for more credit grants. This is further broken down by Hakura (2020) that when a debtor meets or services its present and expected debt obligations without necessarily seeking assistance from the creditors or defaulting, the debts of that nation are said to be sustainable. In the assessment of a country's creditworthiness, there is the need to consider those debts that threaten the developmental finances. If after these considerations, a country is still able to repay future debt obligations, then the economy is fiscally sustainable (Beqiraj et al., 2018). This means that the difference between expected revenue and expected expenditure is a major determinant of public debt dynamics.

It is worthy of note that public debt sustainability measures are practical tools for assessing the ramifications of budget deficits for an economy. A recent analysis

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of public debts in sub-Saharan Africa, by the International Monetary Fund and World Bank, found signs of distress in more than half of the countries within the region (IMF, 2009). Public debt sustainability, thus, forebodes a nation's ability to service current and future debt obligations in ways that do not affect its present finances toward achieving economic growth. On the other hand, economic growth is that increase in outputs resulting from sustainable public debt-related investments without compromising or distorting future finances.

In Nigeria, an important debt sustainability measure, the ratio of public debt to GDP, was largely above 50.0 per cent between 1987 and 1994. In 1995, the ratio dropped to about 41.3 per cent and further to an average of 26.0 per cent until 1999 when it rose to 63.5 per cent. The 2005 debt forgiveness reduced the ratio to 19.0 per cent, attaining 16.2 per cent in 2017 and 2019, respectively (Omotosho et al., 2016). To enhance sustainability, the National Debt Management Framework (2018-2022) of the Debt Management Office (DMO), adopted a 25.0 per cent debt-to-GDP threshold, which it revises over time. The IMF/World Bank have concentrated more on the public debt-to-GDP ratio (solvency threshold) as a measure of public debt sustainability and has maintained that outcome above a 55.0 per cent threshold for Nigeria and her peer countries could be cataclysmic (Afonso & Jalles, 2011; Panizza & Presbitero, 2013). Also, the liquidity threshold (or public debt service-to-revenue ratio) received much attention in the management of a nation's public debt sustainability. Public debt service as a percentage of revenue is a relevant variable because the larger a country's revenue level, the lower the debt service-to-revenue ratio, thus increasing its capacity to redeem public debt obligations as at when due and vice-versa. It is more relevant and interesting in Nigeria considering its dependence on oil. In theory, a rising debt service-to-revenue or debt-to-GDP thresholds can create fiscal imbalances (deficit), which will have consequences on investment and economic growth (Omotosho et al., 2016).

As a result of the necessity to finance Millennium Development Goals (MDGs) along with other reasons (Dijkstra, 2013), debt forgiveness was requested from external creditors, specifically, London Club in 2005 and the first and second phases of grants approved reduced the debt profile to ₦2.20 trillion in 2006 from ₦4.20 trillion in 2005. It remained low but increased gradually until 2015 when it got to ₦10.90 trillion and settled at ₦20.53 trillion in 2018 from ₦18.37 trillion in 2017 (CBN, 2018). Clearly, since the 2006 Paris Club cancelation of about 60.0 per cent of Nigeria's external debt, successive governments have favoured the use of domestic borrowing in financing the annual fiscal deficits, rather than external loans, to strengthen economic sovereignty. Consequently, domestic debt accounted for 69.0 and 62.0 per cent of the Federal Government's outstanding debt in 2017 and 2018, respectively (Mahmud, 2018; CBN, 2018). The dependence of Nigeria on public debt to fund growth-related schemes in the past 20 years amplified its debt burden significantly and without noticeable improvements in the standard of living of Nigerians (Awe et al., 2014; Ogunnoiki, 2016).

Some empirical works on debt sustainability include Kumar and Woo (2015), which revealed that a threshold above 90.0 per cent debt-to-GDP level slows down real per capita GDP in emerging economies. In Nigeria, Omotosho et al. (2016) identified about a 74.0 per cent threshold level for public debt-to-GDP and found that accumulation of debt above the threshold hurt the economy. Analytical evidences indicate poor performances in economies with over 30.0 per cent of debt-to-GDP threshold (Afonso & Jalles, 2011; Panizza & Presbitero, 2013; Hadhek & Mrad, 2014; Aimola & Odhiambo, 2018; Pegkas, 2018). There is also the possibility of public debt-economic growth asymmetric effect. Akinkunmi (2017) and Sanusi et al. (2019) confirmed the existence of nonlinearity in sub-Saharan and Southern African regions in separate studies. According to Sanusi et al. (2019), public debt could impact economic growth positively or negatively, while a negative effect is associated with neo-classical long-run growth, a positive effect is in line with the Keynesian short-run growth.

In terms of the impact of debt sustainability measures on economic growth in Nigeria, to the best of our knowledge, no work has included total public debt as a percentage of disaggregated revenue (oil and non-oil) as a determinant of the solvency threshold. Though, many studies have recognised the traditional liquidity and solvency thresholds (i.e., public debt service-to-revenue ratio, public debt service-to-export ratio, total public debt-to-GDP ratio, and total public debt-to-export ratio). These indebtedness indicators have been shown to affect different economies in different ways because some economies perform less when their debt share of GDP is low and some function better when their public debt significantly exceeds the value of the annual production in the country (Svaljek, 1997; Eberhardt & Presbitero, 2015; Attard, 2019).

Therefore, the sustainability measure deployed in this study is total public debt as a percentage of oil and non-oil revenue because of the dichotomous nature of the Nigerian economy. This is to separately examine the nonlinear impact of the public debt-to-oil revenue ratio and public debt-to-non-oil revenue ratio on economic growth and to ascertain whether these measures sustain economic growth in Nigeria. To know whether there is a nonlinear or asymmetric effect on economic growth, the debt sustainability measures adopted are decomposed into positive and negative. This is because studies reviewed arrived at either positive or negative effects within a particular period with few studies considering the possibility of a nonlinear (asymmetric shock) relationship of the variables within the same period.

II. Literature Review

A number of studies have analysed the aggregated nonlinear impact of public debt on economic growth. Vaca et al. (2020) examined the nonlinear trajectory of the debt-growth relationship in Mexico in the form of an inverted "U". This was a critical examination of whether an increase in debt beyond a certain degree diminishes economic growth. Using a short-term single regression model on data from 1994 to 2016, they found that the debt-to-GDP ratio has a direct and significant impact on economic growth, while its square (nonlinear) is negative and significant. This result confirmed an asymmetric effect (or inverted U-shaped) relationship between public debt and economic growth in Mexico. In terms of the threshold of debt, they revealed a 27.0 per cent debt-to-GDP ratio for the country. That is, beyond that level, Mexico will generate a fall in the growth of the economy.

In contribution to the nonlinear impact of public debt, Sanusi et al. (2019) addressed the nonlinear effect of the public debt-economic growth relationship in the Southern African communities. Their study used annual data from 1998 to 2016 for 16 countries that make up SADC and employed a distributed lag multivariate nonlinear model. They found a direct, immediate, and nonlinear impact relationship in the long-run with a threshold of 57.0 per cent of GDP for Southern Africa. In line with the result, they advised public debt within an optimum degree to be put into productive use in order to achieve the needed growth and to avoid diminishing returns.

To validate the belief that public debt spur growth in a nonlinear path, Butkus and Seputiene (2018) investigated the determinants of debt threshold for growth while relying on Blundell and Bond's System Generalised Method of Moment technique on unbalanced panel data of 152 countries between 1996 and 2016. The results of their study revealed a nonlinear debt-to-growth relationship and the debt turning point is determined by government effectiveness and not trade balance. In other words, the growth of these economies responded negatively to positive shock and vice versa. They concluded that even though government effectiveness is a major determinant of asymmetric effect, trade balance could be used as a basis for determining turning point instead of institutional quality.

However, in terms of the threshold requirements for sustainable public debt, Attard (2019) used annual data of 25 developed and developing economies in Europe to expatiate the nexus between public debt and economic growth. He applied the panel ARDL model to data from 1996 to 2017 and found that public debt negatively impacted economic growth irrespective of its tenure. Therefore, he recommended a 60.0 per cent maximum threshold of public debt-to-GDP ratio for these countries if they must see the positive benefit of debt financing.

Meanwhile, Odejimi and Ozor (2018) explored the response of economic growth to changing public debt profile, gross capital formation and labour quality in West Africa. To find quality answers to their objectives, multivariate regression of panel models was deployed using data from 1970 to 2011 for eleven countries. They found that economic growth did not respond significantly to debt but in assuming no difference among the countries' policies or economic situations, debt accumulation was found to command a strong response from economic growth. Based on their findings, they recommended reduced focus on debts as a driver of economic growth.

Motivated by the findings of studies regarding public debt and economic growth, Saeed and Islam (2018) investigated four South Asian countries using nonlinear analysis to examine the relationship between public debt and economic growth. The estimated results of data spanning 1980 to 2014 suggest a significant nonlinear relationship between the variables. However, the response turned negative for the region when the debt level went above 61.0 per cent of GDP.

Running a panel regression, Beqiraj et al. (2018) considered the empirical study of sustainable debts in 21 European countries from 1991 to 2015. They employed multivariate panel regression and found in the long-run that the government of these countries did not respond positively to the rise in public debts while in the short-run, there was a nonlinear fiscal policy response to changes in public debts.

Aimola and Odhiambo (2018) used 32 years data span to examine the thresholds of public and private debts in Ghana. According to them, the sustainability threshold for public and private debts as a percentage of GDP has surpassed 60.0 per cent since 2013. To mitigate this problem, they advised the government to consider lowering its borrowing and ensure a coordinated use of fiscal, monetary, and debt management policies. Murungi and Okiro (2018) examined the impact of government debt on economic growth in Kenya through extensive review of relevant theoretical and empirical literature. From the literature, they found evidence of positive and negative impacts of government debt on economic growth.

Across Europe, Gómez-Puig and Sosvilla-Rivero (2017) empirically investigated the public debt relationship with economic growth of the Euro Area from 1961 to 2013. They applied an autoregressive distributed lag (ARDL) model and their study depicted mixed results such that averagely, countries in this Euro Area exhibited a negative relationship in the long-run and a positive one in the short-run.

Eberhardt and Presbitero (2015) analysed the link between public debt and growth in 22 low-income, 27 lower-middle-income, 33 upper-middle-income and 36 high-income countries. They adopted linear and nonlinear panel ARDL models using data from 1961 to 2012. They found a long-run asymmetric effect and the coefficients for countries with debt overhang were lower such that the differences were insignificant during positive or negative responses. They concluded that the structure of debt varied through countries, thereby recommending appropriate country-specific policies, as replicating that of one country for another may be seriously misguided.

In their study, Awe et al. (2014), examined the influence of national debt on sustainable economic growth in Nigeria and found a significant negative connection between debt and economic growth. They advocated a process of debt forgiveness that could release funds for domestic investments and consequently impact growth positively. Hence, they recommended that government should seek concessional debts with lower interest rates.

Omotosho et al. (2016) used quarterly data to determine the threshold of the relationship between public debt and economic growth in Nigeria. Their findings identified a 73.7 per cent overall threshold. However, foreign and domestic debts were 49.4 per cent and 30.9 per cent, respectively. According to them, the Nigerian economy was hurt markedly in periods when public debt overshoots threshold and vice versa. Hence, they called for caution in debt accumulation.

Kumar and Woo (2015) researched the power of high public debt on economic growth. Their analysis used panel data spanning 37 years for industrialised and unindustrialised economies. Testing for the bidirectional causality and endogeneity properties of the data (1970 to 2007), they found an indirect connection between debt and growth. They also concluded that the nonlinear impact of a high debt-to-GDP ratio on industrialised economies is lower compared to unindustrialised economies.

In a related study, Panizza and Presbitero (2013) investigated the link between public debts and economic growth in advanced economies. They used a dynamic growth model on disaggregated countries' debt-to-GDP ratio. They split the economies into countries with ratios of less than 30.0 per cent, 30.0 per cent but less than 90.0 per cent and above 90.0 per cent, and concluded that there is causality. Also, in their findings, they showed that only countries with higher (above 90.0 per cent) debt-to-GDP ratio exhibited an inverse impact on growth. Therefore, for those countries, they recommended constricting fiscal policies to reduce the shock.

Henry (2013) evaluated the external debt conversion programme in Nigerian economy. He opined that the debt service burden had become immensely intolerable and is undermining the country's economic development. He used both primary and secondary sources of data, with records of data from the CBN and Ministry of Finance serving the secondary source. He conducted a Chi-square analysis and concluded that the management of Nigeria's external debt is effective but other options other than debt conversion needed to be considered in managing external debt.

From the above literature reviewed, it is evident that the impact of debts on economic growth is mixed. That is, some arrived at positive relationships, while others found a negative relationship. It is also evident that the sustainability measure explored by previous works is a debt-to-GDP ratio which may not reveal the true nature of the country's economy. Therefore, this study investigates Nigeria's public debt situation on whether it exhibits a linear or nonlinear (asymmetric) impact on economic growth. It also deviates from the usual debt-to-GDP measure and adopts the debt-revenue ratio where it further decomposes the revenue into oil and non-oil to individually investigate their nonlinear impact on economic growth in Nigeria.

II.1 Theoretical Framework

According to Buiter (1985), long-term public debt sustainability can be assessed in four ways. First, the solvency approach which involves the assessment of the budget, that is, the difference between government planned incomes and expenditures. Another measure is the dynamics of debt-to-GDP ratio, which aims at stabilising the nominal public debt and nominal GDP. It measures market perception of the likelihood that a country may not pay its external liabilities in time and in full (Roubini, 2001), while the time series approach measures the balance of deficits and surpluses over time provided the government does not change its debt policy. This means that debt is sustainable if the primary surplus and deficit are equal for long time. The fourth measure is Maastricht fiscal criterion of assessment in which total public debt to GDP is expected to not exceed 60.0 per cent at the end of previous financial year (Polasek & Amplatz, 2003; Buiter, 1985).

In theory, it is feasible to measure the sustainable level of foreign borrowing primarily based on the terms, maturity, and availability of foreign capital, however in practice, the assignment is almost impossible, considering the fact that such data is not without problems (Debrun et al., 2019). Thus, a variety of ratios, such as that of debt-to-exports, debt service-to-exports, and debt-to-GDP (or GNP), are widely used as debt sustainability measures. Even though it is difficult to determine the sustainable degree of such ratios, their chief practical value is to warn of potentially explosive growth in the stock of foreign debt.

The relationship between debt sustainability measures and economic growth is linked with many theories. That is, the Classical debt theory of Smith (1776), the Ricardian equivalent theory of Barro in the 1970s, the debt overhang theory of Myers (1977), the Debt-Laffer curve theory considered by Sachs (1989), the Keynesians theories of the 1940s and 50s, Fiscal Insurance theory of Lucas and Stokey (1983), dual-gap theory of Chenery and Strout (1966) and Functional Finance theory of Lerner (1943). However, this study is hinged on the Debt-Laffer curve theory by adopting the dynamics of debt-to-GDP ratio which aims at stabilising the nominal public debt and nominal GDP. Debt-Laffer curve theory was explored by Sachs (1989) at first to reflect debt overhang. It was formalised by Arthur Laffer to analyse the state of affairs and show that when a nation borrows excessively, its potential to finance drops and its risk of default rises. So, it becomes an assessment tool for creditors to measure the suitability of a debtor. That is, when the debt level of debtors is high, lenders calculate the anticipated fee of reimbursements they receive. If the anticipated value is much less than the face value of the debt, lowering the nominal fee of the debt will decrease the threat of default and leads to an increase in the predicted price of future repayments (Tatu, 2014).

Krugman (1988) explained that the Debt-Laffer curve theory is a hyperlink between the capacity of a debtor to pay interest when due and its present position of a debt obligation. This proposition suggests that debt burden is a concern for debtor nations as it results from the capital flight of future revenues that could have been used for internal projects. In effect, it eventually leads to low returns on capital and investment (Calvo, 1998; Chris et al., 2012). Nigeria's productive capacity is weak and this supply-side Debt-Laffer curve theory is relevant to show when debt accumulation will have a beneficial effect on production and the economy. It also stands as a basis for the Debt Management Office to plan its debt portfolio and schedule the contractual agreement for loans.

III. Data Source and Methodology

This study largely utilises time-series data from 1981 to 2021. The choice of sample period is based on availability and the need to cover the period of the Structural Adjustment Programme (SAP). Following the crude oil market crisis of the late 1970s, Nigeria's economic fortune since 1981 was strained by the massive debt spiralling and constrained debt service, as debt liabilities escalated in both interest and capital (Ikudayisi et al., 2015). The oil price boom of the early 1970s had led the nation to embark on ambitious socio-economic development schemes, but with the mismanagement that accompanied an economically-inept military rule, it became an economic disaster. In addition, the oil glut of the early 1980s caused a fall in oil price which nosedived fiscal revenue and plunged a hitherto rich nation to a debtor nation (Udoka & Nkamare, 2016).

Datasets on public debt and economic growth were sourced from the National Bureau of Statistics (NBS), Central Bank of Nigeria (CBN) and World Bank's World Development Indicators (WDI) databases. The data on the exchange rate, total debt, oil revenue, and non-oil revenue are from the 2021 CBN statistical bulletin, while data on GDP growth rate (to proxy economic growth) and real interest rate were sourced from 2022 WDI.

This study deploys linear and nonlinear dynamic models to investigate the impact of debt sustainability measures and its growth implications for the Nigerian economy. The nonlinearity analysis is necessitated by the results of structural break unit root and trend analysis which suggest possible positive and negative effects. This is further supported by the fact that debt dynamics or changes may have a distinct impact on economic activity based on the Keynesian standpoint. Preliminary unit root tests (without and with structural break) of the data indicate mixed order of integration which is suitable for the application of the bound cointegration test. These analyses aim to ascertain the asymmetric effects and rate of adjustment to equilibrium should any shock exist in the economy.

The Augmented Dickey-Fuller (ADF) test is applied because it permits p lagged values of the dependent variable Y_t and the inclusion of a constant and a linear time trend. The general model is given as:

$$\Delta Y_t = \alpha + \beta t + \beta_1 Y_{t-1} - 1 + \sum_{i=1}^{k} \varphi_i \Delta Y_{t-i} + \varepsilon_t, \qquad (1)$$

where, α, β, and φ_i are respectively the constant number, linear time trend coefficient and autoregressive order of lag. When α = 0 and β = 0, the variables are random walk without drift, and in case only β = 0, the series is a random walk. The null hypothesis of ADF test states that Y_t has unit root and there is no stationarity. However, in order to endogenously ascertain the true nature of unit root presence in the data, owing to the fact that the standard unit root test in the presence of structural break could have a serious power distortion, methodology of Perron (2006) that proposes a unit root test which allows for an endogenous structural change is presented in equation (2):

$$Y_t = \mu + \theta Dt + \beta t + \gamma \beta_1 Y_{t-1} - 1 + \sum_{i=1}^{k} \varphi_i \Delta Y_{t-i} + \varepsilon_t \quad (2)$$

where, Dt (dummy variable for a mean shift occurrence at each possible break-date) = 1; if t > T_1 and 0 otherwise; D(T_1)t (dummy variable corresponding trend shift variable) = 1 if t = T_1+1 and 0 otherwise. The test considered is the minimal value of the t-statistic for testing that a=1 versus the alternative hypothesis that over all possible break dates in some pre-specified range for the break fraction. Thereafter, the bound cointegration test which follows the ARDL procedure.

The general ARDL model for one dependent variable and a set of independent variables is denoted as ARDL (p_1, …, p_n), in which the first p_i is the lag order of dependent variable, Y and the rest are respectively the lag orders of the independent variables. It is worthy of note that ARDL, among other advantages, estimates the cointegrating bound test, short-run and long-run results. An ARDL model is appropriate if all the post estimation tests are not significant. Thus, the general forms of bounds cointegration and ARDL models are as follows:

$$\Delta Y_t = \alpha + \sum_{i=1}^{n} \beta_0 \Delta Y_{t-1} + \sum_{i=1}^{n} \beta_i \Delta X_{i,t-i} + \lambda_0 Y_{t-1} + \sum_{i=1}^{n} \lambda_i X_{i,t-i} + \varepsilon_t \quad (3)$$

where, Y is the dependent variable, X_i is the vector of explanatory variables and λ_0, λ_i test the cointegration among variables with which the null hypothesis is no cointegration.

$$\Delta Y_t = \alpha + \sum_{i=1}^{n} \beta_i Y_{t-i} + \sum_{i=0}^{n} \beta_i X_{i,t-j} + \sum_{j=1}^{n} \beta_j \Delta Y_{i,t-i} + \sum_{j=0}^{n} \beta_j \Delta X_{i,t-j} + \varepsilon_t \quad (4)$$

where, β_i and β_j are the long- and short-run parameters respectively. Y_{t-i} is lag of dependent variable and X_i, $t-j$ is the vector of independent variables.

It should be noted that after nonlinear autoregressive distributed-lag (NARDL) estimation the representations of the variables are aided by the application of

Stepwise Least Squares regression to automatically arrange the variables systematically for the application of the Wald test on both long-run and short-run nonlinear estimates. Wald test is used to determine the asymmetric effect and if there is no asymmetric effect, then the linear estimate or result is interpreted. A significant Wald test's F-statistic suggests an asymmetric (nonlinear) effect of the independent variable on the dependent variable and vice-versa for an insignificant F-statistic. The NARDL dynamic multiplier graph is derived to reaffirm the findings. The decision rule here is that if a shock graph (or multiplier line) in the dynamic multiplier graph lies above the zero line, there is a positive response, but if it lies below the zero line, then a negative response to the economic growth rate on the sustainability measures is observed. It is also used to reaffirm the result of the Wald test of asymmetry by observing the zero line whether it passes through or outside the upper and lower bounds of a 95.0 per cent level of significance. Passing through means no asymmetry while lying outside indicates asymmetry.

III.1 Model Specification

Therefore, based on the procedure described above and among previous studies that have used public debt as a determinant of economic growth, for example, Sanusi et al. (2019) for which this paper adapted. The model of Sanusi et al. (2019) is presented as:

$$GDPG = F(PD, X) \tag{5}$$

where, $GDPG$ is growth in GDP, PD is the public debt-to-GDP ratio, and X is the set of control variables consisting of investment, government expenditure, inflation rate and trade openness. This paper thus, modifies equation (5) to incorporate the public debt-to-oil revenue ratio (PDOR) and public debt-to-non-oil revenue ratio (PDNR) as policy variables, while using an exchange rate and real interest rate as control variables. Therefore, the conditional ECM form of the linear and nonlinear ARDL models are:

$$\Delta GDPG_t = \alpha_0 + \beta_t GDPG_{t-1} + \beta_2 Log(EXRT)_t + \beta_3 RI\mathrm{NT}_t + \beta_4 PDOR_t + \sum_{i=1}^{\mathrm{n}} \theta_i GDPG_{t-i} + \sum_{i=0}^{\mathrm{n}} \gamma_i \Delta Log(EXRT)_{t-i} + \sum_{i=0}^{\mathrm{n}} \delta_i \Delta RI\mathrm{NT}_{t-i} + \sum_{i=0}^{\mathrm{n}} \partial_i \Delta PDOR_{t-i} + \rho Ect_{t-1} + \varepsilon_t \tag{6}$$

Equation (6) considers the linear impact of PDOR on GDPG.

$$\Delta GDPG_t = \alpha_0 + \beta_t GDPG_{t-1} + \beta_2 Log(EXRT)_t + \beta_3 RI\mathrm{NT}_t + \beta_5 PDOR\_POS_t + \beta_6 PD\mathrm{OR\_NEG}_t + \sum_{i=1}^{\mathrm{n}} \theta_i GDPG_{t-i} + \sum_{i=0}^{\mathrm{n}} \gamma_i \Delta Log(EXRT)_{t-i} + \sum_{i=0}^{\mathrm{n}} \delta_i \Delta RI\mathrm{NT}_{t-i} + \sum_{i=0}^{\mathrm{n}} \omega_i \Delta PDOR\_POS_{t-i} + \sum_{i=0}^{\mathrm{n}} \xi_i \Delta PDOR\_\mathrm{NEG}_{t-i} + \rho Ect_{t-1} + \varepsilon_t \tag{7}$$

Equation (7) considers the nonlinear impact of PDOR on GDPG.

$$\Delta GDPG_t = \alpha_0 + \beta_t GDPG_{t-1} + \beta_2 Log(EXRT)_t + \beta_3 RINT_t + \beta_7 PDNR_t + \sum_{i=1}^{n} \theta_i GDPG_{t-i} + \sum_{i=0}^{n} \gamma_i \Delta Log(EXRT)_{t-i} + \sum_{i=0}^{n} \delta_i \Delta RINT_{t-i} + \sum_{i=0}^{n} \partial_i \Delta PDNR_{t-i} + \rho Ect_{t-1} + \varepsilon_t \qquad (8)$$

Equation (8) considers the linear impact of PDNR on GDPG.

$$\Delta GDPG_t = \alpha_0 + \beta_t GDPG_{t-1} + \beta_2 Log(EXRT)_t + \beta_3 RINT_t + \beta_8 PDNR\_POS_t + \beta_9 PDNR\_NEG_t + \sum_{i=1}^{n} \theta_i GDPG_{t-i} + \sum_{i=0}^{n} \gamma_i \Delta Log(EXRT)_{t-i} + \sum_{i=0}^{n} \delta_i \Delta RINT_{t-i} + \sum_{i=0}^{n} \omega_i \Delta PDNR\_POS_{t-i} + \sum_{i=0}^{n} \xi_i \Delta PDNR\_NEG_{t-i} + \rho Ect_{t-1} + \varepsilon_t \qquad (9)$$

Equation (9) considers the nonlinear impact of PDNR on GDPG.

GDPG represents the growth rate of gross domestic product, EXRT is the exchange rate, RINT is the real interest rate, PDOR is the total public debt-to-oil revenue ratio, PDNR is total public debt-to-non-oil revenue ratio, α_0 is the intercept while α_1 is the coefficient of trend, *T*, *βs* are the long-run coefficients to be estimated, θ, γ, δ, ψ, ξ and ρ are short-run parameters to be estimated, *n* represents the lag length which differs for each variable, ε represents error term and Δ changes.

Public debt-to-oil revenue ratio (PDOR) is captured by total public debt as a percentage of oil revenue. On the other hand, public debt-to-non-oil revenue ratio (PDNR) is public debt divided by non-oil revenue. PDOR falls when oil revenue increases above the debt obligation and vice-versa. This means that public debt is sustainable as long as oil revenue increases and becomes a burden when oil revenue falls (Yuan & Kazuyuki, 2012). The same explanation goes for PDNR. The effect of PDOR and PDNR on economic growth is positive when revenue increases above public debt and negative when revenue falls below public debt because the level of a country's revenue determines her ability to service/redeem her indebtedness and possibly negotiate for more credit to invest in developmental projects that will propel economic growth.

IV. Results and Discussion

IV.1 Descriptive Statistics

Table 1 describes the properties of the data for the estimation period, 1981 to 2021. It is observed that exchange rate (EXRT) ranges between 0.61 and 399.96 with a mean value of 108.17 naira per dollar and a standard deviation value of 109.91. The mean is farther away from the maximum, hence, positively skewed. The mean growth rate of gross domestic product (GDPG) is 3.0 per cent with maximum and minimum values of 15.3 and -13.1 per cent, respectively. The mean value of public total debt as a percentage of non-oil revenue (PDNR) is 997.1 per cent, while the value ranges between 206.27 and 2957.51 with a deviation from the mean value of 776.47. The average mean value of public total debt as a percentage of oil revenue (PDOR) is 371.6 per cent, and the real interest rate (RINT) is 0.5 per cent.

Table 1: Summary of Statistics

	GDPG	EXRT	RINT	PDOR	PDNR
Mean	3.0415	108.1675	0.4536	371.5817	997.1298
Median	3.6472	111.9433	4.3103	368.1178	661.2548
Maximum	15.3292	399.9636	18.1800	912.6091	2957.5140
Minimum	-13.1279	0.6100	-65.8572	41.6963	206.2723
Std. Dev.	5.3854	109.9115	14.2592	237.0326	776.4662
Skewness	-0.8192	0.9729	-2.7175	0.4741	1.0589
Kurtosis	4.6206	3.1725	12.9110	2.4280	3.0468
Jarque-Bera	9.0722	6.5193	218.2694	2.0947	7.6664
Probability	0.0107	0.0384	0.0000	0.3509	0.0216
Sum	124.7002	4434.8670	18.5967	15234.8500	40882.3200
Sum Sq. Dev.	1160.118	483221.4	8132.9600	2247377.	24115988
Observations	41	41	41	41	41

Source: Authors' computation.

The Jarque-Bera statistics test of normality indicates that variables GDPG, EXRT, RINT and PDNR are not normally distributed at 5.0 per cent level, PDOR exhibited normality at the 5.0 per cent level. Finally, the kurtosis statistic shows that PDOR is platykurtic, while GDPG, EXRT, PDNR and RINT on the other hand are leptokurtic.

Table 2 presents the correlation matrix and it shows that the data for the variables used have the best linearity and are relevant to this paper. According to Dormann et al. (2013), the established threshold for weak collinearity is when the value is less than 0.7 and the summary above depicts that most of the variables are weakly correlated with each other.

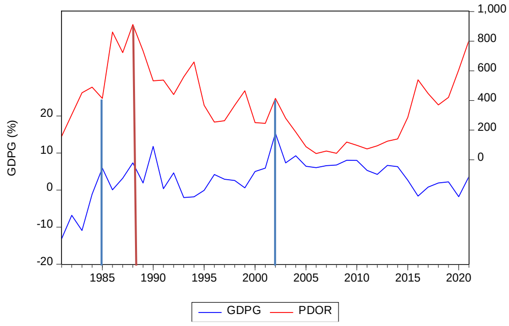
Table 2: Correlation Matrix

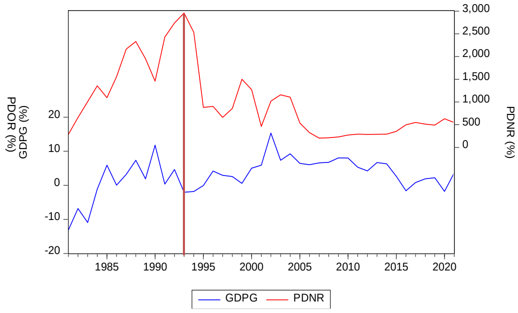
	GDPG	EXRT	RINT	PDOR	PDNR
GDPG	1	0.1586	0.5671	-0.2256	-0.0960
EXRT		1	0.3471	-0.1076	-0.5346
RINT			1	-0.0664	-0.2067
PDOR				1	0.6707
PDNR					1

Source: Authors' computation.

Figure 1 shows the graphical representation of the dependent variable (GDP growth rate) and the exogenous variables (public debt-to-oil revenue ratio and public debt-to-non-oil revenue ratio) in percentage form. GDP growth rate (GDPG) is unstable as it undulates but a somewhat upward trend is observed with breakpoints in 1985 and 2002. The public debt-to-oil revenue ratio (PDOR) has its breakpoint in 1988, and the public debt-to-non-oil revenue ratio (PDNR)'s breakpoint is in 1993. All these breakpoints are indications of financial crises during these periods and are not far from the effects of the 1986 Structural Adjustment Programme (SAP) instituted by the then military administration. It also shows the possibility of nonlinear relationship among the variables (Ekperiware & Oladeji, 2012).

Figure 1: Trends Analysis





Source: Authors' computation.

IV.2 Stationary Test

The stationarity tests adopted are unit root tests without and with a structural breaks. That is, Augmented Dickey-Fuller (ADF) and Phillip-Perron (PP) are carried out for unit roots without breakpoint. Perron's (2006) test of unit root is also carried out to account for structural break point since the conventional unit root test suffers from low power distortion in the presence of structural break (that is, it can report presence of unit root when there is none and vice-versa).

Table 3 presents the unit root tests conducted on the model variables. It shows the standard or conventional ADF and PP unit root results at level, I(0) and the first difference, I(1) for all the variables in three categories of equations (that is, equations that include intercept or intercept & trend or none). The results are mixed order of integration. That is, variables GDPG and RINT under the ADF unit root test are stationary at the level I(0), while variables EXRT, PDOR and PDNR are stationary at the first difference I(1). The same result is also arrived at in PP unit root test.

Table 3: Unit Root without Structural Break Test (Conventional)

Augmented Dickey-Fuller (ADF)							
	LEVEL			FIRST DIFFERENCE			
Variables	Constant	Trend and Constant	None	Constant	Trend and Constant	None	I(d)
GDPG	-4.1580	-3.9822**	-1.9192	-10.0771	-10.3136	-10.1476	I(0)
	(0.0024)	(0.0179)	(0.0534)	(0.0000)	(0.0000)	(0.0000)	
EXRT	1.3936	-2.0776	3.0129	-4.2635	-4.5095***	-3.7419	I(1)
	(0.9986)	(0.5408)	(0.9990)	(0.0018)	(0.0049)	(0.0004)	
RINT	-7.2683	-7.4756***	-7.1782	-9.8216	-9.5889	-9.9892	I(0)
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	
PDOR	-2.0425	-2.6699	-0.8224	-3.2250**	-3.4172*	-3.2591	I(1)
	(0.2683)	(0.2540)	(0.3531)	(0.0274)	(0.0663)	(0.0019)	
PDNR	-1.8218	-3.0350	-1.0255	-5.2526	-3.9142***	-5.3282	I(1)
	(0.3646)	(0.1365)	(0.2692)	(0.0001)	(0.0223)	(0.0000)	
Philip Perron (PP)							
	LEVEL			FIRST DIFFERENCE			
Variables	Constant	Trend and Constant	None	Constant	Trend and Constant	None	I(d)
GDPG	-4.1721	-3.9822**	-3.0057	-10.4068	-12.1131	-10.2430	I(0)
	(0.0023)	(0.0179)	(0.0036)	(0.0000)	(0.0000)	(0.0000)	
EXRT	1.3364	-1.5171	2.9457	-4.1653	-4.2581***	-3.7360	I(1)
	(0.9984)	(0.8060)	(0.9988)	(0.0024)	(0.0092)	(0.0005)	
RINT	-7.0445	-7.1658***	-6.7871	-28.0615	-29.8299	-21.1819	I(0)
	(0.0000)	(0.0000)	(0.0000)	(0.0001)	(0.0000)	(0.0000)	
PDOR	-2.0475	-2.7035	-0.7693	-6.7590	-6.6448***	-6.8575	I(1)
	(0.2663)	(0.2410)	(0.3763)	(0.0000)	(0.0000)	(0.0000)	
PDNR	-1.8319	-2.9581	-1.0005	-5.4397	-5.4308***	-5.5318	I(1)
	(0.3600)	(0.1569)	(0.2789)	(0.0001)	(0.0004)	(0.0000)	

Source: Authors' computation.
*, ** and *** imply significance at 10%, 5% and 1%, respectively. ADF is Augmented Dickey Fuller Unit Root Test, PP is Philip Peron Unit Root Test. Values in parenthesis (…) indicate MacKinnon (1996) one-sided p-values.

Table 4 presents the results of the Philip Perron (2006) unit root test with structural break. It shows variables GDPG, EXRT and PDOR are stationary at the first difference, but exhibit structural breaks IN 1985, 1986, and 1999 respectively. Also, variables RINT and PDNR are stationary at the level and different breakpoints in 1995 and 2005.

Table 4: Unit Root with Structural Break Test

	LEVEL			FIRST DIFFERENCE			
Variables	Break Date	T-statistic	P-value	Break Date	T-Statistic	P-value	I(d)
GDPG	2000	-4.8343*	0.0539	1985	-11.7581***	< 0.01	I(1)
EXRT	2014	-3.8352	0.4780	1999	-5.43146***	< 0.01	I(1)
RINT	1995	-9.6366***	< 0.01	1997	-10.0861***	< 0.01	I(0)
PDOR	2014	-4.2197	0.2475	1986	-7.4731***	< 0.01	I(1)
PDNR	2005	-8.1808***	< 0.01	1995	-7.0275***	< 0.01	I(0)

Source: Authors' computation.

*, ** and *** signify significance at 10%, 5% and 1%, respectively.

IV.3 Regression Results

The results in Table 5 are generated through Akaike Info Criterion (AIC) model selection and automatically select the lag length LARDL (2, 4, 0, 3) model and NARDL (1, 2, 2, 2, 2) model. Further estimation tests the models' reliability as there is the absence of specification error, serial correlation, and heteroscedasticity, with normally distributed residuals. The bound cointegration tests of the two models suggest a long-run equilibrium relationship among the variables (F-test > I(1) at 0.05).

It is observed from the result of equation (7) in Table 5 that there is no evidence of asymmetric effect in the economic growth- public debt-to-oil revenue ratio model in the long-run. This is affirmed by the Wald test (in Part C) and Multiplier graph (Figure 2) results. That is, the F-statistic value of the Wald test is not significant at a 5.0 per cent level of significance, while the zero line of the multiplier graph lies within the upper and lower bounds of a 95.0 per cent level of significance. On the other hand, the coefficient of public debt-to-oil revenue ratio (PDOR) is negative and significant in equation (6). Thus, for every 1.0 per cent increase (or decrease) in public debt-to-oil revenue ratio (PDOR), the growth rate of gross domestic product (GDPG) falls (or rises) by 0.014 per cent in the long-run. Also, in the short-run, there is no asymmetric effect between the growth rate of gross domestic product (GDPG) and public debt-to-oil revenue ratio (PDOR). Therefore, the linear result shows that for every one percentage point increase in public debt-to-oil revenue ratio (PDOR), the growth rate of gross domestic product (GDPG) falls by 1.0 percentage point. Clearly, economic growth responds more to negative changes in public debt-to-oil revenue ratio (PDOR) in the short-run than in the long-run.

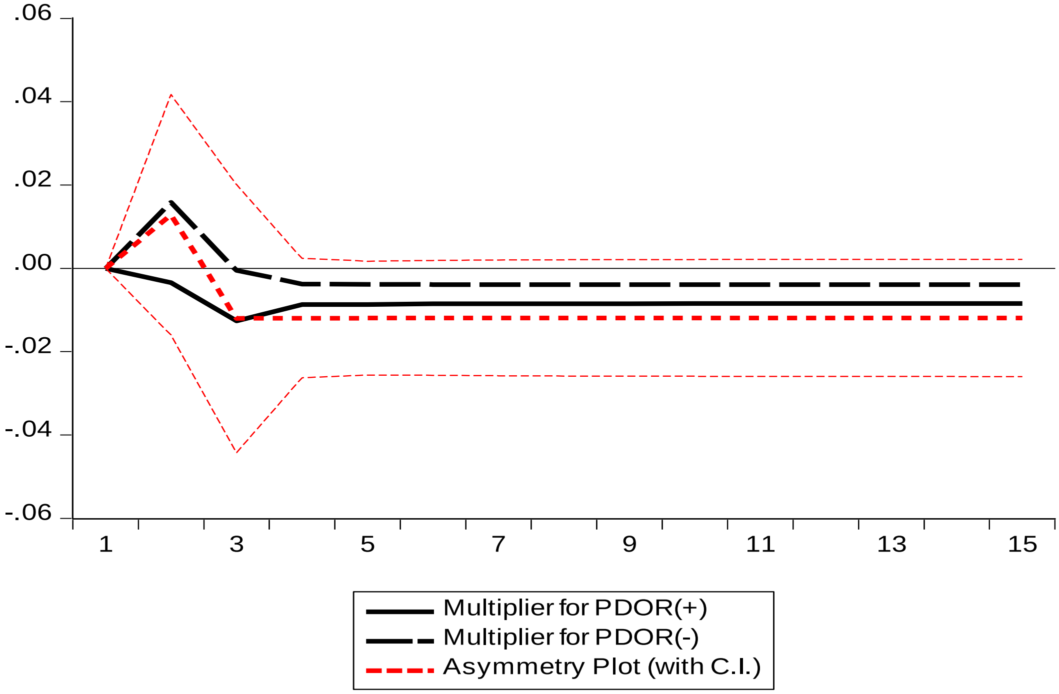
Table 5: Summary of Linear ARDL (LARDL) and Nonlinear ARDL (NARDL) Estimates for Equation (6) and (7)

Part A: Bound Cointegration Test						
F-Statistic	I(0)	I(1)	Significance	F-Statistic	I(0)	I(1)
7.7990***	2.72	3.77	10%	5.9542***	2.45	3.52
	3.23	4.35	5%		2.86	4.01
	4.29	5.61	1%		3.74	5.06
Part B: Estimation						
	LARDL (Equation 6)			NARDL (Equation 7)		
Variable	Coefficient	t-Statistic	Prob.	Coefficient	t-Statistic	Prob.
Long-run						
C	8.3823***	3.4105	0.0023	6.6804**	2.3711	0.0261
GDPG(-1)	-0.6748***	-4.5474	0.0001	-0.9387***	-5.1039	0.0000
LOG(EXRT)	-1.3183*	-1.9710	0.0593	3.4197	1.4061	0.1725
RINT	0.2189**	2.5299	0.0184	0.2882**	2.3085	0.0299
PDOR	-0.0143**	-2.6856	0.0129	-	-	-
PDOR_POS	-	-	-	-0.0086	-1.4726	0.1539
PDOR_NEG	-	-	-	0.0038	0.5261	0.6037
Short-run						
D(GDPG(-1))	-0.2414**	-2.5569	0.0173	-0.1883***	-3.0587	0.0062
DLOG(EXRT)	-1.7758	-0.5290	0.6007	-2.4316	-1.1001	0.2822
D(PDOR)	-1.0044***	-116.7981	0.0000	-	-	-
D(PDOR_POS)	-	-	-	-0.0035	-0.5053	0.6179
D(PDOR_NEG)	-	-	-	-0.0157	-1.5810	0.1270
ECT(-1)	-0.6748***	-5.9242	0.0000	-0.9387***	-5.8935	0.0000
Part C: Post Estimation Test						
Diagnostic Test	F-statistic	Df	Prob.	F-statistic	Df	Prob.
Linearity (RESET)	2.8906	1, 23	0.1026	2.0327	1, 23	0.1674
Serial Correlation	0.7378	2,22	0.4896	1.4195	2,22	0.2631
Heteroscedasticity	1.4488	12,24	0.2118	1.6366	13,24	0.1432
JB-Normality	0.8375		0.6579	2.9953	-	0.2237
Wald_{LR} Test	-	-	-	2.8969	1, 28	0.0998
Wald_{SR} Test	-	-	-	1.2899	1, 28	0.2657
R^2	0.7879	-	-	0.6277	-	-
Adj. R^2	0.7173	-	-	0.5080	-	-

Source: Authors' computation, 2022.
*, ** and *** imply significance at 10%, 5% and 1%, respectively.

The error correction coefficient (ECT) represents the speed of adjustment, that is, the rate at which the model is restored to equilibrium following a disturbance. The coefficient of ECT, -0.6748, implies that about 68.0 per cent of errors generated in one period are corrected in the next period. This highly significant and negative ECT coefficient also supports evidence that there is a stable long-run relationship between the dependent variable and the independent variables. The Adjusted R^2 indicates that 72.0 per cent of the explanatory variables account for the variation in economic growth.

Figure 2: NARDL Dynamic Multiplier Graph for PDOR



Source: Authors' computation.

The results in Table 6 are generated through Akaike Info Criterion (AIC) model selection and automatically select the lag length LARDL (2, 2, 2, 2) model and NARDL (2, 2, 2, 2, 2) model. Further estimation tests the models' reliability as there is an absent of specification error, serial correlation, and heteroscedasticity, with normally distributed residuals for equation (8) and in equation (9). The bound cointegration tests of the two models suggest long-run equilibrium relationship among the variables (F-test > I(1) at 0.05). The existence of cointegration necessitates an interest in the error correction component of the models.

In equations (8) and (9), the long-run coefficient of PDNR is marginally significant, while the coefficients of the decomposed PDNR in NARDL are not statistically significant. This implies the absence of asymmetric effect in the long-run. Therefore, from the LARDL result, a percentage point increase in PDNR leads to 0.0030 percentage point increase in GDPG.

In the short-run, the coefficient of PDNR in equation (8) is insignificant while the negative component of the variable is significant under the NARDL model. It is also noted that a negative change in PDNR represented by PDNR_NEG elicits a positive response from dependent variable (GDPG). That is, for a percentage point increase in PDNR, GDPG falls by 0.0042 percentage point, and a percentage point decrease in PDNR leads to 0.0048 percentage point increase in GDPG. It is observed that GDPG responds slightly more to the decomposed negative shock of PDNR than positive shock. The result of the Wald test confirms asymmetry with a significant F-test. The result is reaffirmed by the multiplier graph in Figure 3 as the zero line in the graph lies outside the upper and lower bounds of 95.0 per cent level of significance at the beginning. Therefore, we conclude that the result is nonlinear in the short-run.

Table 6: Summary of Linear ARDL (LARDL) and Nonlinear ARDL (NARDL) Estimates for Equation (8) and (9)

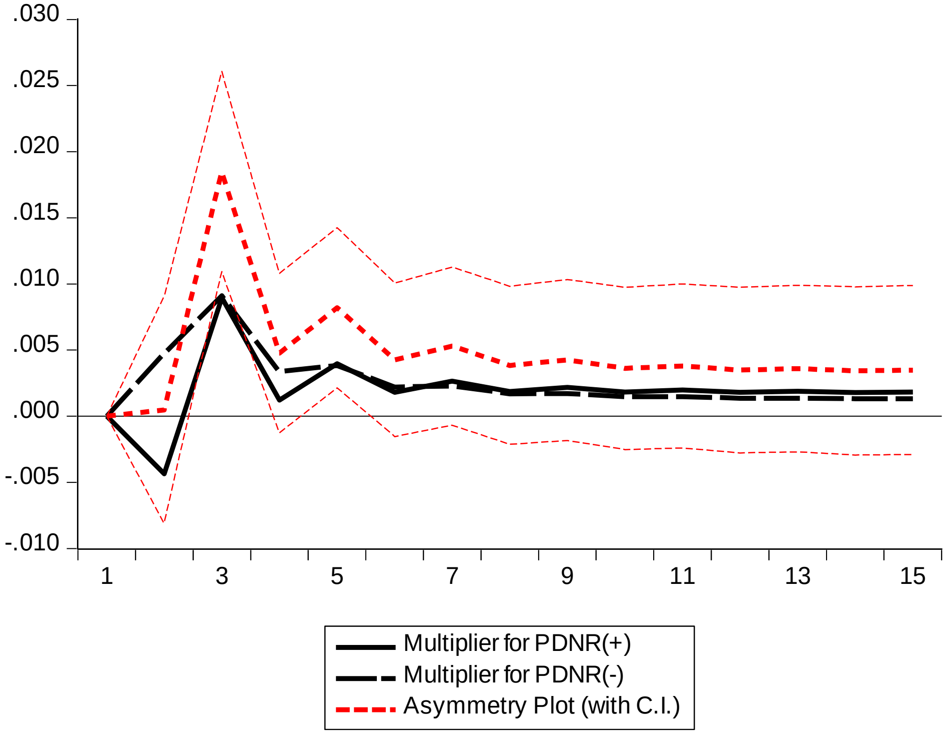
Part A: Bound Cointegration Test						
F-Statistic	I(0)	I(1)	Significance	F-Statistic	I(0)	I(1)
3.9241**	2.01	3.1	10%	5.2221***	1.9	3.01
	2.45	3.63	5%		2.26	3.48
	3.42	4.84	1%		3.07	4.44
Part B	LARDL (Equation 8)			NARDL (Equation 9)		
Variable	Coefficient	t-Statistic	Prob.	Coefficient	t-Stat.	Prob.
Long-run						
GDPG(-1)	-0.5753***	-3.1304	0.0041	-0.5640	-3.5776	0.0015
LOG(EXRT)	-0.0805	-0.1619	0.8725	-3.2960	-1.5036	0.1457
RINT	0.5115**	2.3685	0.0250	0.2057	3.6190	0.0014
PDNR	0.0030*	1.7117	0.0980	-	-	-
PDNR_POS	-	-	-	0.0021	0.6044	0.5513
PDNR_NEG	-	-	-	-0.0009	-0.3645	0.7187
Short-run						
D(GDPG(-1))	-0.2861	-1.9848	0.0570	-0.2892***	-2.5112	0.0192
DLOG(EXRT)	-2.9280	-1.1140	0.2747	-3.2960	-1.5036	0.1457
D(RINT)	0.1839**	2.2708	0.0310	0.2057***	3.6190	0.0014
D(PDNR)	-0.0012	-0.6652	0.5114	-	-	-
D(PDNR_POS)	-	-	-	-0.0042	-1.2763	0.2141
D(PDNR_NEG)	-	-	-	-0.0048***	-2.916074	0.0076
ECT(-1)	-0.5753***	-3.5986	0.0012	-0.5640***	-5.5192	0.0000
Part C: Post Estimation Test						
Diagnostic Test	F-statistic	Df	Prob.	F-statistic	Df	Prob.
Linearity (RESET)	0.1844	1, 27	0.6711	0.0065	1, 23	0.9365
Serial Correlation	0.2748	2,26	0.7619	0.1735	2,22	0.8419
Heteroscedasticity	1.4904	11,27	0.1924	1.4771	14,23	0.1971
JB-Normality	3.1888	-	0.2030	4.4338	-	0.1090
$Wald_{LR}$ Test	-	-	-	0.8588	1, 26	0.3626
$Wald_{SR}$ Test	-	-	-	16.5767***	1, 26	0.0004
R^2	0.5587	-	-	0.7299	-	-
Adj. R^2	0.4591	-	-	0.6431	-	-

Source: Authors' computation.
*, ** and *** imply significance at 10%, 5% and 1%, respectively.

Exchange rate (EXRT) in the long-run shows a negative and insignificant relationship on economic growth rate (GDPG) while real interest rate (RINT) has a positive and significant impact on GDPG. That is, for every 1.0 per cent fall in EXRT, GDPG will rise by 3.3 per cent and vice-versa. Also, if RINT rises by 1.0 per cent, the value of GDPG rises by 0.2per cent and vice-versa.

The error correction coefficient (ECT) represents the speed of adjustment, that is, the rate at which the model is restored to equilibrium following a disturbance. This coefficient of ECT, -0.5640, implies that about 56.4 per cent of errors generated in one period are corrected in the next period. This highly significant and negative ECT coefficient also supports evidence that there is a stable long-run relationship between the economic growth and the independent variables. The Adjusted R^2 indicates that 64.3 per cent of the explanatory variables account for the total variation in economic growth.

Figure 3: NARDL Dynamic Multiplier Graph for PDNR



Source: Authors' computation.

The findings in this study reveal the nature of the (linear and nonlinear) relationships between debt sustainability measures and economic growth. That is, the results show that the public debt-to-oil revenue ratio (PDOR) has a negative and significant relationship with economic growth in the long-run. In practice, the result indicates that the more debt resources are accumulated over the oil revenue generated, the less efficient it is in boosting growth levels. In other words, the heavier the debt burden, the more likely it is to compress output growth in Nigeria. This is not surprising, as the economy is largely dependent on an oil revenue that is markedly lower than the total debt obligations. On the other hand, if the oil revenue increases while total public debt remains constant, debt sustainability measures (or debt burden) will improve and hence boost economic growth.

This finding is consistent with those of Attard (2019), Murungi and Okiro (2018), Anning et al. (2016), and Awe et al. (2014). Specifically, Attard (2019) found that public debt negatively impacts economic growth over the long-term in European Union, while Murungi and Okiro (2018) showed that public debts have a significant impact on growth in Kenya. A negative relationship between public debt and growth was found in Ghana (Anning et al., 2016) and Nigeria (Awe et al., 2014).

However, the findings for public debt-to-non-oil revenue ratio and economic growth shows an asymmetric effect in the short-run but symmetry in the long-run. This simply means that, in the short-run, economic growth responds more to negative shock of public debt as a percentage of non-oil revenue than positive shock. This result is supported by Vaca et al. (2020), Sanusi et al. (2019) and Butkus and Seputiene (2018). Vaca et al. (2020) result indicated an asymmetric effect between public debt and economic growth in Mexico, while Sanusi et al. (2019) found a long-run nonlinear in Southern Africa. The study of Butkus and Seputiene (2018) revealed a nonlinear debt-to-growth relationship for 152 countries.

IV. Conclusion and Recommendations

The results of this study show a significant positive and asymmetric relationship between public debt sustainability measures (public debt-to-non-oil revenue ratio) and economic growth in the short-run and long-run. That is, when dichotomised between oil and non-oil revenues the results change extensively, as a short-run asymmetric interaction is recorded between public debt-to-non-oil revenue ratio and economic growth relationship. The results suggest that, in the short-run, economic growth response is higher for negative shock to public debt-to-non-oil revenue ratio than for positive shocks. This means that non-oil revenue improvement could reduce the debt overhang and improve economic growth. Though, it showed no asymmetric effect but a positive linear relationship in the long-run and that could mean that public debt as a percentage of non-oil revenue sustainability measure is sustainable.

On the other hand, the negative relationship between public debt-to-oil revenue ratio and economic growth indicates that oil revenue generation alone might not have the capacity to upset/upturn the debt obligation without distress in Nigeria. This is evident in the inability of government to meet OPEC quota of production and the incessant drop in oil revenue due to the activities of oil bunkerers in the Niger Delta region. From the findings, the study concludes that economic growth needs to be enhanced through improved government debt-to-non-oil revenue ratio. Therefore, from the findings, the following recommendations are provided:

i. Since oil prices are volatile and subject to global shocks, government needs to diversify the economy especially in sector outside the oil industry and encourage private investment. This will help them to build a more resilient economy that is less dependent on oil revenue and therefore, less susceptible to the impact of public debt. By following this, government can mitigate the negative impact of the ratio of public debt to oil revenue on economic growth in both the short- and long-run; and

ii. Government through the Ministry of Finance can increase their non-oil revenue through measures to reduce fiscal deficit by cutting wasteful spending, broadening the tax base, increasing tax revenue, and implementing fiscal rules that limit deficit. This will help to increase non-oil revenue and reduce the public debt to non-oil revenue ratio. By this, government can manage the asymmetric effect of the ratio of public debt to non-oil revenue on economic growth and reduce the risk of a debt crisis.

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