

The Threshold Effect of Domestic Public Borrowing on the Nigerian Economy

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Abstract: Like many other developing countries, the Nigerian government has increased domestic borrowing recently. This study examines the nonlinear relationship between domestic borrowing and economic growth, covering 1980 and 2019. The study adopts the threshold regression approach to establish the switching point between domestic borrowing and economic growth in Nigeria. The results reveal that the domestic borrowing and economic growth threshold is 14.88% of GDP with an inverted U-shaped curve. The maximum turning point of the variables implies the application of the debt Laffer Curve in Nigeria, showing that domestic borrowing is favourable to the economy before the threshold. However, additional domestic borrowing after the threshold induces an adverse effect on the economy. Also, the regression results of the non-varying threshold measures show that while the effect of external debt has been positive and significant on economic growth, gross fixed capital formation and inflation were negative and significant. Therefore, while recommending more rigorous monitoring and efficient utilisation of domestic borrowed funds by the government, the study emphasises the application of the threshold of 14.88% of GDP on domestic borrowing in the country.

Keywords: Domestic Borrowing, Economic Growth, Threshold Regression, Nigeria

JEL Classification: C22, E62, H63, O55

I. INTRODUCTION

Achieving developmental goals is a central objective of governments across the globe. However, a weak tax revenue base and declining external assistance from external-donor countries have become substantial challenges to developing countries' governments (Al-Refai, 2015). As a follow-up, governments often resort to borrowing to execute social infrastructural development projects to close the resulting fiscal gap. The early emphasis of most developing countries in the 70s was to borrow from bilateral and multilateral international sources of the advanced foreign nations (Gurtner, 2010). However, in the 80s, most borrowing developing countries were confronted with rising interest rates on loans and exchange rate problems following the dollar's appreciation (Demiroglu & Karagoz, 2016). Also, a number of the foreign borrowings from multilateral sources had some conditionality attached. The associated conditionality worsened the overall welfare of the people in the developing country (Niyonkuru, 2016). As a result, pressure mounted on

the capacity of developing countries to borrow and service foreign loans. Hence, debt repayment obligations became a significant burden on the debtor developing countries. Consequently, many fell into a debt trap as the capacity to repay both principal and interest became challenging (Paiko, 2012).

Based on the mounting problems associated with foreign borrowing, many developing countries resolved to borrow more from internal sources (Maana et al., 2008; Panizza & Presbitero, 2014). Like other developing countries, Nigeria opted for internal borrowing because it was easier for the government to access, removed the foreign exchange risk associated with foreign borrowing, and assisted in deepening the domestic financial markets (Maana et al., 2008). Furthermore, domestic borrowing affords the governments of developing countries the latitude to escape the undesirable conditionality that may work against the long-run welfare interest of the developing country.

Despite the benefits of domestic borrowing, sustained borrowing may potentially increase the interest rate, crowd-out private investment and hence adversely affect economic growth (Gaber, 2010). Some authors have also argued that a sustained increase in domestic borrowing may cause foreign exchange problems and induce the twin-deficit hypothesis (Sakyi & Opoku, 2016). Accordingly, persistent domestic borrowing could lead to excessive money supply over demand and result in foreign reserve depletion and the balance of payment disequilibrium (Okoro, 2013). Besides, suppose government spending and taxes are exogenous. In that case, bond-financed deficits are often unsustainable. As a result, the Central Bank would eventually monetise the government fiscal deficit and thus increase the money supply for the economy and inflation in the long run (Saleh, 2003). On the other hand, where the Central Bank does not monetise the deficit, inflation could still be an essential consequence of the crowding-out effect.

Economic theory suggests that public debt complements tax revenues to smoothen consumption in the period of a surge in public expenditures (Cecchetti et al., 2013). Hence, public debt aids the transfer of resources from future to current generations while raising the society's inter-temporal welfare. Thus, at moderate levels, government spending through borrowed funds may contribute positively to the country's aggregate demand,

output and employment. Nevertheless, higher debt levels could become inimical to a country's growth and welfare (Kumar & Woo, 2010; Panizza & Presbitero, 2014). Therefore, at some threshold point, additional public borrowing would become detrimental to the economy and negatively impact economic growth and welfare.

The Nigerian government has engaged in extensive fiscal deficit financing for several decades after independence in 1960. Except for a few years, there were overall deficits in the government budget from 1981 to 2019 (CBN, 2019). Over the years, the level of government public borrowing has grown tremendously despite the increase in the nation's revenue supported by the earnings from the export of crude oil. Following Nigeria's external debt paid down by the Obasanjo administration in 2006, the government embarked on aggressive internal borrowing to sustain the growing fiscal deficit. With a total budget of N9.1 trillion for 2017, N2.01 trillion (23%) was budgeted for debt service (DMO, 2018). Between 2006 and 2019, domestic borrowing accounted for over 75% of total government borrowing and consumed about 90% of the entire debt service by the government in Nigeria (CBN, 2019). In addition, following the worldwide drop in the price of crude oil in 2016, the Nigerian economy has faced severe economic challenges. The fall in oil revenue, the high cost of borrowing and the effect of the Covid-19 Pandemic on the economy have made loan repayment a challenging problem for the Nigerian government. With the government still willing to borrow more, the country will likely face the problem of severe economic problems occasioned by an increased debt service burden and possibly a debt trap. Hence, this study examines the nonlinear relationship between domestic debt and economic growth to establish a threshold for government domestic borrowing for an oil-based developing economy like Nigeria, covering 1980 to 2019. Expectedly, such a debt-growth threshold would signal the turning point where the increase in the country's domestic borrowing would become detrimental to the level of economic activity.

The rest of the paper is structured as follows: Section 2 presents an overview of the discussion on the theoretical and empirical studies on government public debts while section 3 articulates the theoretical framework and methodology for the study. The preoccupation of section 4 is the presentation of the empirical findings, while the last section covers the highlight of conclusions and the policy implications of the findings.

II. LITERATURE REVIEW

2.1 Theoretical Literature

The theoretical review covers the studies on the interactions between government domestic borrowing with economic growth.

The Neo-classical theory holds that massive fiscal deficits create an excess supply of government borrowing, which leads to higher real interest rates. When governments borrow extensively from the local financial markets, the resulting pressures often lead to a higher interest rate, which slows down

private investment activity (Kumar & Baldacci, 2010). Therefore, the neo-classical economists argue that government spending through persistent borrowing from the domestic financial markets could 'crowd out' the private sector investment. On the other hand, *the Keynesian Theory of fiscal deficit* sees no harm in public borrowing since fiscal deficit is incurred to provide goods of necessity for citizens. The Keynesian argument for budget deficit is premised on the principle of the multiplier effect, which underscores the mechanism of how a change in public expenditure would produce a more significant change in national output. On the underlying theory, Keynesians argue that budget deficits increase domestic production and raise the level of employment and crowd-in private investment. *The Twin Deficit Hypothesis* focuses on the budget deficit and the current account deficit. The theory suggests that an increase in the budget deficit will exert upward pressure on domestic absorption and hence interest rates and the country's exchange rate. While the rise in domestic absorption causes import expansion, causing a higher interest rate that is attractive to foreign investors and causes capital inflows and appreciates the country's currency. The currency's appreciation eventually worsens the current account balance via a decline in net exports (Egwaikhide, 1999).

The Ricardian equivalence hypothesis (REH) looks at two principal ways of increasing government expenditure: tax revenue or issuing government debt in the form of government bonds with the interest and principal paid later. Therefore, the REH argues that while tax financing and deficit financing are equal, deficit financing postpones the inevitable tax that the citizens pay to repay the principal and interest rate on the bonds (Muhammad, 2012). Hence, the hypothesis argues that financing the fiscal deficit through debt does not affect consumption, output, and employment because rational economic agents adjust their savings in expectation of future taxes that will pay off the debt. The extended Endogenous Growth Theory captures the threshold relationship between fiscal deficit and economic growth (Slimani, 2016). According to the theory, government plays a significant role through well-selected productive investments like promoting the accumulation of knowledge, research and development, real public investment, human capital development and law and order, which can generate growth both in the short- and long-run (Altayligil & Akkay, 2013). The model emphasises an explicit link between government spending and long-run economic growth in endogenous growth and shows the process of determining optimal public expenditure. Beyond this point, any additional expenditure may affect economic growth negatively. Therefore, if public spending exceeds its optimal level, there will be a negative correlation.

Conversely, if public spending falls below its optimal level, there will be a positive correlation (Slimani, 2016). Arthur Laffer developed the *Debt Laffer Curve Theory* to demonstrate the relationship between tax rates and the volume of tax revenue collected by governments (Van & Hoang, 2018). Krugman (1989) applied the Laffer curve debt theory to the debt overhang and showed the link between a country's ability

to service debt obligations and the current level of public debt. Krugman posits that when a country accumulates too much debt, then repayment obligation will exceed the ability to pay, and the obligation act as a marginal tax rate. However, if the state succeeds in obtaining better results than those expected, benefits will return to the loan creditors and not to the state.

2.2 Empirical Review

In discussing the studies on the fiscal deficit and economic growth relationship, several authors have empirical results that support the neoclassical approach that government funding of fiscal deficit from the domestic financial market crowds out private investment with negative implications for economic growth (Badawi, 2012; Paiko, 2012; Ezeabasili & Nwakoby, 2013; Nkalu, 2013; Shetta & Kamaly, 2014; Saibu & Alenoghena, 2017; Hussain et al., 2015; Tung, 2018; Akamobi & Unachukwu, 2021). As a follow-up, a different set of authors argue in favour of the Keynesian approach that fiscal deficit positively affects economic growth and crowd in private investment (Maana et al., 2008; Maji & Achegbulu, 2012; Odhiambo et al., 2013; Duokit & Ekong, 2016; Bakare et al., 2016; Nwakobi et al., 2018; Biplob, 2019). The third set of empirical studies opines that the level of economic activity did not simply respond to the implementation of fiscal policy. These authors argue in favour of the application of the Ricardian Equivalence Hypothesis (REH) and maintain that consumption and total output will not respond to changes in fiscal policy (Afzal, 2012; Ogba, 2014; Panizza & Presbitero, 2014; Sunge et al., 2015; Abada, 2016; Ofori-Abebrese & Pickson, 2018; İkiz, 2020).

The final set of empirical studies argues that fiscal deficit could positively or negatively affect economic growth, depending on the country's level of development and the fiscal deficit deployed. Nersisyan & Wray (2010), in their analysis of budget deficit and economic growth, argue that the adverse effect of high indebtedness levels on economic growth would be dependent on an absolute threshold. While recognising that fiscal deficit financing could positively affect economic growth, they maintain that there is a limit to the positive economic growth that fiscal deficit financing can enhance. If the debt burden gets too high, then at a point, debt would become damaging to the level of economic activity, implying that debt maintains a nonlinear relationship with growth. Several other empirical studies have canvassed this position (Cecchetti et al., 2010; Onwioduokit, 2011; Presbitero, 2012; Checherita & Rother, 2012; Wright & Grenade, 2014; Panizza & Presbitero, 2014; Benayed et al., 2015; Mupunga & Roux, 2015; Swamy, 2015; Quynh Nhu et al., 2016; Yifei, 2017; Shkolnyk & Koilo, 2018; Wissem, 2019; Medina et al., 2020; Ndoricimpa, 2020; Siong et al., 2021).

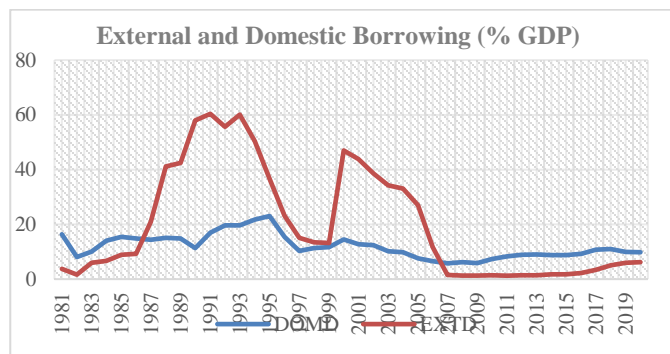
2.3 Gaps in the Literature

Several studies on country-specific debt-growth nonlinear relationships exist in the literature. Quite a number of the existing studies focus on the country's total debt: internal plus external (Presbitero, 2012; Mupunga & Roux, 2015; Benayed et al., 2015; Omotosho et al., 2016; Eboreime & Sunday, 2017). Also, some studies have examined the nonlinear relationship between external debt and economic growth (Dao Ha & Oanh, 2017; Shkolnyk & Koilo, 2018). However, there are no country-specific studies that extensively investigated the nonlinear relationship between domestic borrowing and economic growth. The existing country-specific studies on domestic debt and economic growth in Nigeria like Onogbosele & Ben (2015), Igbodika et al. (2016) and Ibrahim & Shazida (2019) did not examine the nonlinear relationship between the variables. Furthermore, the existing studies on the Nigerian economy that investigated the threshold of debt-economic growth (Omotosho et al., 2016; Eboreime & Sunday, 2017) focused on total debt without examining domestic debt in their preparatory work. Besides all the studies on the Nigerian economy, their scope did not fully cover the period when the Nigerian government borrowed heavily from internal sources from 2005 to 2019. This research study entirely focuses on the nonlinear relationship between domestic debt and economic growth in Nigeria and concentrates on the Nigerian government's period of heavy domestic borrowing.

2.4 The Nigerian Government Borrowing Activity

The Nigerian Government borrowing activity is mainly driven by fiscal deficit spending. Nigeria was already involved in deficit spending in 1970 with a negative fiscal deficit of N455.1 million. The Nigerian government borrowing grew to N10,020 million in 1980. The upward borrowing trend continued as total government debts again grew from N13.2 billion in 1981 to N444.6 billion in 1991 (See Figure 1). There was a drop in government borrowing from 1995 to 1998. The downward trend was more from external borrowing which underscored the Abacha Administration's isolation from the rest of the world. Although in 1999 government borrowing was N1,193.9 billion, it shot to an all-time high in 2004 with N6,260.6 billion. During this period, foreign loans dominated the country's total debt and, the repayment of both interest and principal has become complicated and challenging. In 2005 and 2006, the Olusegun Obasanjo's administration negotiated and paid off most of the country's external debts (London Club and Paris Club). At the end of 2006, the country's total debts obligations were down to N2,204.7 billion. The exit of the Obasanjo's administration marked the commencement of another round of aggressive government borrowing activity which was now more focused on the domestic sources.

Figure 1. Domestic and External Borrowing in Nigeria



Source: Author's Compilation from CBN Statistical Bulletin of 2010 and 2019

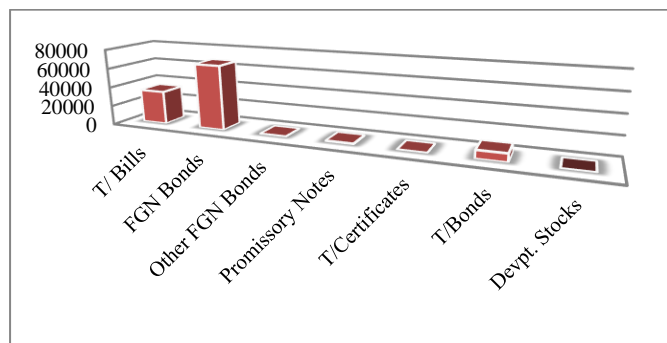
From 2006, domestic borrowing took over the dominant position in the country's government borrowing. The country's domestic debts grew rapidly from N1,525 billion in 2005 to N4,552 billion in 2010, increasing by 300%. Between 2010 and 2014, domestic debts obligation grew again by 174%. In 2014, the total value of domestic debts had grown to N7,904 billion, making 83% of total debts and 9% of GDP. Overall total debt in Nigeria in 2019 was N23,295.05 billion and stood as 16.15% of the country's GDP. While domestic debt stood at N14,272.63 billion (61.27% of total debt), foreign debt was N9,022.42 billion and 38.73% of total debt.

2.5 The Instruments Government's Domestic Borrowing

The Nigerian government has borrowed from the domestic financial markets using several financial instruments of debts. The government has used treasury bills, treasury certificates treasury bonds, federal government bonds, promissory notes and development stock. Between 1970 and 1980, total government domestic borrowing multiplied to N8.216 billion while treasury bills and development stock competed for dominance in the market. However, between 1981 and 1990, the supremacy of treasury bills in the market was established, while treasury bonds were introduced in 1989. Also, between 1991 and 2001, total government domestic borrowing maintained a steady rapid growth from N116.198 billion to N1,016.97 billion (See figure 2). The Federal Government Bonds introduced treasury bonds into the market in 2003. The massive growth in government domestic borrowing became more apparent from 2006 after Nigeria's foreign debts pay down.

The FGN bond became dominant in the market from 2007. As total government domestic borrowing increased from N1,753.26 in 2007 to N11,058.20 in 2016, it was dominated by FGN bonds. In 2017, the government introduced a new dimension to the existing FGN bonds. The federal government sold three new types of FGN bonds: FGN Sukuk, FGN Green Bonds, and FGN Savings Bonds. Combined with the regular FGN bonds, total federal government bonds dominate the country's domestic borrowing instruments. In 2019, the combined FGN bonds made N10,762.52 billion, which was 75% of the government's total domestic borrowing (N14,272.64 billion) for the year.

Figure 3 Government Domestic Borrowing Instruments (N *Billion)



Source: Author's Compilation from CBN Statistical Bulletin of 2010 and 2019

A summary of the analysis for this period shows the decline in Development stock and Treasury bonds and the increase of Treasury bills and FGN Bonds as the main investment instruments of government borrowing. There is an improvement in the share of long term government borrowing instruments over time, indicating some progress in the maturity lengthening of Nigerian public domestic borrowing.

III. THEORETICAL FRAMEWORK AND METHODOLOGY

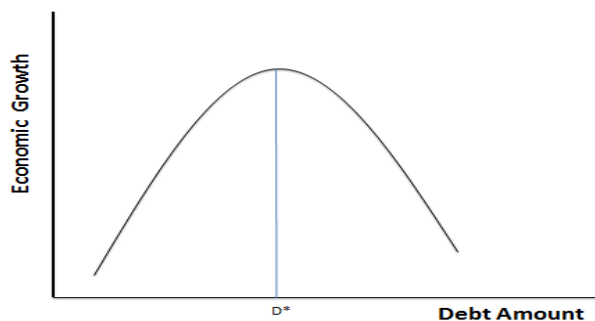
3.1. Theoretical Framework

The Debt Laffer Curve characterises the nonlinear relationship between public debt and economic growth. Krugman (1988) formulated the actual derivation of the Laffer curve and the underlying logic behind it. The analysis involves estimating a model that relates the economic growth rate to public debt and other variables. Krugman (1989) applied the Laffer curve debt theory to debt overhang and showed how a country's ability to service debt is related to the current level of public debt. Krugman maintains that when a country acquires too high a level of debt, then the accruing debt service obligation gets higher than the ability to pay. However, when the state manages to resolve the payment problem, the benefit of the loan repayment effort will accrue to the loan creditors and not the state. Hence, the state may stand discouraged from the venture as the more extensive benefits of the government borrowing effort accrue to the loan creditors.

Therefore, the Laffer curve shows that the larger the total debt, the smaller the repaying capability. On the upside of the curve (Figure 3), the higher the current amount of debt and with an increase in economic growth, the debt repaying capability will also increase. However, when the debt amount reaches the top of the curve, which is called the optimum debt, then at that point, the economic growth reaches its highest. This is the debt threshold that a country can hold without worrying about its negative effect on economic growth. But, the downside of the curve shows that when the debt exceeds the threshold, it will restrain the economic growth and the debt repaying capability becomes difficult for the country. Hence, the analysis shows that debt may positively or negatively affect economic growth. A reasonable amount of debt would stimulate economic

growth. The governments can use debt to fund and supply the investment needs of national key projects, encourage production development, and stimulate economic growth (Mupunga & Roux, 2015).

Figure 3 The Laffer Curve



Source: Krugman (1988)

However, if the debt becomes too large and exceeds the threshold, then it will hurt the economic growth: large debt will reduce private capital, which leads to the withdrawal of private investment; debt reduces the nation's savings; debt causes inflationary pressure; it distorts economic activities as well as damage the social welfare (Van & Hoang, 2018). So, how much is the reasonable amount of debt incurred by the government? When does the debt exceed this amount and negatively influence economic growth? The threshold point answers the questions.

3.2. Methodology

3.2.1 Model Specification

This paper focuses on the long term nonlinear relationship between domestic borrowing and economic growth. Therefore, we can hypothesise that domestic borrowing would contribute positively to economic growth up to the threshold point and, after that, would become a drag once this threshold point is exceeded. Based on the hypothesis, this study seeks to offer evidence (if any) supporting the existence of the 'laffer curve' based on the relationship between domestic borrowing and economic growth in Nigeria. Although, the debate on that may be considered the sustainable level of debt for countries at different stages of development. Hence, a consensus is that a nonlinear model would estimate the debt-growth relationship better than the regular linear relationship (Panizza & Presbitero, 2014). Some milestone studies have addressed nonlinearity investigation by adopting the externally imposed thresholds using fitting threshold regressions. The empirical studies designed to capture the hump shape often incorporate a quadratic term within an ordinary regression equation, knowing that the significance of the quadratic term will imply that the threshold point lies within the range of the dataset.

We can consider an augmented neoclassical growth model that incorporates related growth with public debt and other control variables in line with Checherita & Rother (2012) and Panizza & Presbitero (2014):

$$GDPR_t = \beta_0 + \beta_1 DOMD_{1t} + \beta_2 f(DOMD_{12}) + \beta_3 Z_{3t} + \varepsilon_t \quad (1)$$

Where $GDPR_t$ represents economic growth, $DOMD_{1t}$ is domestic debt as a percentage of GDP. Z_t represents the set of control variables like external debt, private investment, interest rate and inflation. While $\beta_0, \beta_1, \beta_2$ & β_3 are the parameters to be estimated, ε_t is the random error term.

It is assumed that only one extreme point exists in the interval for a bell-shaped relationship; then, the slope of the estimated curve would be positive at the earlier part and becomes negative at the later part of the interval. Therefore, if we build on the relationship from equation (1) to incorporate the bell-shaped assumption, we can have the following:

$$\beta_1 + \beta_2 f'(DOMD_{low}) > 0 > \beta_1 + \beta_2 f'(DOMD_{high}) \quad (2)$$

The test can now be conducted to investigate whether the inequalities in the interval of the data set contain an extreme point or not. Proceed to set up a set of composite hypotheses to include the null and alternative as follows:

$$H_0: \beta_1 + \beta_2 f'(DOMD_{low}) > 0 \text{ and } \beta_1 + \beta_2 f'(DOMD_{high}) < 0 \quad (3)$$

$$H_1: \beta_1 + \beta_2 f'(DOMD_{low}) \leq 0 \text{ and/or } \beta_1 + \beta_2 f'(DOMD_{high}) \geq 0 \quad (4)$$

Equation (1) can now be re-specified to exhibit the quadratic form as follow:

$$GDPR_t = \beta_0 + \beta_1 DOMD_{1t} + \beta_2 f(DOMD_{12})^2 + \beta_3 Z_{3t} + \varepsilon_t \quad (5)$$

The implication of the bell-shaped relation in equation (5) can be better underscored in equation (6) as follows:

$$\beta_1 + 2\beta_2 f'(DOMD_{low}) > 0 \text{ and } \beta_1 + 2\beta_2 f'(DOMD_{high}) < 0 \quad (6)$$

The quadratic growth function in equation (5) can now be incorporated into the composite null and alternative hypotheses in equations (3) and (4) to form equations (7) and (8) as follows:

$$H_0: \beta_1 + 2\beta_2 f'(DOMD_{low}) > 0 \text{ and } \beta_1 + 2\beta_2 f'(DOMD_{high}) < 0 \quad (7)$$

$$H_1: \beta_1 + 2\beta_2 f'(DOMD_{low}) \leq 0 \text{ and/or } \beta_1 + 2\beta_2 f'(DOMD_{high}) \geq 0 \quad (8)$$

These models that are specified in equations (7) and (8) can now be estimated using NARDL and threshold regression to determine the existence of the "Debt Laffer Curve" in Nigeria. The Debt Laffer Curve has the shape of an inverted U. This condition holds when the alternative hypothesis is favoured at the expense of the null hypothesis. It means that the first part of the equation is negative, followed by a positive. Most empirical studies conducted on the debt-growth threshold relationship in developing African countries have supported the existence of the "debt Laffer Curve" (Mupunga & Roux, 2015).

3.2.2 Techniques of Model Estimation

This estimation technique adopted in this study is the threshold regression approach. The threshold regression model is a version of the nonlinear regression model which possesses piecewise linear specifications. The model is regime-switching, and it happens when one of the variables crosses some unknown thresholds. The threshold models are more realistic and closer to practical reality situations as most behavioural variables are nonlinear. Threshold models can generate nonlinearities and are rich in dynamics (Bai & Perron, 2003; Perron, 2006)

A typical multiple linear regression model with t observations and m potential threshold can produce $m+1$ regimes. Considering the observations in the regime $j = 0, 1, 2, \dots, m$ hence, the linear regression may be specified as follow:

$$Y_t = X_t\beta + Z_t\delta_j + \varepsilon_t \quad (9)$$

Where Y is economic growth (GDPR); Z is a vector of covariates which is domestic borrowing (DOMD), and X is external borrowing (EXTD), inflation (INFL), interest rate (INTR) and gross fixed capital formation (GFCF).

There are two categories of regressors. The X variables possess parameters which do not vary in the model, while the Z variables have parameters that can vary but are regime-specific.

A threshold variable q_t would be strictly increasing the threshold values ($\gamma_1 < \gamma_2 < \gamma_3 \dots < \gamma_m$) in such a way that regime j exists only when:

$$\gamma_j \leq q_t < \gamma_{j+1} (\gamma_0 = -\infty \text{ hence, } \gamma_{m+1} = \infty)$$

When the threshold variable is equal to or less than the j -th threshold value, regime j is estimated but less than the $(j+1)$ -th threshold. For example, in a single threshold with two regime model, the following stipulations will hold:

$$Y_t = X_t\beta + Z_t\delta_1 + \varepsilon_t \quad \text{if } -\infty < q_t < \gamma_1 \quad (10)$$

$$Y_t = X_t\beta + Z_t\delta_2 + \varepsilon_t \quad \text{if } \gamma_1 < q_t < \infty \quad (11)$$

If an indicator function $k(\cdot)$ is deployed, it takes the values 0 when the expression is false and 1 otherwise. In combining to equate $k_j(q_t, \gamma) = k(\gamma_j \leq q_t < \gamma_{j+1})$, it becomes possible to merge the individual regime specifications $m+1$ into the following single equation:

$$Y_t = X_t\beta + \sum_{j=0}^m k_j(q_t, \gamma) + Z_t\delta_1 + \varepsilon_t \quad (12)$$

The nonlinear least-squares approach is basically to estimate the model's parameters. Hence, the objective function of the least-squares sum of squares becomes:

$$S(\delta, \beta, \gamma) = \sum_{t=1}^T \left[Y_t - X_t\beta + \sum_{j=0}^m k_j(q_t, \gamma) + Z_t\delta_1 \right]^2 \quad (13)$$

The threshold regression estimates are obtained by minimizing $S(\delta, \beta, \gamma)$ with respect to the parameters.

3.2.3 Variables and Data Sources

The data adopted for this study is sourced from the World Development Indicators (WDI) and Central Bank of Nigeria (CBN) covering 1980 to 2019. While the data on economic growth, inflation, interest rate, private investment and trade openness are obtained from WDI, domestic borrowing and external borrowing are obtained from the Central Bank of Nigeria Annual Statistical report for 2020.

Table 1. Variable Description, Measurement and Data Source

Variable	Description and Measurement	Source
DOMD	Domestic Borrowing is measured by total domestic borrowing by the federal government of Nigeria divided by GDP	CBN Statistics
GDPR	Economic growth is the annual percentage growth rate of GDP at market prices: defined as $\left(\frac{Y_t - Y_{t-1}}{Y_{t-1}}\right)\%$ for each year	WDI
INFL	The inflation rate on the consumer price index indicates the annual percentage change in the cost to the average consumer in terms of acquiring a basket of goods and services yearly. The Laspeyres formula is used.	WDI
INTR	The lending rate is the bank rate that satisfies the government's short- and medium-term financing needs and the private sector (Lending rate/Monetary Policy Rate).	WDI
EXTD	External borrowing is total external debt by the federal government of Nigeria. It is estimated as the total amount of publicly guaranteed and privately nonguaranteed long-term debt, short-term debt and use of IMF credit. It is divided by GNI.	CBN
GFCF	Gross fixed capital formation refers to land improvements (fences, ditches, drains, and so on); equipment purchases, plant, machinery; and the construction of railways, roads, and the like, including schools, offices, hospitals and the like.	WDI

Source: Author's Compilation (From WDI & CBN)

IV. PRESENTATION OF EMPIRICAL RESULTS AND ANALYSIS

The threshold regression analysis estimates the exact turning point (where it exists) in the relationship between domestic borrowing and economic growth. The specification for the threshold test is shown in Table 2. The test is based on the Bai-Perron (2003) critical values for the threshold. It offers the threshold value of domestic borrowing concerning economic growth in terms of sequential and repartition values. The specified threshold non-varying regressors include external borrowing, private investment, inflation and interest rate.

Table 2 Threshold Specification

Multiple threshold tests			
Bai-Perron tests of L+1 vs. L sequentially determined thresholds			
Dependent Variable: GDP			
Threshold variable: DOMD			
Threshold non-varying regressors: EXT D GFCF INFL INTR			
Threshold test options: Trimming 0.15, Max. thresholds 5, Sig. level 0.05			
Sequential F-statistic determined thresholds:		1	
		Scaled	Critical
Threshold Test	F-statistic	F-statistic	Value**
0 vs. 1 *	5.8236	17.4709	13.9800
1 vs. 2	1.9831	5.9493	15.7200
* Significant at the 0.05 level.			
** Bai-Perron (2003) critical values.			
Threshold values:			
	Sequential	Repartition	
1	14.87994	14.87994	

Source: Author's Computation

The full result of the threshold regression investigation is shown in Table 3. The domestic borrowing threshold with economic growth is 14.88% of Nigeria's GDP and is significant at 5% level. 14.88% of GDP is the turning point in the relationship between DOMDF and GDP such that it becomes asymmetrical. The upper part of Table 3 shows that the coefficient of domestic borrowing is positive (0.8198) before the threshold of 14.88% of GDP. On the other hand, the coefficient of domestic borrowing is negative (-1.3432) after the threshold of 14.88%. The exact threshold occurs at 29 annual points into the data indicating the year 2009. The positive trend following the negative direction of the domestic borrowing curve before and after the threshold point shows an inverted U-shape curve in the relationship between domestic borrowing and economic growth. It means that for values of domestic borrowing before the threshold of 14.88% of GDP, economic growth is positive and favourable to the country. However, there is a negative effect on the country's economic growth as the nation sustains domestic borrowing beyond the threshold of 14.88% of GDP.

The regression results of the non-varying variables show that while the effect of external debt has been positive and significant on economic growth, gross fixed capital formation and inflation have had a negative and significant impact on economic growth. However, the effect of interest rate has been positive on economic growth, and it is not significant. The impact of domestic borrowing has been both positive and negative on economic growth.

Table 3 Threshold Regression between DOMDF and GDP

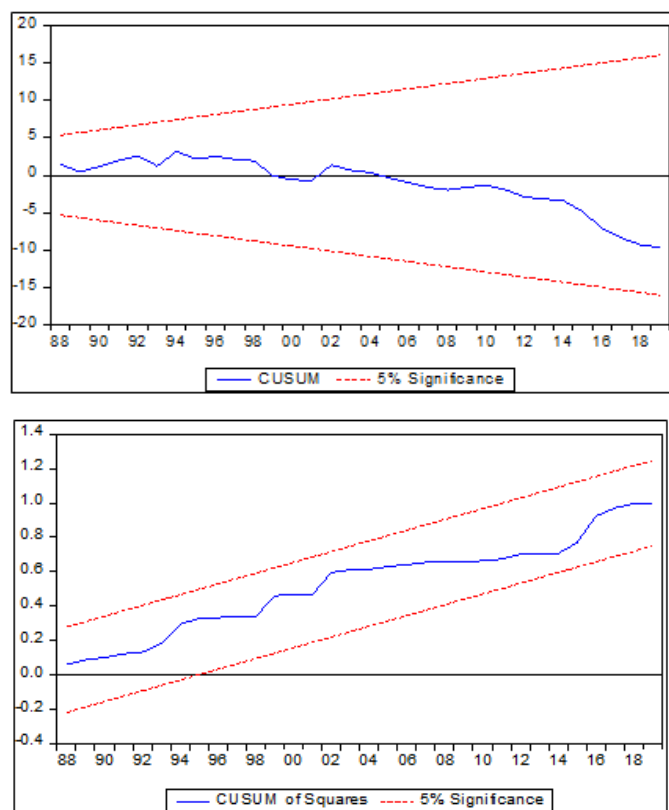
Dependent Variable: GDP				
Method: Discrete Threshold Regression				
Sample: 1980 2019				
Included observations: 40				
Threshold variable: DOMD				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
DOMD < 14.87994 -- 29 obs				
DOMD	0.8198	0.2706	3.0297	0.0048
C	25.0550	4.8127	5.2061	0.0000
14.87994 <= DOMD -- 11 obs				
DOMD	-1.3432	0.3630	-3.7004	0.0008
C	40.9868	5.5940	7.3269	0.0000
Non-Threshold Variables				
EXTD	0.1272	0.0497	2.5613	0.0153
GFCF	-0.1568	0.0352	-4.4542	0.0001
INFL	-0.0975	0.0347	-2.8138	0.0083
INTR	0.2844	0.2019	1.4085	0.1686
R-squared	0.7772	Mean dependent var		17.1763
Adjusted R-squared	0.7285	S.D. dependent var		5.3994
F-statistic	15.9490	Akaike info criterion		5.0835
Prob(F-statistic)	0.0000	Durbin-Watson stat		2.0836
Breusch-Godfrey Serial Correlation LM Test:				
F-statistic:	0.4829	Prob. F(2,30):		0.6217
Breusch-Pagan-Godfrey Heteroskedasticity Test:				
F-statistic:	0.3522	Prob. F(7,32):		0.9229
Normality Test:				
Jarque-Bera:	0.0481	Probability:		0.9763
Omitted Variables: RAMSEY Reset Test				
F-statistic:	0.9978 (2, 30)	Probability:		0.3806

Source: Author's Computation

On the performance criteria of the model, the coefficient of determination (adjusted R-Squared) is 0.73, indicating that changes in the model regressors explain about 73% of the total variation in economic growth. The value of the R-Squared indicated that the model is a good fit. Also, the value of the F-statistic and the probability [15.95 (0.0000)] shows that it is statistically significant at a 5% level of significance, indicating that the model is well specified. The diagnostics on the threshold regression results reveal that it does not suffer from serial correlation from the value of the Durbin-Watson statistic (2.08). The Durbin-Watson result on serial correlation was strengthened by the Breusch-Godfrey Serial Correlation LM Test with the value of the F-statistic (0.4829) and probability (0.6217), indicating that the null hypothesis of no serial correlation cannot be faulted. In addition, the model is free from heteroskedasticity as the result of the Breusch-Pagan-Godfrey Test (with F-statistic: 0.3522 and Probability: 0.9229) shows that the null hypothesis of homoscedasticity should be accepted. The normality test indicates that the Jarque-Bera value is 0.0481 with a probability of 0.9762, indicating that the null hypothesis of normality for the data set cannot be rejected. Finally, the functional form investigation using the Ramsey

RESET test indicates that the threshold regression model is not misspecified. The test on the recursive estimates of the threshold regression model (Figure 4) shows that trend values of the CUSUM and CUSUM Squares are stable at a 5% level of significance.

Figure 4 CUSUM and CUSUM Squared Estimates of Threshold Regression Model



V. CONCLUSION AND RECOMMENDATIONS

This research study investigates the nonlinear relationship between domestic borrowing and economic growth using threshold regression covering the period between 1980 and 2019. The threshold regression examination results confirm the existence of the threshold point for domestic borrowing at 14.88% of GDP. It means that domestic borrowing by the government becomes a drag on economic growth when it grows beyond 14.88% of GDP. Also, the estimated results indicate that the relationship between domestic government borrowing and economic growth has an inverted U-shaped curve. The results confirm the application of the debt Laffer curve hypothesis in Nigeria. Some studies that prove the nonlinear relationship between government borrowing and economic growth and justify the presence of the debt-GDP threshold include Mupunga & Roux (2015), Omotosho et al. (2016), Eboime & Sunday (2017) and Van & Hoang (2018). On the other hand, some authors concluded with empirical results at variance with the debt and growth threshold relationship (Pescatori et al., 2014; Chudik et al., 2015; Rahman et al., 2019).

The regression results of the non-varying measures show that while the effect of external debt has been positive and significant on economic growth, gross fixed capital formation and inflation were negative and significant on economic growth. Although the effect of interest rate is positive on economic growth, it is not significant. Domestic government borrowing is not all in the region of positive contribution to the economy. On the contrary, a more significant segment of the borrowing contributes negatively to the economy; hence the government should improve the efficient administration of borrowed funds in the execution of public infrastructural projects. Also, the country's monetary authority should implement measures to control the inflationary trend that accompanies the fiscal policy effect of domestic borrowing. Finally, this study recommends that the Nigerian government implements and maintain a domestic borrowing threshold of 14.88% of GDP. The main limitation of this study is the use of only one methodology to estimate the domestic borrowing threshold for the country. Ndoricimpa (2020) has argued that estimating a debt threshold could be sensitive to modelling choices. Therefore, it may be necessary to conduct further studies to reconfirm the threshold and the direction of the threshold found in this study. Using any combination of other threshold estimation techniques like the nonlinear autoregressive distributed lag (NARDL) and the U-test of Mehlum and Sasbuchi would be appropriate to reconfirm the nature and direction of the domestic debt-growth threshold in Nigeria.

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