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RESEARCH ARTICLE

PUBLIC DEBT AND ECONOMIC GROWTH IN NIGERIA: EVIDENCE FROM THRESHOLD COINTEGRATION

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Abstract

The aim of most government when accumulating public debt is to enhance an improved economy. However, economic performance has been abysmally poor in Nigeria despite its high debt profile. Few studies have considered the non linear relationship between public debt and economic performance in Nigeria using the threshold cointegration technique. Therefore, this study examined the threshold effect of public debt on economic growth using time series data from 1985 to 2020. Findings revealed asymmetric cointegration between public debt and economic growth ($F[p_1 = p_2 = 0]$, = 13.118, $p < 0.05$). The results of the asymmetric error correction model found that public investment had a positive and significant relationship with economic growth ($\beta = 0.675$, $t = 3.542$, $p < 0.05$) while trade openness had a negative and significant relationship with economic growth ($\beta = -0.226$, $t = -3.617$, $p < 0.05$).The study concluded that there is a threshold cointegrating relationship between public debt and economic growth in Nigeria. Therefore, the study recommends that the Nigerian government should efficiently utilize funds borrowed domestically and contract less of external debt in order to maintain a sustainable economic growth.

Keywords: Domestic Debt, External debt, Public Debt, Economic Growth, Threshold Cointegration, Nigeria.
JEL CLASSIFICATION: H63

1. Introduction

Public debt is an issue of global concern for developing countries with particular emphasis on African economies. The performance of developing countries has been considered

disappointing stemming from the effects of the 1980s/1990s debt crisis (Da Veiga, Ferreira-Lopes and Sequeira, 2016) and inherent fiscal deficit in African economies. Many of these countries are financially handicapped and find it difficult to fully utilize the economic resources meant to boost their developmental progress (Maitra, 2019). These countries struggle hard to meet up with the financial requirement needed to achieve desired economic goals and therefore adopt borrowing as a supportive agent. Hence, their fiscal policy measure is anchored on borrowing in financing their fiscal deficits to attain sustainable growth and development.

The World Bank emphasized that debt accumulation has become worrisome in the past years. In Africa, average public debt to GDP ratio has increased by half from 40% to 59% for Sub-Saharan Africa within the period of 2010-2018. The situation of debt in Africa became increasingly unsustainable as these countries were unable to easily repay the burdensome debt accumulated over the years. The International Monetary Fund (IMF, 2019) warned that around 40% of African countries are in debt distress as a fall out from the huge debt burden surrounding their economies. Recipient countries sometimes fail to achieve the desired objectives and are far from launching a robust economic performance. The continuous effort of these borrowing countries in an attempt to strive for development through the use of deficit budgeting has led to major setbacks in their economies (Da Veiga et al., 2016).

Nigeria is not excluded amongst the challenged African countries in terms of fiscal deficit. The challenge has been justified by the vicious cycle of weak fiscal positioning associated with low level of revenue to GDP ratio. The fiscal situation in Nigeria is generally a low tax revenue and high public expenditure leading to fiscal deficit. Government can decide to generate more revenue by printing money, increasing tax rate or borrowing and in the rear cases of budget surplus. Amidst the various options, the country has been more reliant on public borrowing to survive the vulnerable fiscal scenario. This intention of borrowing tends towards enhancing various economic goals such as price stability, reduced unemployment, fiscal balance, balance of payment equilibrium and sustainable economic growth (Omotosho, Bawa and Doguwa, 2016; Ajayi and Edewusi, 2020). Unfortunately, the growing burden of debt and low returns on investment has dominated the fiscal space of the country making it more difficult to achieve the set economic goals and objectives.

Nigeria has witnessed series of downturn in its economic performance despite the consistent upsurge in government borrowing. To buttress this fact is the decline in the growth rate of the economy from 9.5% in 2010 to 2.55% in 2019 representing a 7% decline in growth rate. The IMF in February, 2020 revised the GDP growth rate to drop from 2.55% to 2%. The fashionable pattern of public borrowing had escalated the curiosity of monetary authorities

and researchers regarding the quantum of debt accumulation that would enhance economic growth (Omotosho et al., 2016).

The track record of 2005-2006 debt relief came with the expectation to revive the economy from the challenges of the prevailing unsustainable debt situation and in turn promote higher standard of living. It was perceived to be a poverty reduction effort focused on strengthening the economy and ensuring debt burden sustainability (World Bank, 2018). Surprisingly, the economic situation in Nigeria is worsened due to policy uncertainty and macroeconomic imbalances presenting the country with less attraction for external private financial inflows (AFDB, 2022).

Given the contribution of fiscal policy in regulating the financial and economic performance of the economy, the issue of public debt has received numerous attention in the literature. The public debt-growth nexus have been extensively discussed in (Shittu et al., 2020; Oluitan, 2020; A*kpansung and Gidigbi, 2020;* Didia and Ayokunle, 2020; Priyardarshana, 2019; Khanfir, 2019; Akhanolu et al., 2018; Essien et. al., 2016; Laosebikan, et. al. 2018; Égert, 2014; Babu et al., 2015; Egbetunde, 2012). These plethora of studies have used different techniques to unravel the nonlinear relationship between public debt and economic growth, there is a mixed result of empirical evidence. The likely reason for this lack of consensus in the literature is traceable to the use of various methodologies. Despite this extant empirical literature, none of these studies have examined the cointegrating relationship between public debt and economic growth in Nigeria using the threshold cointegration.

The choice of the threshold cointegration technique is due to its uniqueness in addressing the asymmetric impact of public debt on economic growth. Past literatures have examined the unit root properties of public debt and economic growth especially with the use of the conventional (symmetric) cointegration approach. The approach has its drawback of misspecification in an asymmetric adjustment process and failure to capture the actual adjustment process under the error-correction mechanism (Enders and Siklos, 2001). In contrast to other approaches, this study employed the advantage of threshold cointegration that captures the asymmetric behavior of the relationship and filled the vacuum created by previous studies. Hence, this study specifically examined the impact of public debt on economic growth within the framework of threshold cointegration analysis.

The remainder of this article is organized viz.; the next immediate section is devoted to the narration of past empirical studies. This is followed by the methodology section which

discusses the data and method applied in the study. Section 4 covers the discussion of results while Section 5 concludes and provides policy recommendations.

1.0 Literature Review

1.01 Conceptual Review

Economic Growth

Economic growth is an indication of the level of progress in the economic activities of a country. It is one of the major factors reflecting the well-being and progress of a large number of people (Boldeanu & Constantinescu, 2015) and refers to the increase in the real gross domestic product (GDP) or GDP per capita of any given economy. Generally, an increase in the national product of an economy measured in constant prices is regarded as economic growth. It is also regarded as the central goal of a country's economic policy and agenda reforms (Fadare, 2010).

Every country prioritizes achieving sustainable economic growth which is considered an essential goal for macroeconomic policy (Lopes da Veiga *et al.*, 2016). Therefore, a sustainable economy is driven by a robust level of GDP. Apparently, this level of GDP requires financial resources that when converted into investible capital can productively generate external and internal dynamics of value creation (Lopes da Veiga *et al.*, 2016).

Economic growth of a country has been related to government expenditure, which significantly depends on the amount of resources at the reach of the government (Khorravi & Karimi, 2010). Budgetary and fiscal policies are, obviously, important determinants of economic growth. Aside from the resources provided in an active expansionary fiscal policy, public debt has been the alternative channel through which these resources are raised. Government decides to borrow in order to finance the fiscal deficit, alleviate poverty and encourage sustainable economic growth (Soludo, 2003). The accumulation of public debt is not expected to slow down growth, as long as the borrowed funds are productively channeled for investment purposes. However, the effect of the large accumulation could expose the country to a heavy debt burden when the country is unable to meet up with its debt obligations. Consequently, this further contributes negatively to the economic growth of the nation (Sulaiman & Azeez, 2012).

Developing countries, particularly Nigeria is one of the countries trapped in the incidence of high level indebtedness and poverty. This has implications for the growth potential of the economy. This assertion is based on the economic theory that nations can better alleviate poverty through overall growth. Otherwise, economic growth stifled by heavy debt burden can trap such country in the vicious circle of poverty. The efforts of the World Bank and the IMF birth the launching of the HIPC initiative in 1996 in order to address the concerns on debt-growth relationship. This initiative provided poor countries struggling to service heavy debt burden with a comprehensive debt relief and aimed to position the country for long-term debt sustainability without hampering development. The country has received assistance under the HIPC initiative in 2005/2006 and presently, the challenge remains how the country's debt burden do not return to unsustainable levels.

Boldeanu *et al.* (2015) categorized the various factors that trigger economy growth into direct and indirect. The direct factors consist of human resources, natural resources, increase in capital employed and technological advancement, whereas the indirect factors include institutional quality, aggregate demand size, savings and investment rates, capital and financial efficiency, labour mobility, budgetary and fiscal policies.

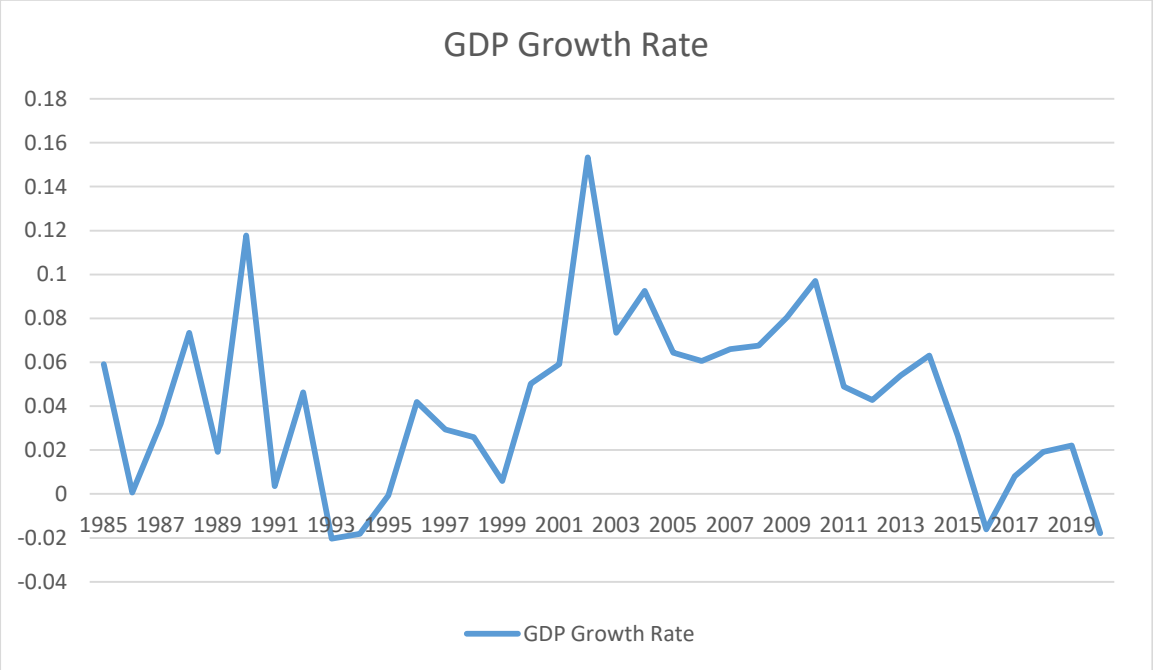

Figure 1: Trends of GDP growth rate in Nigeria from 1985 to 2020
Source: Author's computation

Figure 1 shows the oscillating trend of Nigeria's growth rate which reflects the lowest around 1983 and the highest data point at 2003. Despite the debt cancellation of 2005/2006, the growth rate in Nigeria has assumed a downward trend up till 2020.

Public Debt

Obtaining sufficient fund for financing government expenditure is a pre-requisite for the attainment of government macroeconomic and social objectives. Government debt remains one of the powerful fiscal tools adopted by government in financing its expenditure when revenue accruing from government multiplicity sources does not match the fund needed in financing such expenditure. Low level of domestic savings, reduced capital formation and investment results when there is absolute shortage in domestic revenue and foreign exchange earnings. The dual-gap theory states the need for government borrowing as an attempt to bridge the nation's saving-investment gap and foreign exchange (import-export) gap. The saving-investment gap takes place when low per capita income, a causative factor of low savings is insufficient to boost productive investment and meet the developmental goals.

Soludo (2003) is in agreement with the view of the dual gap theory when he pointed out two main reasons for contracting public debt. First, public debt are utilized for macroeconomic reasons when catering for the financing of an increased level of consumption and investment expenditure and second, to finance fiscal and BOP deficit so as to reduce poverty and encourage sustainable economic growth. In addition, public financing is an important ingredient driving economic growth; otherwise, its paucity may necessitate government borrowings.

Eke and Akujuobi (2021) stated that public debt constitutes a viable means through which nations of the world bridge their short fall of fund needed in carrying out economic projects that have the potentials to improve the standard of living of the citizenry and promote sustainable growth and development. As a yardstick for measuring the efficiency of public borrowing, it should impact economic growth and investment of a country significantly up to an extent where high level of external debt servicing sets in and affects the growth as the focus moves from financing private investment to repayments of debts (Nur, Shafinar & Abdul, 2019; Sasmal & Sasmal, 2018).

Public debt is one of the means to complement government revenue when the government expenditure is greater than its receipts (or budget deficits). The pattern of government debt as a source of government revenue is different from other sources of government revenue such as taxes, fees, fines, grants etc. (Jhingan, 2006; Shuaib & Peter, 2010). The neoclassical growth model serves as the theoretical foundation for the justification of government borrowings, stating the need for countries with scarce capital to borrow and accumulate more capital in order to reach a steady-state level of output per capita inflow (Ogbonna, Ihemeje,

Obioma, Hanson & Amadi, 2021). The past global economic crisis also motivated countries of the world to borrow and especially the developing countries. These countries resort to borrowings in order to finance their ever increasing expenditure levels and cover up for the decline in revenue and capital inflows (Ogbonna *et al*., 2021).

Economic theory suggests that reasonable level of debt by developing countries of the world has the tendency for contributing to the growth of the economy. This is so as countries in their developing stages have low stock of capital but with return on investment in excess of their developed nations' counterparts (Yusuf & Mohd, 2020). In the submission of Pattillo, Poirson and Ricci (2004), public debt should enhance the growth of the economy as well as the repayment of the principal and interest in as much as the borrowed fund are used productively and macroeconomic instability, policies that distort economic incentives or sizable adverse shocks do not set in. The appreciable impact of reasonable level of debt has left scholars such as Yusuf and Mohd (2020) to the conclusion that reasonable level of public debt may stimulate economic growth in as much as it does not get to a substantial level that would necessitate sacrificing reasonable percentage of government expenditure and foreign exchange earnings for debt repayment and also mortgage the future of generations unborn. They argued further that the cost of servicing debt can increase beyond a level which the economy can tolerate thereby hampering the efforts to address the desired fiscal and monetary policy objectives.

Public debt has been a topical issue in the academics and formed the basis for empirical researches in developing economy, particularly Nigeria. The history of public debt in Nigeria can be traced back to the foundation laid in the colonial era, the period Nigeria embraced the financial reform purposely to finance its fiscal deficit through the creation of marketable public securities. The prompting and need for infrastructural expansion compelled Nigeria into the acquisition of the first major external debt in 1958 (Nwannebuike *et al*., 2016), being the fund raised from the World Bank to finance railway construction. Based on the statistics given in the debt profile, the country has been operating in a whirlpool of huge sum of external debt exceeding the volume of domestic debt until after the debt cancellation of 2005 when changes occurred in the debt structure of the economy. This reformatory policy engaged the substitution of public external debt with debt issued domestically and since then, internally sourced loan has been on the rising trend. The overall debt in Nigeria has been growing in the recent dispensation to a level that has inserted fears in to the heart of different concerned stakeholders.

1.1 Theoretical Review

The theoretical framework for this study is hinged on Adam and Bevan (2005) model of endogenous growth that describes the impact of deficit flows and public debt stock on economic growth. The study extended the work of Barro (1990) and Barro and Sala-I-Martin (1992) to demonstrate the saving behavior in the simple overlapping generation model embedded in the endogenous growth model. The model is structured to accommodate an unbalanced budget (budget deficit) which may be financed through seigniorage or public debt.

The overlapping generation model presents individuals who live for two periods, with the assumption that there are no intergenerational transfer and as such, every individual is born at time t = 0,1, 2,……..n. The identical preference of these individuals is represented as:

$$U = blnc_1 + (1 - \mathrm{b})\, c_2, \tag{1}$$

$Where\ c_1$ and c_2 represent the first and second generation consumption period; b stands for the preference parameter.

In line with the Barro (1990) and Barro and Sala-I-Martin (1992) extension of the endogenous growth model to accommodate public debt, the production function that captures the overall public spending as a determinant of output in the Cobb Douglas form is presented as:

$$y_t = Az_t^{\theta} k_t^{\delta} (n_t h_t)^{1-\delta} \tag{2}$$

where y_t stands for output at time t, z_t represents the public expenditure on capital stock, $n_t h_t$ represents the aggregate number of skilled labour force and k_t is the aggregate capital stock while A is the technological progress and innovation.

Public spending is essentially sourced from taxes and borrowed funds. In this light, public spending can be disintegrated into the basic components and thus, equation 3.2 is restated as:

$$y_t = Apst_t^{\varrho} psb_t^{\ni} k_t^{\delta} (n_t h_t)^{1-\delta} \tag{3}$$

where pst_t stands for tax-financed public spending and psb_t accounts for the debt-financed public spending. Debt-financed public spending can be split into two forms namely the domestic debt and the external debt. Equation 3.3 is then re-specified as:

$$y_t = Apst_t^{\varrho} psd_t^{\ni} pse_t^{\gamma} k_t^{\delta} (n_t h_t)^{1-\delta} \tag{4}$$

where psd_t depicts public spending via domestic debt and pse_t is the public spending via external debt.

1.2 Empirical Review

This section reviews several empirical literatures on the debt-growth nexus in the developed and developing countries. These reviewed literature on the relationship between public debt and economic growth shows some conflicting results and hence, debatable and inconclusive. Some scholars argued for the existence of a positive relationship, negative relationship while some advocate for the existence of an inverted-U shaped debt-growth link. Also, several other studies have looked into either the individual or combined effects of external and domestic debt on growth to capture public debt effectiveness.

Checherita-Westphal et al. (2012) considered the link between public debt-GDP ratio and GDP growth rate in 12 euro area countries using the dataset covering 1970 – 2008. Their findings establish a non-linear effect of public debt on growth, evidence revealed an inverse U-shaped relationship with turning point between 90-100 (%) on the average across all the samples and models. The authors identified channels of transmission by which public debt adversely hamper growth prospect; such channels are private saving, total factor productivity, public investment and long-term nominal and real interest rates. The existence of a negative relationship between public debt and growth was found by Calderon and Fuentes (2013) for a panel data of advanced countries between 1970 and 2010.The study revealed some of the medium through the adverse effect of public debt are mitigated, such medium entail high quality domestic policies, strong institutional quality and outward-oriented policies. Dinca and Dinca (2015) empirically explored the relationship between government debt and per capita GDP growth rate for a sample of 10 EU countries covering the period 1999-2010. The outcome of the study revealed a non-linear effects and identified 51% of debt to GDP ratio, the point after which debt begin to negatively affect growth.

With regard to public debt and economic growth in OECD countries, Égert (2014) confirmed the non-linear nexus using threshold model and the technique of sensitivity analysis. The outcome of the analysis indicated a negative and non-linear debt-growth relationship. At the range between 20% and 60% of Debt-GDP ratio, the existence of a negative non-linear correlation surfaced at the low public debt level. Guei (2019) investigate the implication of external debt on economic growth in a group of 13 emerging economies between 1990 and 2016 using both linear and non-linear model specifications. The employed ARDL model results showed no robust effect of external debt on growth in the long run, although debt effects on growth were significant but negative in the short run. The paper by Bahr et al.

(2020) investigated the macroeconomic effect of total debt, public domestic debt and public external debt using an unrestricted Vector Autoregressive approach, with an application to the Canadian economy. From the empirical analysis of the 28 years data, the results obtained reveals a negative correlation between public domestic debt and growth while positively related with price level in the short run. The revealed impact of public external debt and total debt on economic growth is positive both in the long and short run. Lim (2019) considered the relational effect of the totality of public and private debt on growth in 41 advanced and emerging countries in the period 1952Q1 and 2016Q3.The study verified the existence of an inverse relationship between debt accumulation and output growth. Conclusively, debt expansion exert an unfavorable effect on growth.

From the economists' point of view, the relationship between public debt and the economic performance in developing countries have been a controversial matter as no consensus is existing on the subject matter. For instance, Atique and Malik (2012) aimed to research into the effect of domestic debt and external debt on Pakistan's economic growth. Both external and domestic debts negatively influence economic growth in Pakistan, with a stronger influence of external debt. This means that the Pakistan economy is trapped in the debt overhang problem, whereas the increasing debt servicing incurred through external debt contributes to its more negative effects. The study also suggests that the Pakistan's currency is weaker when compared to the currency used in servicing its foreign debt.

In a paper investigating the dynamic relationship between accumulated debt and economic growth in the South Africa, Baaziz et al. (2015) highlighted the transitional behavior of public debt on economic growth using the Logistic Smooth Transition Regression (LSTR) and captured other control variables, openness and inflation. Having tested the non-linear relationship, results shows that the debt threshold limit in South Africa is 31.37 % of GDP, a limit beyond which more debt becomes an impediment to the South African economic growth.

Following all these empirical literature, it is evident that consensus is yet to be reached on the subject matter. A lot of research has been carried out the non-linear relationship between public debt and economic growth in Nigeria but the threshold and asymmetric technique has not been explored. This has actually paved the way for this study to investigate the asymmetric cointegration relationship between public debt and economic growth in Nigeria.

2.0 Methodology

This paper examined the threshold cointegrating relationship between public debt and economic growth. In this regard, the study extracted relevant data on real gross domestic

product growth, public debt (domestic and external), gross fixed capital formation and trade openness from 1985 to 2020. Time series data on domestic and external public debt, and real gross domestic product growth rate were retrieved from the Central Bank of Nigeria (CBN) Statistical Bulletin while gross fixed capital formation and trade openness are collected from the World Bank World Development Indicators

The model specification for estimating the existing relationship between the public debt and economic growth follows the theoretical framework of Adam and Bevan (2005) model of endogenous growth that describes the impact of deficit flows and public debt stock on economic growth.

Consequently, the stated objective of the study is specified based on the established theoretical foundation laid in linking the dependent and independent variables. The empirical model for the relationship between public debt and economic growth in Nigeria is stated as thus;

$$gr_t = \beta_0 + \beta_1 Psdd_t + \beta_2 Psed_t + \beta_3 Ks_t + \beta_4 Top_t + e_t \quad (5)$$

Where gr_t is the real GDP growth rate, $Psdd_t$is a measure of domestic debt while $Psed_t$stands for external debt in the economy, Ks_t is the gross fixed capital formation, Top_t is the trade openness of Nigeria and $e_t$is the stochastic term.β_0 is the slope of the model, $\beta_1, \beta_2, \beta_3, and\ \beta_4$ are the coefficient of the parameters.

Enders and Siklos (ES) Threshold Cointegration Tests

There is recently a growing consensus that public debt and economic growth exhibit non-linearities, meanwhile the conventional unit root tests possess lower power in detecting their mean reverting tendencies. Given the threshold cointegration framework, the starting point for the model is specified based on the Engle and Granger (EG) two-step cointegration procedure that implicitly assumes the presence of linear adjustment mechanism. The findings of the I(1) series for both the public debt and economic growth of Nigeria helps us to proceed with the long-run equilibrium cointegration tests. In the first step, the linear estimate of the regression model towards the long run equilibrium takes the form.

$$Y_t = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \cdots \ldots\ldots\ldots\ldots + \beta_n X_n + \mu_t \quad (6)$$

Where Y_t represent the dependent variables, X_i stand for the independent variables,β_i are the parameter estimates with i = 1, 2…n, and μ_t is the stochastic error term that may be serially correlated.

The next step focuses on the coefficient estimates of ρ_1 and ρ_2, modifying the EG specification and assuming that deviations from the long run equilibrium behave as a threshold autoregressive (TAR) process such that:

$$\Delta\mu_t = \mathrm{I}_t\rho_1\mu_{t-1} + (\mathrm{I} - \mathrm{I}_t)\rho_2\mu_{t-1} + \varepsilon_t \quad (7)$$

Where the term I_t represents the Heaviside indicator function such that $\mathrm{I}_t = 1$ if $\mu_{t-1} \geq \tau$ and $\mathrm{I}_t = 0$ if $\mu_{t-1} < \tau$, where τ is the estimated threshold value. τ is determined endogenously by adopting the Chan (1993) method where the optimum threshold value is such that the error sum of square is minimized. When the system is convergent ($\mu_t = 0$), the deviation of μ_{t-1} above the threshold, adjustment is assumed as $\rho_1\mu_{t-1}$ and denoted by $\rho_2\mu_{t-1}$ when deviation of μ_{t-1} is below the threshold. The coefficients ρ_1 and ρ_2 are the different speed of adjustments for the discrepancies from the long run equilibrium in the public debt-growth nexus.

Alternatively, if the speed of adjustment exhibits a directional momentum, then the Heaviside indicator function may be allowed to depend on the changes of the sequence in μ_{t-1}. The speed of adjustment depends on whether $\Delta\mu_{t-1}$ is increasing or decreasing. This is referred to as the momentum threshold autoregression (M-TAR) and is active when adjustment is asymmetric in nature. The M-TAR model, M_t represents the change in μ_{t-1} i.e. $\Delta\mu_{t-1}$ instead of the level of μ_{t-1} in the form;

$$\Delta\mu_t = M_t\rho_1\mu_{t-1} + (\mathrm{I} - M_t)\rho_2\mu_{t-1} + \varepsilon_t \quad (8)$$

Increase in $\Delta\mu_{t-1}$ tend to persist when $\rho_1 < \rho_2$, otherwise, decreases in $\Delta\mu_{t-1}$ revert to the threshold. If $\mu_{t-1} > \tau$, the adjustment rate is at ρ_1, that is, eqn. (8) becomes $\Delta\mu_t = \mathrm{I}_t\rho_1\mu_{t-1} + \sum_{i=1}^{m}\gamma_i\,\Delta\mu_{t-1} + \varepsilon_t$, and if $\mu_{t-1} < \tau$, the adjustment rate is at ρ_2, where $\Delta\mu_t = \rho_2\mu_{t-1} + \sum_{i=1}^{m}\gamma_i\,\Delta\mu_{t-1} + \varepsilon_t$ is adopted.

The null of no cointegrating relationship for both the TAR and M-TAR models is expressed as $\rho_1 = \rho_2 = 0$ and the rejection implies that either $\rho_1\ or\ \rho_2$ is greater than zero. It is then possible to test for the presence of symmetric adjustment h_0: $\rho_1 = \rho_2$ and asymmetric adjustment h_1: $\rho_1 \neq \rho_2$. The F-statistics for this null hypothesis using the Monte Carlo approach, denoted by Φ and Φ^* statistics (TAR and M-TAR model tables) have a non-standard distribution. Although, when there is no presumption on the use of either of the two tests, the AIC and SBC are recommended in the selection of the appropriate adjustment mechanism.

Note that when an asymmetric cointegration relationship is established, an asymmetric error correction model can be used to evaluate the possible short run and long run dynamics between public debt and economic growth in Nigeria.

4. Results, Data Analysis and Discussion of Findings

This section focuses on the discussion of empirical results of threshold analysis of public debt and economic growth in Nigeria. To begin with, the unit root tests of the time series and

finally the threshold cointegration results.

Table 1: Unit Root Tests

Variables	ADF	PP	Remarks
GR	-1.983	-2.206	
ΔGR	-10.198***	-11.851***	I(1)
KS	-2.184	-2.617	
ΔKS	-7.526***	-7.551***	I(1)
PSDD	1.376	1.958	
ΔPSDD	-5.092***	-3.758***	I(1)
PSED	-1.626	-1.422	
ΔPSED	-3.203**	-3.261**	I(1)
TOP	-2.855	-2.609	
ΔTOP	-7.112***	-7.573***	I(1)

Source: Researcher`s computation (2022)

Notes: Table 2 shows the result of the Augmented Dickey Fuller (ADF) and Phillips-Perron (PP) unit root tests. *, **, and *** indicates 10, 5, and 1 per cent level of significant.

In examining the asymmetric and threshold effect of public debt on economic performance, the necessary but not sufficient condition is to examine the time series properties of the variables. The unit root tests result reported in Table 1 show that the Real GDP Growth Rates (GR), Capital Stock proxy with Investment (KS), External Debt to GDP (PSED), Domestic Debt to GDP (PSDD), and Trade Openness (TOP) were all stationary in their first differences I(1). Arising from the unit root test results of ADF and PP which have one-unit root, the study was able to use the ES asymmetric cointegration test.

Table 2: Public Debt and Economic Growth

Dependent Variable: GR

Panel A: Engle-Granger Cointegration test - Cointegrating Equation

Variable	Coefficient	Std. Error	t-Stat	Prob.	ADF	VIF
C	19.173	4.190	4.576	0.000	-3.984***	N/A
PSDD	-0.806	0.162	-4.978	0.000		4.403
PSED	0.271	0.120	2.262	0.031		1.512
TOP	0.054	0.048	1.121	0.271		1.168
KS	-0.534	0.108	-4.939	0.000		3.611

Panel B: Enders and Siklos Asymmetric Cointegration Test

Parameters	TAR Consistent (φ_u)	MTAR Consistent (φ_u^*)
p_1	-1.720 (-5.111)***	-1.422 (-4.267)***
p_2	-0.775 (-1.770)	-0.849 (-1.260)

Test		
$H_0: F(p_1 = p_2 = 0)$	13.118	10.029
$H_0: F(p_1 = p_2)$	4.824	1.041
Threshold τ	-2.887	-4.121
Lag	2	2
AIC	180.459	184.373
Q_{LB}	0.861 (0.930)	0.257 (0.992)

Source: Researcher`s computation (2022)

Notes: The results in Panel B are from the estimation of equations (5) and (7). The critical value is 10.75 at 5 percent for the TAR model and 11.54 for the MTAR model is from Wane, Gilbert and Dibooglu (2004), while the symmetric *F*-stat at 5 percent is 2.45. Q_{LB} test for the null of non-autocorrelation * Significant at 10%, ** Significant at 5%, *** Significant at 1%.

To confirm the presence of cointegration between public debt and economic growth in Nigeria, the ADF test on the residual of the estimated regression is statistically significantly at 1 percent. Thus, the null of no cointegration was rejected in favor of a cointegrating relationship. In addition, the variance inflation statistic for each of the independent variables is less than 10, this implies that the explanatory variables are not correlated with one another.

Panel B Table 2 reports the asymmetric cointegration tests. In the second column of table 2, we reject the null hypothesis of no cointegration for the TAR model because the asymmetric *F*-statistic of 13.118 is greater than the critical value of 10.75, at the 5 per cent significance level. Also, the study rejects the null of symmetric conitegration under the TAR because 4.824 is greater than the critical value 2.45 at the 5 per cent significance level. Column three of table 2 reports the MTAR model. Here, the study failed to reject the null hypothesis of no cointegration because the asymmetric *F*-statistic of 10.029 is less than the critical value of 11.54, at the 5 per cent significance level. The null hypothesis of symmetric cointegration could also not be rejected at the 5 per cent level of significance because the *F*-stat of 1.041 is less than the 2.45 critical value. Given that the symmetric and asymmetric statistics are significant under the TAR model, the TAR model is appropriate. For the TAR model, $|p_1|$ is stationary implying that the existence of long run equilibrium relationship between public debt and economic growth. The essence of the equilibrium relationship implies that the use of public debt as a fiscal policy instrument can influence fluctuations in economic growth. Given that $|p_1| > |p_2|$ in the TAR model and the threshold value is -2.887, the study confirm that the adjustment process towards the equilibrium above -2.887 is persistent whereas deviation from the equilibrium is relatively convergent below the estimated threshold. The estimated TAR model also suggests that it is devoid of autocorrelation.

Table 3: Asymmetric Error Correction Model for Public Debt and Economic Growth
Dependent Variable: GR

Variable	Coefficient	Std. Error	t-Stat	Prob.

C	0.058	0.672	0.086	0.932
DGR(-1)	-1.096	0.198	-5.537	0.000
DKS	0.675	0.191	3.542	0.002
DPSDD	1.460	0.752	1.943	0.063
DPSED	-0.624	0.329	-1.899	0.069
DTOP	-0.226	0.062	-3.617	0.001
$p_1 u_{t-1}$	-0.882	0.215	-4.099	0.000
$p_2 u_{t-1}$	-0.086	0.249	-0.344	0.734

Source: Researcher`s computation (2022)

Notes: Table 3 reports the asymmetric error correction model for effect of public debt on growth in Nigeria. $p_1 u_{t-1}$ and $p_2 u_{t-1}$ are the asymmetric error correction term.

Since symmetric cointegration is established between public debt and economic growth as well as evidence of asymmetric adjustment under the TAR model, then the asymmetric version of the error correction model (ECM) was estimated and presented in Table 3. In the short run, there is evidence that capital stock has positive and significant relationship with economic growth. In sharp contrast, trade openness has negative and significant relationship with economic growth. Turning to the major variables which are public debt, the results revealed that in the short run domestic debt has positive and insignificant relationship with economic growth and external debt hamper growth in the short run. The error correction term $p_1 u_{t-1}$ of -0.882 is negative and significant at 1 percent level of significant; this further corroborates the speed of adjustment results in the TAR model. Thus, the variables adjust back to equilibrium when economic growth is improving. Conversely, the error correction term $p_2 u_{t-1}$ of -0.086 is negative and statistically insignificant at 5 percent level. This implies that the variables did not adjust back to equilibrium when economic growth is worsened.

The asymmetric $H_0: F(p_1 = p_2 = 0)$ statistic of 13.118 is greater than the critical value of 10.75, at the 5 percent significance level, this implies that the null hypothesis that public debt has no significant threshold and asymmetric effect on economic growth in Nigeria was rejected. Therefore, public debt has threshold and asymmetric cointegration relationship with economic growth in Nigeria. This evidence suggests that adjustment process is asymmetric such that the response of economic growth to positive shock in public debt persists but the negative shocks revert quickly towards the long run equilibrium. This evidence showed that the speed of adjustment is faster when economic growth is enhanced than when economic growth is hampered.

Corroborating this findings with the results of previous studies, there is evidence that the result is in consonant with the findings of Calderon and Fuentes (2013); Dinca and Dinca (2015); Égert (2014); Guei (2019).

5. Conclusion & Recommendations

This study examined the relationship between public debt and economic growth in Nigeria from 1985 to 2020. To achieve the aims of the study, the study applied the threshold cointegration of Enders and Siklos (2001) to examine the threshold relationship between the variables of interest.

Based on the analysis of the study, the result of asymmetric tests found the presence of threshold and asymmetric cointegration among economic growth, gross fixed capital formation, domestic and external borrowing, and trade openness in Nigeria. Furthermore, the result of the asymmetric error correction model suggests that gross fixed capital formation has positive and significant relationship with economic growth in the short run. In sharp contrast, trade openness has negative and significant relationship with economic growth in the short run. Turning to the major variable which is public debt, the results revealed that in the short run domestic debt had positive and insignificant relationship with growth and external debt hamper economic growth in the short run. The implication of the findings suggests that public domestic borrowing has the potential to drive economic growth but not significantly. This is traceable to the fact that the volumes of domestic debt pumped into productive economic activities are not substantial. In addition, funds realized through external borrowing have negative consequence on the growth of the country and could likely emanate from the depletion of the country's international reserves. The theoretical implication is that additional stock of domestic debt may facilitate economic growth when efficiently utilized in the adequate proportion while an additional stock of external debt may retard economic growth if the greater portion of the country's reserves is used up in debt servicing. Corroborating this findings with the results of previous studies, there is evidence that the result is in consonant with the findings of Dinca and Dinca (2015) which confirms the asymmetric cointegration among the variables. Also, Égert (2014) confirmed the non-linear relationship using threshold model and the technique of sensitivity analysis. The outcome of the analysis indicated a negative and non-linear debt-growth relationship.

In conclusion, external debt impedes economic growth; however, domestic debt has the potential to improve the Nigerian economic growth. The results also show that gross fixed capital formation has significant positive relationship with economic growth in Nigeria, while trade openness has negatively significant relationship with economic growth in Nigeria. It is therefore recommended that the Nigerian government should efficiently utilize domestic

borrowed funds and contract less of external borrowing in order to maintain a sustainable economic growth.

6. Contribution to Future Research

This study has contributed to the empirical literature by providing robust evidence on effect of public debt on economic growth in Nigeria. Many studies have investigated the effect of public debt on economic growth in Nigeria, but none to the best of our knowledge in Nigeria has been conducted on the effects of public debt through domestic and external debts on economic growth measured by real gross domestic product while controlling for the role of trade openness within the framework of asymmetric threshold cointegrating relationship.

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