Domestic Public Debts and Economic Growth Nexus in Nigeria: Further Empirical Evidence from Causality and Structural Breaks Analyses

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The existing empirical studies have so far not justified any clear-cut generalization as to the causal link and impact of government domestic debt on economic growth, especially in less developed and developing countries. The actual evidence on the association between these variables does not point to any undeviating conclusion. In the current study, an attempt was made at providing further empirical evidence to the debate by examining the causal relationship between the two variables, as well as identifying the structural breaks in the variables. The study utilised Nigerian annual time-series data stretching from 1981–2018. Data were analysed using Johansen-Juselius cointegration, vector error correction modelling, Granger causality, Augmented Dickey-Fuller and Bai-Perron’s multiple structural breaks procedures. The result provided convincing support for the existence of stable short-run and long-run relationships between public domestic debt and economic growth. The study neither found any causal relationship between public domestic debt-to-GDP ratio and real GDP growth rate nor established any lagged effect of domestic debt-to-GDP ratio on the growth rate of the gross domestic products in Nigeria. Bai-Perron’s test found strong evidence of five structural breaks in the variables, with identifiable economic and political shocks in the country during the sampled period. The study, therefore, recommended that the Nigerian government should acquire domestic debt only for very high priority and self-sustaining projects that could contribute positively to economic growth, and reduce superfluous economic and political shocks in the country.

Key words: Domestic public debt, economic growth, Bai-Perron structural breaks, granger causality, vector error correction model, Nigeria

INTRODUCTION

Developing countries often resort to borrowing when the ever-increasing needs in the social development process cannot be met by the nation’s ordinary public revenues. Borrowing can also be due to major infrastructure investments, war, development financing, natural disasters, economic crisis, and budget deficits (Aybarç, 2019). These borrowings have political, economic, and social impacts on the national economy. Since the interest and principal debt, the amount is usually paid from taxes; these debts are a burden on society (JMPC, 2018; Saman, 2007; Muley,
As noted by Samuelson (1976), “The public debt is a burden on the back of our children and grandchildren... All debt is evil; public debt evil” (p. 896).

However, following the substantial weakening of public finances in different economies, occasioned by the 2008 global financial crisis (which was followed by a massive increase in public sector borrowing), and the intensification of most developing countries to turn their economies into the upper middle-income category by 2030, there has been a revival of enquiries on the role of public debts in promoting economic growth. Economies with a high level of debt-to-GDP ratio experience subdued economic growth. Clements, Bhattacharya, and Nguyen (2003) stated that high levels of public debt can depress economic growth in low-income countries; this by implication means that domestic borrowing has been favoured over international borrowing.

Most of the existing studies on the relationship between public debt and growth consider public debt as a domestic debt (see, e.g., Bohn, 1998; Checherita & Rother, 2010; Greiner, 2007). According to Ejigayehu (2013), Zaman and Arslan (2014), and Soydan and Bedir (2015), the empirical results generally reveal that the accumulation of external debt is associated with an increase in economic growth up to an optimal level, and an additional increase of external indebtedness beyond the level inversely contributes to the economy. Hence, for some years now, several developing and emerging countries have adopted aggressive policies aimed at substituting external public debt with domestically issued debt (Panizza, 2008; Presbitero, 2012). Guidotti and Kumar (1991) showed that in 15 emerging market countries, the domestic public debt-to-GDP ratio went from 10 per cent in 1981 to 16 per cent in 1988, while Christensen (2005) found that low-income countries have a tradition of domestic borrowing (in his sample of sub-Saharan African countries, domestic public debt was about 10 per cent of GDP in 1980).

Domestic public deficit financing has been observed to have many advantages, namely: (i) Lower exposure of the public debt portfolio to currency risk if and when the domestic debt is denominated in local currency (Hausmann, Panizza, & Rigobon, 2006; Bacchiocchi & Missale, 2012); (ii) Lower vulnerability to capital flow reversals (Calvo, 2005); (iii) Improved institutional infrastructure underlying the organization and functioning of local financial markets (Arnone & Presbitero, 2010). Kyurumyan (2009) attributed the large increase of public domestic debt to four supply and demand factors: a). Financial crises (mostly to finance recapitalization of the banking system); b). Central bank attempts to sterilize capital inflows limit inflation and exchange rate appreciation; c). Attractiveness of domestic borrowing; and d). Increased demand for emerging and developing country public domestic currency debt.

However, despite the abundance of the theoretical and empirical literature on the public debt-economic growth nexus, the empirical foundations of the causal relationship between domestic public debt and economic growth is scanty, and the reported evidence has been mixed and sometimes conflicting (Donayre & Taivan, 2017; Gómez-Puig & Sosvilla-Rivero, 2017). Over again, since the causal relationship between public debt and economic growth is said to be intrinsic to each country (Donayre & Taivan, 2017; Gómez-Puig & Sosvilla Rivero, 2015), it implies that the causal links between public debt and economic growth analysis are an empirical problem. Unlike most past studies on the subject which make inferences based on cross-sectional
Granger-causality tests, the current study conducted causal tests for Nigeria and thus has the advantage of capturing country-specific factors.

This study used the Johansen-Julius cointegration and vector error correction procedure with structural breaks to assess the causal linkages between public domestic debt and economic growth in Nigeria. The originality of this paper resides in the consideration of domestic debt-to-income ratio and growth rate of domestic income, even without control variables. As also noted by Gómez-Puig and Sosvilla-Rivero (2015) and Saungweme and Odhiambo (2019), the direction of causality between public debt and economic growth, and the influence of structural breaks have direct policy implications, especially on tax and investment decisions—and hence on economic growth. Though government domestic borrowing is often thought of as a way of avoiding inflation and external crises, it oftentimes reduces the credit which would otherwise be available to the private sector, putting pressure on domestic interest rates (Akpansung, 2018). This, by implication, means that extensive use of domestic borrowing can have severe implications on the economic growth of the borrowing country.

Nigeria’s domestic debt increased to N84,093.1 billion in 1990 and later rose to N794.8066 billion in 1999, showing an increase in N710.7135 billion between the two periods. By 2001 domestic debt had grown to a four-digit figure of N1016.98 billion showing an increase of N222.1734 billion between 1999 and 2001. The stock of Federal Government consolidated debt at the end of the first half of 2010 was N4,405.18 billion or 15.3 per cent of GDP. This represented an increase of 15.4 per cent over the level at end-December 2009. The breakdown showed that the domestic debt was N3,764.76 billion or 85.5 per cent, while the external debt amounted to US$4.27 billion (N640.41 billion) or 14.5 per cent of the total. The gross domestic product (GDP) at 1990 constant basic prices grew by 7.5 per cent in the first half of 2010, compared with 6.3 per cent in the first half of 2009. The growth was driven by the non-oil sector which expanded by 8.3 per cent and accounted for 83.0 per cent of the GDP (CBN, 2010). The FGN’s domestic debt outstanding by instruments shows that as at end-December, 2016, the FGN’s domestic debt stock comprised mainly FGN bonds (68.41 per cent), Nigerian Treasury Bills (29.64 per cent) and Treasury Bonds (1.95 per cent).

Nigeria’s domestic debt accounted for a higher percentage of Nigeria’s fiscal exposure, increasing from N6537.527 billion in 2012 to N7904.02 billion in 2014, and N11058.2 billion in 2016. The 2016 figure represented an increase of N2,221.21 billion or 25.14 per cent of 2015 outstanding domestic debt of N8,837.00 billion). Recent data showed that the domestic debt grew by N458.36 billion between the end of December 2018 and the end of March 2019 (DMO, 2019). Though the Debt Management Office (DMO) intends to reduce domestic borrowing to 60 per cent from previous 80%, the ratio of domestic to foreign debts stood at 68.49 per cent to 31.51% at the end of March 2019. The total public debt to Gross Domestic Product (GDP) ratio was 19.03%, which was within the 25 per cent government-imposed debt ceiling. The public debt /GDP ratios as at December 2018 and June 2019 were 19.09 per cent and 18.99 per cent respectively (DMO, 2019).

Studies have shown that much less attention has been given to the issue of public domestic debt in developing countries, despite its potentially significant impact on economic growth. Though there are many studies on the impact of domestic debt on economic growth in Nigeria (Anyanwu, &
Erhijakpor, 2004; Adofu & Abula, 2010; Oke, & Sulaiman, 2012; Amassoma, 2011; Wosowei, 2013; Ekperiware & Oladeji, 2012; Onyeiwu, 2012), to the best of the authors’ knowledge, studies specifically investigating the causal relationship between public domestic debt and economic growth, with multiple structural breaks in Nigeria are nonexistent, a gap that the current study has bridged.

**LITERATURE REVIEW**

**Theoretical framework**

The early theoretical connections between public debt and economic growth have been expounded by Buchanan (1958), Meade (1958), Modigliani (1961) and Diamond (1965). Like Buchanan (1958), Modigliani (1961), argued that public debt is a burden for next generations, which comes in the form of a reduced flow of income from a lower stock of private capital. Diamond (1965) argued that when a government borrows domestically, they use up domestic private savings that would otherwise have been available for private-sector lending. This implies that domestic public debt can produce a further reduction in the capital stock arising from the substitution of government debt for physical capital in individual portfolios.

The orthodox view is that debt (reflecting deficit financing) can stimulate aggregate demand and output in the short run, but crowds out capital and reduces output in the long run (Elmendorf & Mankiw, 1999). The neoclassical model postulates that a reasonable level of borrowing contributes positively to economic growth. It considers debt as a substitute for domestic savings and investment and therefore domestic savings and investment are crowded out as a result (Krugman, 1988). In the Solow’s (1957) neoclassical growth theory, an increase in government debt (due to a fiscal deficit) leads to a temporary decline in growth along the transition path to a new steady-state, whereas in the endogenous growth model, an increase in government debt would lead to a permanent decline in growth (Saint-Paul, 1992). Growth models augmented with public agents issuing debt to finance consumption or capital goods tend to exhibit a negative relationship between public debt and economic growth, particularly in a neoclassical setting.

Though reverse causality is a particularly important issue for the study of the link between debt and growth (Huang, Panizza, & Varghese, 2018), correlation, however, does not imply causation (Panizza & Presbitero, 2012), and cross-country literature has been less successful in establishing the presence of a causal link going from public debt to economic growth (Panizza & Presbitero, 2013; 2014). The link between public debt and economic growth could be driven by the fact that it is low economic growth that leads to high levels of debt. The observed correlation between debt and growth could also be due to a third factor that has a joint effect on these two variables. Establishing the presence of a causal link going from debt to growth requires finding an instrumental variable that has a direct effect on debt but no direct effect on economic growth (Panizza & Presbitero, 2012).

Generally, as noted by few other authors, both theoretical and empirical studies on the link between public debt and economic growth yield inconclusive results depending on a set of heterogeneous factors, including the level of development of the countries, data coverage, the methodology used, researchers’ choice of control variables, etc.
Empirical review

Some empirical studies indicate that the direction of causality between public debt and economic growth is bi-directional (the feedback hypothesis), while other studies found no causality existing between public debt and economic growth (debt-growth neutrality hypothesis). The few studies supporting this hypothesis include Panizza and Presbitero (2014) for OECD countries, Reinhart, Reinhart and Rogoff (2012) for 44 advanced and emerging countries, Jalles (2011) for 72 developing countries, Ahmed, Butt, Sabihuddin and Shaista (2000) for Asian countries.

The number of studies that specifically examined the direction of causality between public debt and economic growth has concentrated mostly in developed countries (see, Donayre & Taivan, 2017; Kobayashi & Shirai, 2017; Owusu-Nantwi & Erickson, 2016; Gómez-Puig & Sosvilla-Rivero, 2015; Puente-Ajovín & Sanso-Navarro (2015), Panizza & Presbitero, 2014; Reinhart & Rogoff, 2010; Ferreira 2009; Abbas & Christensen, 2007). These studies were conducted using different samples and at different periods, and have produced mixed evidence on the direction of causality between these two macroeconomic variables (Saungweme & Odhiambo, 2019b).

Eze, Nweke and Atumba (2019) analyzed the impact of public debts on economic growth in Nigeria for the period 1981-2017 using ARDL model and Chow Breakpoint test. The results revealed that external debt has a negative and significant impact on GDP while domestic debt has a negative and insignificant effect on GDP.

Using a dynamic multivariate autoregressive-distributed lag (ARDL)-bounds testing approach for Zambia for the period from 1970 to 2017, Saungweme and Odhiambo (2019a) found unidirectional Granger-causality from economic growth to public debt in Zambia, irrespective of whether the analysis was done in the short run or the long run. The results also indicated no evidence of significant structural break between the study variables, as well as failed to find any causality between public debt service and economic growth in Zambia.

Findings from a study conducted by Panagiotis (2018) for Greece shows among others that, government debt and population growth hurt growth; the nexus between debt and growth depends on debt breaks. Particularly, at debt levels before 2000, increases in the government debt-to-GDP ratio were associated with insignificant effects on economic growth. However, as the government debt rises after 2000, the effect on economic growth diminishes rapidly and the growth impacts become negative.

Using multivariate vector autoregression approach and annual time series data spanning 1981-2016, Akpansung (2018) analysed the dynamic interactions and impacts of domestic debts on private sector credit, prime lending rate, and real output in Nigeria. The study provided evidence that Government domestic debt exerted statistically insignificant positive impacts on both private sector credit and prime lending rate, and a statistically significant negative impact on real output in Nigeria during the study period.

By analysing the short-run relationship between public debt and economic growth for a panel of 10 European Monetary Union (EMU) countries over a period of 22 years, from 1995 to 2016, Botelho (2017) found that public debt caused economic growth in most of the countries analysed.
The country-specific regressions showed that the countries that present a causal relationship departing from public debt to economic growth were Belgium, Ireland, Luxembourg and Netherlands. This analysis also showed that the causal relationship varies across countries.

Using a two-stage least square (2SLS) estimation technique, Akhanolu, Babajide, Akinjare, Oladeji and Osuma (2018) found that external debt negatively impacts the Nigerian economy while internal debt positively does the same for the period, 1982-2017.

In the analysis of the direction of causality between public debt and real economic growth in developed countries using a sample of 20 Organisation for Economic Co-operation and Development (OECD) countries for the period from 1970 to 2010, Donayre and Taivan (2017) found that in highly market-driven economies, the direction of causality is from low GDP growth to public debt; while in more socialist states, causality runs either from low GDP growth to public debt accumulation or is bi-directional.

Kobayashi and Shirai (2017) found that excessive public debt depresses GDP growth rates by discouraging private sector investment and can thus cause economic recessions. Alejandro and Ileana (2017) examined the impact of government debt on the gross domestic products in 16 Latin American economies for the period 1960-2015 using Two-Stage Least Squares (2-SLS). The results indicated that debt has a positive impact on GDP growth but declines to close to zero beyond public debt-to-GDP ratios between 64% and 71%; up to this threshold, additional debt has a stimulating impact on growth.

Gómez-Puig and Sosvilla-Rivero (2015) also tested the causal relationship between public debt and economic growth in developed countries using a sample of 11 central and peripheral countries of the European Economic and Monetary Union (EMU). The study utilised time-series data stretching from 1980 to 2013. The empirical evidence in this study is mixed. The results for Germany, Greece, Italy, Belgium and Spain show evidence that causality flows from public debt to economic growth. Concerning Finland and Ireland, the results show causality from economic growth to public debt, while in Austria and Portugal no causal relationship was confirmed.

Owusu-Nantwi and Erickson (2016) used Johansen cointegration and the vector error correction model to examine the long-term and causal relationship between public debt and economic growth in Ghana using annual time series data from 1970 to 2012. The study found a positive and statistically significant long-run relationship between public debt and economic growth. Bidirectional Granger causality link was found between public debt and economic growth in the short run. This bidirectional link between debt-to-GDP ratio and real GDP growth rate reported is consistent with the study by Egbetunde (2012).

Matthew and Mordecai (2016) examined the impact of public debt on the economic development of Nigeria using annual time series data spanning 1986 to 2014. The Johansen co-integration test results revealed the presence of a long-run relationship among the variables. External debt stock had an insignificant negative relationship, while domestic debt stock had a direct and significant relationship with economic development. The study also found a one-way causal relationship between domestic debt and gross domestic product per capita in Nigeria.
Using Granger-causality tests on panel samples of 16 OECD countries, Puente-Ajovín and Sanso-Navarro (2015) found no evidence of causality between public debt and economic growth in studied economies. Similar results were confirmed by Panizza and Presbitero (2014) for 17 OECD countries using an instrumental variable approach to control for reverse causality.

In a paper examining the consequences of public debt for economic growth and investment in the Philippines for the period 1975-2010 based on autoregressive distributed lag technique, Naeem (2015) found that public external debt had a negative and significant impact on economic growth and investment, confirming the existence of a debt overhang effect. The study also indicated that domestic debt had a negative influence on the investment and positive effect on economic growth.

In Swaziland, Precious (2015) examined the effects of both public external and domestic debt on economic growth for the period 1988-2013, using ordinary least squares technique. External debt was found to have an insignificant impact while domestic debt had a positive and significant impact on economic growth.

Manik (2016) investigated the “cause-effect” relationship between public debt and economic growth for the Indian economy over the period, 1980 -2014. He employed ADF and PP time series unit root tests, VAR lag selection criteria, Johansen cointegration test, VECM, and VEC Granger causality test. The study found no causal relationship between domestic debt and economic growth but a unidirectional causality exists from economic growth to external debt both in the short run and in the long run. Ferreira (2009) found bidirectional causality between public debt and economic growth for OECD countries. A similar finding was obtained by Egbetunde (2012) in Nigeria. In these studies, higher debt seemed to have led to lower economic growth and lower economic growth influenced the evolution of higher debt.

Gómez-Puig and Sosvilla-Rivero (2017) empirically investigated the short and long-run impact of public debt on economic growth, using annual data from both central and peripheral countries of the euro area (EA) for the 1961-2013 period. The estimated result based on Autoregressive Distributed Lag (ARDL) bounds testing approach suggest different patterns across EA countries and tend to support the view that public debt always hurts the long-run performance of EA member states, whilst its short-run effect may be positive depending on the country.

The research work of Dritsaki (2013) on Greece over the period 1960-2011, however, found unidirectional causality running from growth to debt. Tasos (2014) found no causality between debt and growth for Greece. Bal and Rath (2015) examined both the short-run and long-run effect of public debt on economic growth in India during 1980-2011, and found a significant negative relationship between the two variables. In their study of the relationship between economic growth, external debt and domestic debt in Nigeria between 1970 and 2010, Aminu, Ahmadu and Salihu (2013) found no causation existing between domestic debt and GDP as well between external debt and domestic debt. The OLS result also revealed a negative impact of external debt on economic growth while domestic debt impacted positively.

Using Ordinary Least Squares Method (OLS), Error Correction and parsimonious models Onyeiwu (2012) found a negative effect of domestic debt on economic growth in Nigeria based on quarterly data between 1994 and 2008. The result also showed that the domestic debt holding of
government was far above a healthy threshold of 35 per cent of bank deposit as the average over the period of study was 114.98 per cent of bank deposit presenting evidence of crowding out of private investments. Maana, Owino and Mutai (2008) investigated domestic debt and its impact on the economy in Kenya. The study used a version of the Barro growth regression model as expounded by King and Levine (1993), using the data that are ranging from 1996 – 2006. The model was specified by regressing real outputs on domestic debt and some other variables that influence real outputs. The study found that domestic debt impact positively on real output in Kenya.

Abbas and Christensen (2007) investigated domestic debt of 93 low income and emerging market economies (including Nigeria) over 1975-2004. The study found that moderate levels of non-inflationary domestic debt had a positive impact on economic growth, improved monetary policy, broadened financial market development, strengthened domestic institutions and accountability, enhanced private savings and financial intermediation. It further found evidence that when domestic debt exceeds 35% of bank deposits it undermined growth, crowded out private investments and damage bank efficiency.

Bua, Pradelli, and Presbitero (2014) introduced a new data set on the stock and structure of domestic debt in 36 low-income countries over the period 1971 -2011, to explore the relevance of different arguments put forward on the benefits and costs of government borrowing in local public debt markets. The study found that domestic public debt had been on increase since 1996. It also found that the concentration of the investor base, mainly dominated by commercial banks and the central bank, may crowd out lending to the private sector, which thus affect the economy largely.

The empirical study of Rais and Anwar (2012) found a negative and statistically significant relationship between both domestic and external debts on economic growth. Putunai and Mutukh (2013), along with Fincke and Greiner (2014) found a significant and positive correlation between debts and GDP. Using Nigerian time series data for the period, 1970-2003, Anyanwu and Erhijakpor (2004) found that current domestic debt outstanding as a ratio of GDP had a significantly negative effect on economic growth, while past-accumulated domestic debt as a percentage of GDP increased economic growth by 0.30% - thus rejecting the domestic debt overhang hypothesis. Using cointegration and Granger causality tests on Ghanaian data over the period 1959 -1995, Singh (1999) found that the tests support the Ricardian equivalence hypothesis between domestic debt and economic growth in Ghana. The Ricardian equivalence hypothesis states that the relationship between public debt and economic growth is nonexistent. Eberhardt and Presbitero (2015) and Eigert (2015) support the existence of nonlinearity in the debt-growth nexus, but state that there is no evidence at all for a threshold level common to all countries over time; while Gómez-Puig and Sosvilla-Rivero (2015) and Donayre and Taivan (2017), who analysed the causal relationship between public debt and economic growth, also suggest that the causal link is intrinsic to each country.
METHODOLOGY

Analytical technique

This study adopted the ex-post facto research design. Data used for analysis were extracted from the Central Bank of Nigeria Statistical Bulletin (2018). Both growth rate of real gross domestic products and domestic public debts were extracted from the Bulletin while the ratio of the domestic public debt to gross domestic products was calculated by the authors. The methodology consisted of four steps. To avoid the spurious regression problem, the order of integration of the variables (without breaks) was investigated using the Augmented Dickey-Fuller (ADF) and Phillip Perron (PP) unit root tests. Unit root test with structural break was also carried out using the ADF test. Thereafter, a test for cointegration with structural breaks amongst the variables was conducted based on Bai and Perron (1998, 2001) procedure. Since the estimated parameters in the specified model were average values for the entire sample period (1981-2018), there is the possibility that the parameters could change over time if a structural break occurred. Therefore, the study also explored the possibility of multiple structural changes in the parameter relating to the domestic debt-GDP variable to the real growth rate by using the Bai and Perron (1998) test. Failure to account for structural breaks may not only lead to the erroneous conclusion that these indices are characterized by a random walk (Chaudhuri & Wu, 2003), the unit root test results may equally be biased towards flawed non-rejection of the non-stationarity hypothesis (Perron, 1989; 1997).

Bai and Perron (1998, 2001) proposed some tests for structural changes and a selection procedure based on a sequence of tests to estimate consistently both the number of breaks and the induced structural regimes in a linear model specified as:

\[ y_t = x_t^i \beta + z_t^j \delta_j + u_t \]

Where \( y_t \) is the observed dependent variable at time \( t \), \( j = 1, \ldots, m + 1 \), where \( m \) is the number of breaks in \( m + 1 \) regime; \( x_t \) and \( z_t \) are “vectors of covariates”; \( \beta \) and \( \delta_j \) are the corresponding vectors of coefficients, and \( u_t \) is the error term. The objective is to estimate the unknown regression coefficients and the breakpoints when a number of observations on \( y_t \), \( x_t \) and \( z_t \) are available.

Johansen-Julius cointegration test and vector error correction model were later employed to estimate and evaluate the models. The existence of a long-run relationship between the variables of consideration was assessed using the model:

\[ \Delta GRGD\Pi P_t = \Pi GRRGD\Pi P_{t-1} + \sum_{i=1}^{p-1} \Gamma_i \Delta GRRGD\Pi P_{t-1} + a(\text{DEBT/GDP})_t + \epsilon_t \]  

\[ \Delta(\text{DEBT/GDP})_t \]

\[ = \Pi(\text{DEBT/GDP})_{t-1} + \sum_{i=1}^{p-1} \Gamma_i \Delta(\text{DEBT/GDP})_{t-1} + aGRGD\Pi P_t + \epsilon_t \]
Where:

\[ GRRGDP_t = \text{Growth rate of real gross domestic products at time } t. \]

\[ (DDEBT/GDP)_t = \text{ratio of domestic public debts to gross domestic products at time } t. \]

In the third step, post-diagnostic tests were carried out, including the Breusch-Godfrey Serial Correlation LM test, and Breusch Pagan-Godfrey heteroskedasticity test. The CUSUM and CUSUMSQ tests of Brown et al. (1975) were applied to determine if the estimated model was stable over the study period. Finally, the Granger Causality test was employed to test which of the variables Granger cause one another. The EViews statistical package was used in carrying out all the analysis in this study.

**Model Specification**

The impact of public domestic debt on the economy is examined using the King and Levine’s (1993), as well as Maana, Owino, and Mutai (2008), and Tasos (2014) version of the Barro growth regression model with the form:

\[ GRRGDP_t = \alpha_0 + \alpha_1 (DDEBT/GDP)_t + \epsilon_t \]  

Where:

\[ GRRGDP_t = \text{Growth rate of real gross domestic products at time } t. \]

\[ (DDEBT/GDP)_t = \text{ratio of domestic public debts to gross domestic products at time } t. \]

\[ \epsilon_t = \text{Error term at time } t. \]

Theoretically, the coefficient of the independent variable is expected to be positive, that is, impacting the dependent variable positively: \( \alpha_1 \) and \( \alpha_2 > 0 \).

**EMPIRICAL RESULTS**

**Descriptive Statistics**

The basing of the growth rate of real gross domestic products (GRRGDP) and the domestic debt as a ratio of gross domestic products (DDEBT/GDP) was ideal as the mean values of the two variables were within the same range, 4.3981 and 4.8035 respectively. Likewise, the maximum and minimum values were a bit close to each other; and the standard deviation of the two variables was in a close range as well. GRRGDP was normally distributed considering the Jarque-Bera statistics value of 0.2476 and the probability of the value of 0.8835. DDEBT_GDP had a Skewness and Kurtosis that was a bit above 1 and 3 respectively, and as a matter of fact, the Jarque-Bera statistics and its probability value (10.8659 and 0.0043) could not confirm its normality. However, relying on the assumption of the Central Limit Theorem (CLT) that a distribution tends to be normally distributed when a set of observation is greater than 30, which is the case here; therefore, it is assumed that the variable was equally normally distributed.
Table 1: Descriptive Statistics

<table>
<thead>
<tr>
<th></th>
<th>GRRGDP</th>
<th>DDEBT_GDP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>4.3981</td>
<td>4.8035</td>
</tr>
<tr>
<td>Median</td>
<td>4.7600</td>
<td>3.6662</td>
</tr>
<tr>
<td>Maximum</td>
<td>14.6000</td>
<td>18.3812</td>
</tr>
<tr>
<td>Minimum</td>
<td>-7.5765</td>
<td>0.0733</td>
</tr>
<tr>
<td>Std. Dev.</td>
<td>4.3894</td>
<td>5.2607</td>
</tr>
<tr>
<td>Skewness</td>
<td>-0.1633</td>
<td>1.2711</td>
</tr>
<tr>
<td>Kurtosis</td>
<td>3.2228</td>
<td>3.6316</td>
</tr>
<tr>
<td>Jarque-Bera</td>
<td>0.2476</td>
<td>10.8659</td>
</tr>
<tr>
<td>Probability</td>
<td>0.8835</td>
<td>0.0043</td>
</tr>
<tr>
<td>Observations</td>
<td>38</td>
<td>38</td>
</tr>
</tbody>
</table>

Source: Authors’ computation using EViews 10.

Figure 1 shows the graphical presentation of the data used in this paper. The data ranged from the year 1981 to 2018.

Figure 1: Graphical presentation of data
Source: Authors’ computation using EViews 10.

Unit Root Tests without Structural Break

The ADF and P-P tests without a structural break were first employed to analyze the unit root properties of the series. The results from the ADF and PP tests with a linear time trend are reported in Table 2. Both ADF and PP tests affirmed that the two variables in the model were induced stationary, that is, integrated at first difference.

Table 2: Unit Root Tests without Structural Break

<table>
<thead>
<tr>
<th>Variable</th>
<th>ADF</th>
<th>PP</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Level</td>
<td>1st Diff.</td>
</tr>
</tbody>
</table>

Source: Authors’ computation using EViews 10.

Values in the parenthesis stand for critical value at the 5% for the respective test and variable. *** implies a probability value of 1% and below; and ** implies prob. Value of 5%
Unit Root Tests with Structural Breaks

Perron (1989) demonstrated that the ADF test could lead to misleading inferences if potential structural breaks are ignored. He noted that if there is a structural break, the power to reject a unit root decreases when the stationary break alternative is true. Hence, the unit root test with break was carried out using the ADF test. The ADF test confirmed the stationarity of the two variables at the first difference with the break dates at 2008 and 1994 for the domestic debt-GDP ratio and growth rate of GDP, respectively. The variables were not stationary at level but the identified break dates at the level were 2014 and 2002.

Table 3: Unit Root Tests with Structural Break (ADF)

<table>
<thead>
<tr>
<th>Variable</th>
<th>ADF</th>
<th>Level</th>
<th>Break Date</th>
<th>1st Diff.</th>
<th>Break Date</th>
<th>Order of Integration</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>[-4.4436]</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>[-4.8598]</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Authors’ computation using EVIEWS 10.

Values in the parenthesis stand for critical value at the 5% for the respective test and variable.

*** implies a probability value of 1% and below; and ** implies prob. Value of 5%

Figure 2 shows a graphical presentation of test statistics of unit root with a break for domestic debt-GDP ratio using Dickey-Fuller t-statistics at the level and at first difference. The figure shows the break-dates at the level to be 2014 and 2008 at first difference.

Figure 3 shows the graphical presentation of test statistics of unit root with a break for the growth rate of real gross domestic products using Dickey-Fuller t-statistics. The figure shows that breaks occurred in the series in 2002 and 1994 for level and first difference tests, respectively.
Bai-Perron’s Breakpoint Test

Going by the Bai-Perron’s (1998, 2001) tests and their recommendation, the study used a trimming region of 15% and allowed the system to search for a maximum of five breaks, which is the largest permissible number according to the Bai and Perron procedure. The results seemed to suggest strongly that there are five structural breaks in each of the estimated models. The identified breakpoints were assessed based on Scaled F-statistic, Weighted F-statistic, UDMax and WDMax statistics at 0.05 significance level, and the four statistical tests gave credence to the presence of five (5) breakpoints in the variable. The detected break dates and the associated levels of the domestic public debt-to-GDP ratio are summarized in Table 4. The breakpoints were identified to be 1993, 1999, 2004, 2009, and 2014. All the identified breakpoint periods were of significant events in Nigeria and some of the periods had significant events attached to them at the global level. The extent of domestic debt from 1993 to 1994 increased by 67 per cent, a huge forward increment. In 1999, when the country was returning to democratic rule there was a huge leap in domestic debt, about 103 per cent above 1998 figure. In 2004 the ratio of domestic debt to gross domestic products decreased by 18 per cent and rebounded in the following year by 16 per cent. Just immediately after the global economic recession in 2008, the ratio of domestic debt to gross domestic products leapt by 143 per cent and the trend continued until after 2014 when the variable took another leap by 103 per cent. It should be noted that the 2009 break date in Nigeria nearly coincided with those in 2008 (when Lehman Brothers collapsed) in Germany, Greece and the Netherlands; and in 2009 (coinciding with the beginning of the Euro Area sovereign crisis) in Spain. In 2009 the Spanish public deficit reached a historical peak of 11.0 per cent of GDP (Gómez-Puig & Sosvilla-Rivero, 2017).

Table 4: Bai-Perron’s Breakpoints

<table>
<thead>
<tr>
<th>Variable</th>
<th>Scaled F-statistic</th>
<th>Weighted F-statistic</th>
<th>UDMax Statistic</th>
<th>WDMax statistic</th>
<th>Breakpoints</th>
<th>Year</th>
</tr>
</thead>
</table>

Source: Authors’ computation using EViews 10.
** implies prob. value of 5%

Figure 3: GRRGDP Unit Root Tests with Break at Level and First Difference
Since the series considered in the study appear to be stationary with a structural break(s), it implies that the effects of shocks to these series were transitory and thus eliminated as time elapsed.

Cointegration Test

The Johansen-Juselius Cointegration test was applied to test for the existence of the long-run relationship between the variable of interest since the applied test affirmed the induced stationarity of the variables at the first difference. The trace statistic under the said test indicated one (1) cointegrating equation.

**Table 5: Cointegration Test**

<table>
<thead>
<tr>
<th>Hypothesized No. of CE(s)</th>
<th>Eigenvalue</th>
<th>Trace Statistic</th>
<th>0.05 Critical Value</th>
<th>Prob.**</th>
</tr>
</thead>
<tbody>
<tr>
<td>None*</td>
<td>0.3504</td>
<td>17.2633</td>
<td>15.4947</td>
<td>0.0268</td>
</tr>
<tr>
<td>At most 1</td>
<td>0.0469</td>
<td>1.7293</td>
<td>3.8414</td>
<td>0.1885</td>
</tr>
</tbody>
</table>

*Source: Authors’ computation EViews 10.*

*Trace test indicates 1 cointegrating eqn(s) at the 0.05 level*

*denotes rejection of the hypothesis at the 0.05 level*

Vector Error Correction Model (VECM)

The detection of a cointegration equation in the previous section means that a VECM can be used to check for a short-run relationship. The VECM results in Table 6 show that there is a short-run relationship between public domestic debt and economic growth. The error correction term is negatively signed, indicating that the system would eventually revert to equilibrium. It shows that any deviation between the growth rate of gross domestic products and the ratio of domestic debt to gross domestic products would be corrected within one (1) year, 5 months’ period approximately. The highly significant estimated error correction term provides further support for the existence of stable long-run relationships between public domestic debt and economic growth. The study could not establish any lagged variable effect on the growth rate of the gross domestic products, which is the dependent variable in the model. The result shows that public domestic debt is inversely and insignificantly related to economic growth in both first and second lags. The model explained 32.08 per cent variation in the growth rate of the gross domestic products. The F-statistics value of 2.7397 confirmed the joint significance of the variables in the model at the 5 per cent significance level. Post-estimation diagnostic tests confirmed another reliability status of the model.
Table 6: Vector Error Correction (VEC) Test

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>S.E</th>
<th>t-stats</th>
</tr>
</thead>
<tbody>
<tr>
<td>CointEq1</td>
<td>-0.6978***</td>
<td>0.2040</td>
<td>-3.4206</td>
</tr>
<tr>
<td>∆(GRRGDP(-1))</td>
<td>0.1658</td>
<td>0.1800</td>
<td>0.9213</td>
</tr>
<tr>
<td>∆(GRRGDP(-2))</td>
<td>0.0829</td>
<td>0.1697</td>
<td>0.4886</td>
</tr>
<tr>
<td>∆(DDEBT_GDP(-1))</td>
<td>-0.4416</td>
<td>1.0718</td>
<td>-0.4120</td>
</tr>
<tr>
<td>∆(DDEBT_GDP(-2))</td>
<td>-0.3669</td>
<td>1.1035</td>
<td>-0.3325</td>
</tr>
<tr>
<td>Constant</td>
<td>0.4300</td>
<td>0.7779</td>
<td>0.5527</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.3208</td>
<td></td>
<td></td>
</tr>
<tr>
<td>F-statistic</td>
<td>2.7397**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DW stat.</td>
<td>1.8530</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Authors’ computation using EViews 10.
*** implies a probability value of 1% and below; and ** implies prob. Value of 5%

Post Estimation Diagnostic Tests

Serial Correlation Test

Table 7.1 showed the output of the Serial Correlation LM test for the estimated model. Both the test’s F-statistic and Obs*R-squared statistic values of 2.1010 and 8.8055 with a probability values (0.1107 and 0.0661) greater than 5 per cent threshold of significance level implies acceptance of null hypothesis, that, there is no serial correlation in the residual.

Table 7.1: Breusch-Godfrey Serial Correlation LM Test

<table>
<thead>
<tr>
<th>F-statistic</th>
<th>2.1010</th>
<th>Prob. F(4,25)</th>
<th>0.1107</th>
</tr>
</thead>
<tbody>
<tr>
<td>Obs*R-squared</td>
<td>8.8055</td>
<td>Prob. Chi-Square(4)</td>
<td>0.0661</td>
</tr>
</tbody>
</table>

Source: Authors’ computation using Eviews 10.

Heteroskedasticity Tests

Table 7.2 showed the output of the Breusch Pagan-Godfrey heteroskedasticity test for the estimated model. The test statistics reported in the table showed a probability value greater than 5 per cent threshold of significance level respectively. This implies acceptance of the null hypothesis, that, there is no heteroskedasticity in the residual. The test rejected the presence of heteroskedasticity in the residuals.

Table 7.2: Heteroskedasticity Test: Breusch Pagan-Godfrey

<table>
<thead>
<tr>
<th>F-statistic</th>
<th>0.7956</th>
<th>Prob. F(6,28)</th>
<th>0.5813</th>
</tr>
</thead>
<tbody>
<tr>
<td>Obs*R-squared</td>
<td>5.0980</td>
<td>Prob. Chi-Square(6)</td>
<td>0.5313</td>
</tr>
<tr>
<td>Scaled explained SS</td>
<td>4.4829</td>
<td>Prob. Chi-Square(6)</td>
<td>0.6116</td>
</tr>
</tbody>
</table>

Source: Authors’ Computation using EViews 10.
Stability Test Results

The CUSUM and CUSUMSQ tests of Brown et al. (1975) were applied to determine if the estimated model was stable over the study period. The CUSUM test is based on the cumulative sum of the recursive residuals, together with the 5 per cent critical lines, while the CUSUM of squares test plots the cumulative sum of squares together with the 5 per cent critical lines as boundaries. As shown in Figure 4, both the CUSUM and CUSUMSQ residual plots of the domestic debt-economic growth model are within the 5% critical lines, hence, providing evidence of the stability of the model’s parameters.

Granger Causality

The analysis of Granger causality test became possible after affirming the stationarity of the variables of interest. The F-statistic test in the granger causality test reinforced the acceptance of the null hypothesis in the two tests. We therefore, asserted that there was no causal relationship between the ratio of domestic debt to gross domestic products and the growth rate of gross domestic products in Nigeria. The finding was the same even when the variable was reversed. Thus, our finding supports the debt-growth neutrality hypothesis and corroborates Panizza and Presbitero (2014) and Reinhart and Rogoff (2010). Similar results were confirmed by Aminu, Ahmadu and Salihu (2013) which found no causation existing between domestic debt and GDP for Nigeria (1970-2010); Puente-Ajovín and Sanso-Navarro (2015) for 16 OECD countries; Tasos (2014) for Greece; Gómez-Puig and Sosvilla-Rivero (2015) for Austria and Portugal; and Manik (2016) for Indian economy over the period, 1980-2014.

Table 8: Granger Causality Test

<table>
<thead>
<tr>
<th>Null Hypothesis</th>
<th>Obs</th>
<th>F-Statistic</th>
<th>Prob.</th>
<th>Decision</th>
</tr>
</thead>
<tbody>
<tr>
<td>DDEBT_GDP does not Granger Cause GRRGDP</td>
<td>36</td>
<td>0.23031</td>
<td>0.7956</td>
<td>Accept</td>
</tr>
<tr>
<td>GRRGDP does not Granger Cause DDEBT_GDP</td>
<td>0.58494</td>
<td>0.5632</td>
<td>Accept</td>
<td></td>
</tr>
</tbody>
</table>

Source: Authors’ computation using Eviews 10.

SUMMARY AND CONCLUSION

This study has used Nigerian time-series data (1981-2018) to examine the causal relationship between domestic debt-GDP ratio and growth rate of GDP, as well as identified the structural breaks in the variables. The two variables (without structural breaks) were found to be induced-stationary based on Augmented Dickey-Fuller (ADF) and Phillip Perron (PP) unit root tests.
Similarly, the ADF unit test (with structural breaks) confirmed the stationarity of the two variables at the first difference with break dates at 2008 and 1994 for the domestic debt-GDP ratio and growth rate of GDP, respectively. The variables were not stationary at level but the identified break dates at the level were 2014 and 2002.

The Bai-Perron’s (1998, 2001) test identified five (5) optimum breakpoints occurring in 1993, 1999, 2004, 2009, and 2014, each structural break coinciding with identifiable economic and political shocks in the country. The Johansen-Juselius cointegration and vector error correction model confirmed stable long-run and short-run relationships between domestic debt-GDP ratio and growth rate of gross domestic products respectively; with adjustment to equilibrium occurring within 1 year and 5 months or at a speed of 69.8%. The Granger causality analysis revealed no causal relationship between domestic debt-GDP ratio and economic growth in Nigeria during the study period. The study could not, however, establish any lagged variable effect on the growth rate of the gross domestic products. Post diagnostic tests indicated neither serial correlation nor heteroskedasticity in the residual just as the parameters were found to be structurally stable at 5% level of significance.

Based on these findings, the paper concluded that domestic debt-to-GDP ratio neither influenced the level of economic growth nor established any causal relationship between the domestic debt-to-GDP ratio and the real GDP growth rate in Nigeria during the sampled period. The identified structural breaks coincided with identifiable economic and political shocks in the country. The study, therefore, recommended that the Nigerian government should acquire domestic debt only for very high priority and self-sustaining projects that could contribute positively to economic growth, and reduce unnecessary economic and political shocks in the country.

REFERENCES


