Government Debt Sustainability and Investments in Nigeria: Trends and Risk Thresholds amidst Macroeconomic Swings

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Abstract

The core idea behind government debt is to fund fiscal deficit, which is anticipated to drive economic investments. To a larger extent, this is not the case, as evidenced in the Nigerian context, where debt has risen so high with investment levels declining, thus questioning the government's ability to manage and sustain its debt to pursue vital investment needs. This study aimed to investigate the threshold effect of debt sustainability on investments amidst macroeconomic swings from 1981 to 2020. In this regard, the threshold autoregressive regression (TAR) was used because it gave information on the optimal threshold of debt sustainability that would attract investments. Also, the Granger causality test was carried out to show the direction of causality among the variables. This paper concentrated on debt service to revenue and total debt stock to GDP as debt sustainability measures while investment was decomposed into public, private, and foreign investments. The paper yields that, based on the multivariate TAR analyses, the main threshold variables, that is, debt service to revenue and total debt stock to GDP, had a non-linear relationship with public, private, and foreign direct investments amidst changes in macroeconomic variables such as exchange rate, inflation, and monetary policy rate. The threshold coefficient of debt service to revenue indicated that public and foreign direct investments declined during low thresholds while private investment increased. However, the opposite prevailed when debt service to revenue exceeded the threshold values. However, the Granger causality test showed that debt service to revenue Granger caused total debt stock to GDP and exchange rate Granger caused debt service to revenue ratio, implying that exchange rate swings could affect the government's ability to service debt which in turn explains the non-linear relationship between debt sustainability and investments. Hence, it was concluded that Nigeria's lack of debt sustainability was associated with revenue generation, which explains why the models did not follow a linear path.

Keywords: *Debt Sustainability, Investments, Macro Economy, Threshold Analysis, Nigeria*

Introduction

In periods of financial crisis and low resource availability, governments often rely on debt by borrowing from more prosperous countries or international financial institutions. These borrowings empower countries to fund development projects and programs – but, taken too far, the debt repayment burden can "submerge" a country's revenue which could lead to default and

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capital flight (IMF, 2021). Even the COVID-19 pandemic has aggravated the problem as many countries seek to lessen the health and economic consequences of the crisis by further increasing public health expenditures in the face of declining revenue. The simultaneous rise in expenditures and the decline in revenue generation have heightened the need for debt, raising the tension between attaining crucial development goals and managing debt vulnerabilities in many developing countries (Yussuf & Mohd, 2021). In the case of Nigeria, despite being a frontrunner economy in Africa, factors like low domestic production, shrinking revenue, and rising expenditures have triggered economic problems induced by the budget deficit and over-indebtedness.

From a theoretical standpoint, Krugman (1989) states that over-indebtedness arises when debtor countries can no longer meet their debt obligations. The result is that the expected return from investments will be insufficient to enhance economic prosperity to the extent that planned government spending on debt service will weaken investments and reduce revenue generation through taxes (Mugumisi, 2021). However, rational expectations of economic players can challenge the theory of over-indebtedness because economic agents anticipating a future rise in tax rates may decrease their consumption (Omotosho *et al.*, 2016). Furthermore, with the possible tax hikes, savings that are expected to drive domestic investments are eroded, leading to macroeconomic instability, which in turn discourages foreign investments (Uremadu & Onyele, 2019). Hence, it is believed that debt must be based on a maximum threshold beyond which additional debt would crowd out investments.

Adebayo *et al.* (2021) argued that debt denominated in foreign currencies exposes the debtor country to a greater debt burden due to currency depreciation as the rising interest rate spread on hard currency debt amplifies the crowding-out effect. With higher exposure to foreign currency, countries that hold more dollar or foreign currency-denominated debt would be faced with the risk of financial crisis since currency swings could result in a default. It implies that if highly indebted countries should experience a budget deficit, the perception of potential macroeconomic instability would increase, and unstainable levels of debt would be reached. In fact, the global financial crisis has shown that the unsustainability of national debt could be self-reinforcing as

over-indebtedness forces an upward trend in interest rates, causing difficulty for the government to service the debt (Fasoranti *et al.*, 2019).

The Debt Management Office (DMO) of Nigeria recognizes the need to ensure that the public debt remains sustainable in the medium to long-term by carrying out a Debt Sustainability Analysis (DSA) in the medium to long-term, which aligns with the macroeconomic framework, to ascertain the current and future levels of debt, as well as its capacity to meet obligations of debt service as and when due without compromising growth and development (DMO, 2019). According to the DMO, Nigeria conducts Debt Sustainability Analysis (DSA) yearly. The DSA is an exercise that assesses the risk associated with debt distress. The framework of the DSA gives an objective evaluation of debt sustainability under a specified macroeconomic context that delineates a country's monetary and fiscal stance under some assumptions and conditions. This exercise ensures that Nigeria's aggregate public debt portfolio is subjected to proper quantitative and qualitative analysis by appraising its capacity to repay its debt obligations, to evaluate its debt sustainability.

The significance of this paper lies in determining the optimal threshold of debt that would enhance investments in the face of the macroeconomic situation of Nigeria. Additionally, the study would reach conclusions and advance recommendations that would profit economic decision-makers in policy development and drive strategies that would contribute to overall economic development. Amidst the investigations of debt sustainability, the study attempts to ascertain the optimal level (threshold) of public debt that is sustainable towards the enhancement of public investments. The rest of the paper is thematically arranged into three sections. The following section presents the conceptual, theoretical, and empirical issues in an attempt to integrate the dynamism of the subject into the discourse. This is followed by a literature survey and exploring the substantive issue. The last section concludes the paper.

Statement of the Problem

Although Nigeria's debt to GDP ratio seems to be ideal – 18.23% as of 2020 – the debate regarding the adequacy or inadequacy of the debt sustainability framework of the World Bank and IMF that is mostly used in the assessment has been a challenge (Guzman, 2018). Part of the problem is associated with the fact that debt to GDP reveals incomplete information and hence should not be the sole yardstick for ascertaining sustainability. For example, there are changes in

the debt-to-GDP ratio when the GDP level increases due to rebasing while the revenue used to repay the debt remains constant (Chowdhury & Islam, 2012). Moreover, other varying factors that determine the dynamics of debt, such as fluctuations in exchange rate exposures, inflation and interest rates, economic growth, and current account and fiscal deficits, affect the country's capacity to carry or sustain debt over and above the debt to GDP criterion. Similarly, according to Jensen (2021), there exist other financial risks such as maturity mismatch (that is, using short-term borrowings to fund long-term projects with long maturity periods over which little or no revenue is generated to service the debt) as well as currency mismatch (accumulating debt in foreign currency while revenue is `denominated in domestic currency yet debt repayment happens in hard currency). Hence, other measures, such as debt service (% of revenue), have been used in determining the level of public debt sustainability (DMO, 2019).

While there is no universal threshold from which the negative impact of government debt is evident, studies such as Knapkova *et al.* (2019); Belguith & Omrane (2019) proclaimed that the threshold varies in different countries. On the other side, Pescatori *et al.* (2014) argued that there is no evidence of a particular debt threshold that would divide the amount of public debt into "good" and "bad", the one which should exert a positive or negative impact on investment growth. Similarly, Baum *et al.* (2012) indicated that the short-term impact of the debt is positive, but it falls almost to zero and loses significance if the debt overhang exceeds 67% in the Euro area. Goedl & Zwick (2018) found that Austrian fiscal policy is consistent with a stable long-run distribution of the debt-GDP ratio with a value close to the 60% threshold. Thus, the reason for applying the threshold analysis in this study is to unravel the level of government debt that would be "good" or "bad" for diverse investment categories in the Nigerian economy, which is the methodological gap this study aims to fill.

Given the speedy rise in debt accumulation in Nigeria, Aliu *et al.* (2021), Chukwu *et al.* (2021), and Ogunjimi (2019) discussed the association between debt sustainability and public investments; however, empirical works using the threshold regression technique are scanty. Again, the studies reviewed did not compare the threshold effect of government debt on private, public, and foreign investments, a gap this study aims to cover. As such, this study attempts to answer whether Nigeria's public debt is sustainable using a well-established empirical method,

namely the threshold analysis. This study investigates whether Nigeria's debt is empirically sustainable in the milieu of rising investment needs.

Objectives of the Paper

The broad objective of this paper is to present the threshold effects of debt sustainability on investments in the face of macroeconomic swings in Nigeria using time series data from 1981 to 2020. To achieve this, the following specific objectives guided the study:

   a.   To ascertain the optimal threshold effect of debt overhang (total debt to GDP ratio) on public, private, and foreign investments in Nigeria.

   b.   To specify the optimal threshold effect of debt sustainability capacity (total debt service to total revenue) on public, private, and foreign investments in Nigeria.

   c.   To indicate the effect of macroeconomic variables on public, private, and foreign investments in Nigeria.

Literature Review

Theoretical Exposition: Over Indebtedness

There are various theories on government debt. Among the most important is that of Barro (1978), which reveals the total neutrality of the debt in the macroeconomic environment. This theory, however, is linked to 19th-century English economist Ricardo, hence its designation by the phrase 'Ricardian equivalence'. The Ricardian equivalence hypothesized the rationality of economic agents and showed that a policy of budget or fiscal deficit, funded by debt, had no effect on investment activities insofar as agents are no longer susceptible to 'fiscal illusion' (which occurs when government revenues are not completely transparent or are not fully perceived by taxpayers; then the cost of government is seen to be less than it actually is). The investors make perfect anticipations and will incorporate this change into their decision. Consequently, they will expect an increase in future taxes intended to repay the initial debt. In anticipation of these future withdrawals, they will rapidly build up savings equivalent to the total government debt, thus compromising the fiscal stimulus policy.

Over-indebtedness is defined by Krugman (1988) as an inverse relationship between debts denominated in foreign currencies and investment. In this situation, over-indebtedness arises when indebted countries can no longer meet their burdens. An optimal debt level must be

specified to ensure efficient debt sustainability (Stiglitz, 2016). In other words, a very high debt level no longer favors investment. The high level of debt indicates a rise in future tax rates. As these rates are highly reliant on the level of investment, these new taxes would likely create distortions in investment. The immediate consequence is that the expected return from productive investments will be insignificant for economic sustainability, to the extent that spending on debt service will weaken foreign and domestic investments (Ndoricimpa, 2020).

If economic agents realize rational expectations, this theory of over-indebtedness can be challenged. However, they instead anticipate a future tax increase which reduces their consumption and could negatively impact the macroeconomic environment. Furthermore, there is no longer any need to prove the nexus between savings and investments as a high debt level with possible increases in tax rates can erode savings which in turn will negatively affect economic growth by causing a paucity of investible funds, hike in interest rates, increase in inflation due to low output and exchange rate depreciation arising from the decline in the purchasing power of money in the indebted country (Knapkova *et al.*, 2019; Dawood *et al.*, 2017). The theory of over-indebtedness assumes, as mentioned above, that there must be a maximum threshold beyond which any increase in public debt would cause a negative influence on the macroeconomic space.

Fiscal Stance and Debt Profile of Nigeria

Table 1 shows the periodic growth rate of SSA and Nigeria's total debt for the periods 1981 – 1990, 1991 -2000, 2001 – 2010, and 2011 – 2020. It can be observed that for the first period (1981 – 1990), the average growth rate of public debt in Nigeria exceeded that of low-income SSA countries. In the following period (1991 -2000), the average growth rate of the low-income SSA countries and Nigeria dropped to 1.70% and -0.41% due to the debt forgiveness granted to highly indebted countries, of which 31 were from Africa and 10 from SSA including Nigeria. In the third period (2001 – 2010), the average growth rate of Nigeria's debt declined to -12.97% while that of SSA increased to 3.43%. For the fourth period, the increase in debt by 10.02% and 11.73% shows that Nigeria appears to have incurred more debt than the entire low-income countries in SSA despite its large economy and natural resource endowment.

**Table 1: Debt profile of low-income SSA countries compared to Nigeria**

Period	SSA's debt status	Nigeria's debt status
1981 - 1990	9.76%	10.59%
1991 - 2000	1.70%	-0.41%
2001 - 2010	3.43%	-12.97%
2011 - 2020	10.02%	11.73%

Source: https://www.worldbank.org/en/programs/debt-statistics/ids/products

The origin of Nigeria's debt problem is tied to the collapse of the global oil price in 1981 and the persistent volatilities in the international oil market coupled with domestic lapses (Abbas & Christensen, 2010). Despite the series of refinancing and rescheduling, especially by foreign creditors, either members of the London Club (banks), Paris Club (governments), or independent creditors, Nigeria's indebtedness kept increasing over time. Even the government proposes to obtain ₦5.012 trillion to fund its fiscal gap in 2022, complicating Nigeria's debt situation, which is rapidly becoming unwieldy (Izuaka, 2021).

In 2005, the country's debt, mostly borrowed from the Paris Club creditors, stood at about $30 billion. After negotiations, the Paris Club announced a final agreement for debt relief worth $18 billion (most of which was registered as aid), and $12 billion was repaid by Nigeria in 2006 (Muhammad & Taofik, 2018). Unfortunately, the relief was short-lived as the country's external debt increased significantly between 2010 and 2020, with increases in debt service costs ranging from 11.19% and 39.42 % between 2010 and 2020 (CBN, 2020). The country is seen to be at a high risk of debt distress, especially between 2015 and 2020. Accumulated debt coupled with rising needs for public investments, including financing of strategic infrastructure amidst a low tax base, constitutes a severe challenge. As a result, budgetary allocation to enhance public investments has been a major problem facing Nigeria.

Figure 1: Growth rate (%) of external and domestic debt
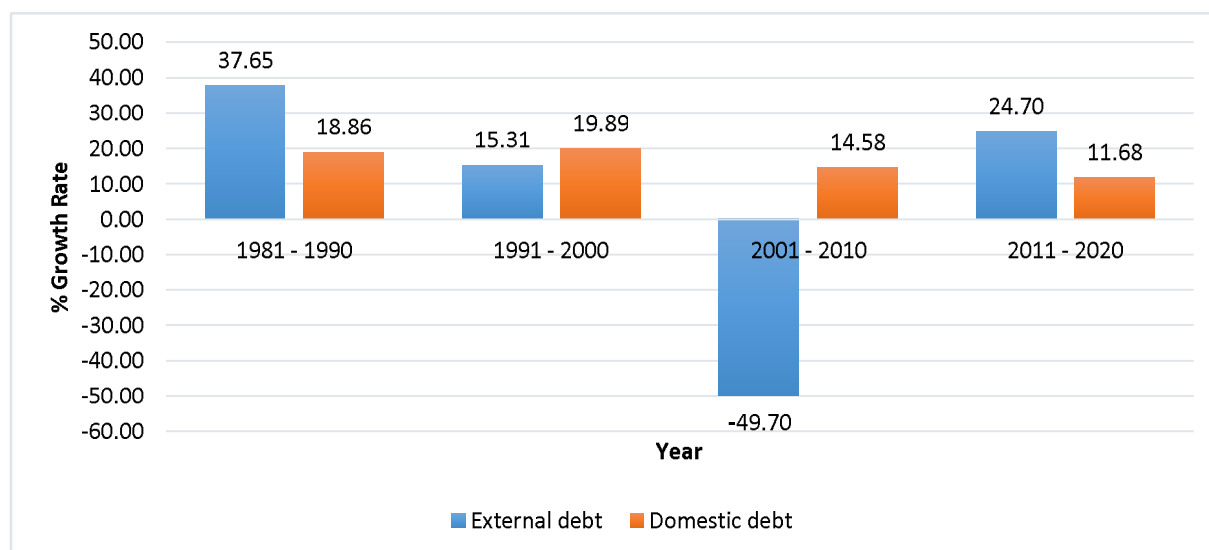
Source: Central Bank of Nigeria (CBN) Statistical Bulletin (2020)

Figure 1 reveals that Nigeria's debt profile, especially foreign debt, has been increasing even after the debt relief granted by the Paris Club in 2005. The rising debt profile has attracted a huge cost of servicing, indicating that a large proportion of the country's revenue has been committed to debt servicing instead of productive investments that would ensure economic growth. This situation often drives the government to increase the tax rates, which in turn raises the tax burden on investors, leading to macroeconomic instability as investors (both domestic and foreign) resort to diverting their investments to less indebted countries with less macroeconomic economic swings, a process known as capital flight (Onyele & Nwokocha, 2016). The decline in the growth rate of external debt recorded between 2001 to 2010 was due to the debt relief of $18 billion granted to Nigeria by the Paris Club in 2005 (Muhammad & Taofik, 2018).

Table 2: Average growth rate (%) of total revenue and debt service

Period	Revenue (₦'billion)	% change in revenue	Debt service (₦'billion)	% change in debt service
1981-1990	27.91	--	5.79	--
1991-2000	557.15	94.99	56.51	89.75
2001-2010	4771.40	88.32	297.09	80.98
2011-2020	9069.14	47.39	1516.75	80.41

The declining revenue generation depicted in Table 2 has been due to the over-reliance on oil revenue. This calls for proper economic diversification that would create other revenue sources capable of financing the country's investment needs and reducing the incidence of over-borrowing in the future. As such, concerns have been raised about why Nigeria has continually accumulated much debt while having its natural resource endowment and economic size. This unusual situation can be explained by the incessant fluctuations in oil prices, a product on which the Nigerian economy is based. A report from the Organization of Petroleum Exporting Countries (OPEC) shows that crude oil prices have been continually declining over the world market from 134 USD per barrel between 2008 and 2009 to 41.47 USD per barrel in 2020 (OPEC, 2021). However, government revenue in Nigeria comes from two major sources: oil and non-oil, but the former has contributed the largest over the years. On the other hand, tax collection statistics show that Nigeria needs to catch up with many countries, as less than 30% of the workforce pays taxes (Osemeke, 2020). It explains why government revenue is rapidly declining while the cost of debt servicing is persistently rising (Izuaka, 2021).

Table 3: Disaggregated government revenue

| Period	Oil (₦'billion)	Non-oil (₦'billion)	Total (₦'billion)
1981-1990	20.08	7.83	27.91
1991-2000	435.96	121.19	556.19
2001-2010	3,799.90	971.51	4,771.41
2011-2020	5,695.67	3,373.47	9,069.14

Irrefutably, Nigeria's economic attractiveness depends on the global oil market. Table 3 indicates that oil revenue has been higher than non-oil revenue, implying that Nigeria has not fully explored other sources of revenue generation to back up its economy, and worst of it all, recent efforts towards economic diversification is yet to yield a reasonable result as large importation of food and other foreign products are still ongoing, leading to unfavorable trade balance and the need for more borrowings to fund future investments.

Macroeconomic Swings in Nigeria

Adopting the Structural Adjustment Program (SAP) in 1986 triggered demand for foreign debt. Foremost, Nigeria's debt portfolio has high exposure to exchange rate risk due to the large proportion of foreign debt (Aderemi *et al.*, 2020). On the other hand, when the government accumulates debt from the local market (domestic debt), there would be excess demand for funds which raises the real interest rates and calls for monetary policy adjustments.

Figure 2 shows that the currency composition of Nigeria's external debt is mainly foreign currencies (especially the US dollar) and the Special Drawing Rights (SDR), which is a dollar-denominated international reserve asset created by the IMF to supplement its member countries' official reserve (DMO, 2020). This means that the Federal Government debt is exposed to exchange rate risk. According to the DMO, Government's total debt portfolio before 2016 had minimal exposure to foreign exchange risk due to the relatively high proportion of domestic currency debt in the portfolio at about 80%. However, continuous borrowing from different foreign sources in recent years could cause exchange rate risk due to currency mismatch, leading to macroeconomic downturns that could hinder future economic output and revenue generation (see, Kouladoum, 2018).

**Figure 2: Currency composition (%) of Nigeria's debt**

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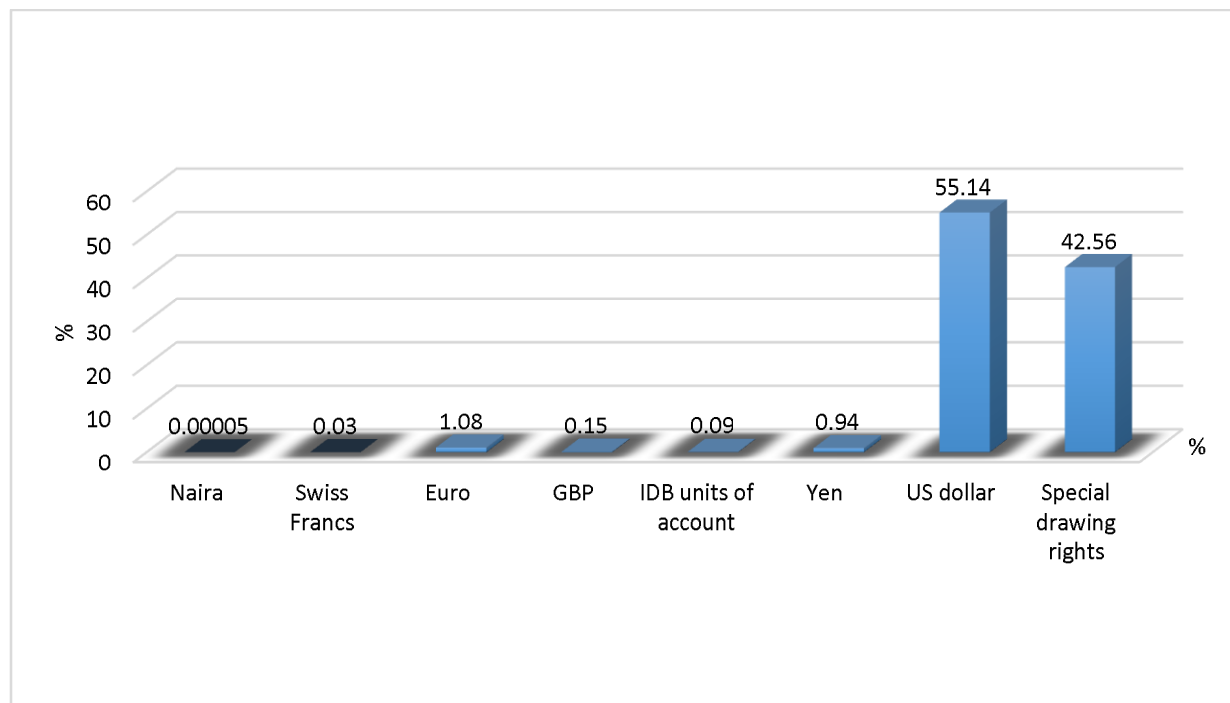
Source: Debt Management Office (DMO) of Nigeria, (2020)

Investment Climate of Nigeria

Investors in Nigeria are facing a challenging business environment. According to the Doing Business Report (2020), Nigeria ranks close to the bottom in "ease of doing business" (131 out of 189 countries), indicating the existence of core hindrances. The investment climate encompasses those attributes such as macroeconomic factors that influence the financial return on economic activities. Hence, a non-conducive investment climate would likely discourage the private sector from investing in both physical and human capital, leading to low productivity. According to the International Cooperative Alliance (ICA), the three most prominent constraints to doing business are lack of access to finance, electricity, and transport. Investment climate constraints such as macroeconomic and political instability significantly add to the cost of doing business in Nigeria (Guarco, 2021). Figure 3 looks at Nigeria's annual growth rate of key investment components.

Figure 3: Investment Profile of Nigeria
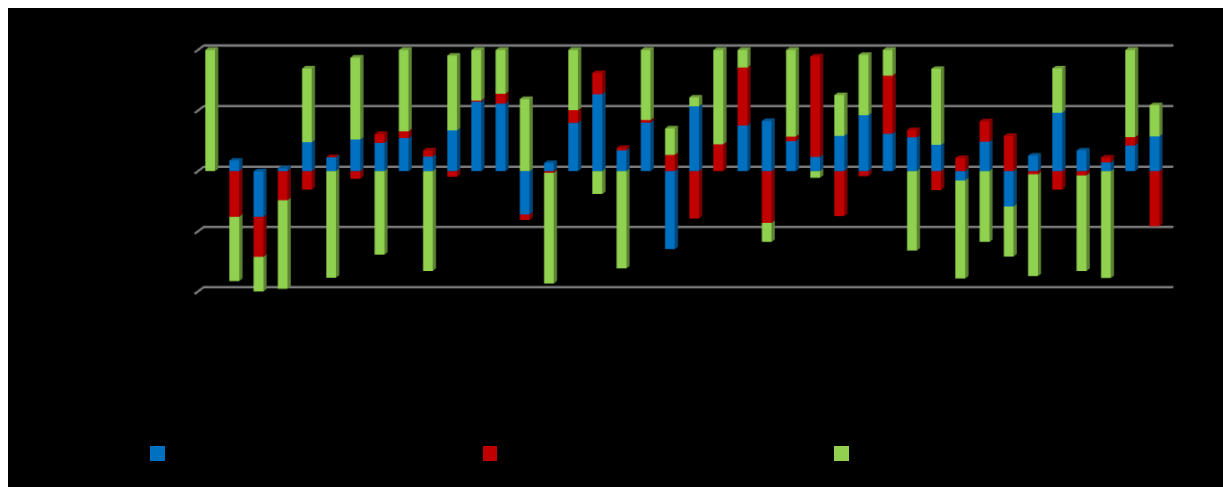
Source: Central Bank of Nigeria Statistical Bulletin (2020)

Empirical Review

The empirical frontier of the debt-investment relationship has improved in recent years. The foremost reason behind this development is the computation of debt sustainability and the optimal threshold. For example, debt sustainability measures such as total debt (% of revenue), total debt (% of GDP), and external debt (% of export earnings) all point to a country's ability to

service its debt (DMO, 2019). The second motivation for the recent empirical development is the advances in econometric methods, such as the threshold regression used to estimate the optimal level of debt sustainability. From the review of empirical studies, the following were observed:

1. The econometric models are built on three theoretical perspectives.
   a) The first group investigated the threshold effects of public debt sustainability on investments (Omotor, 2021; Ramu, 2021; Pokou, 2020; Akinlo, 2021; Ndoricimpa, 2020; Fasoranti *et al.*, 2019; Khanfir, 2019; Knapkova *et al.*, 2019; Belguith & Omrane, 2019; Goedl & Zwick, 2018; Beqiraj *et al.*, 2018; Culling, 2017; Omotosho *et al.*, 2016; Pescatori *et al.*, 2014; Baum *et al.*, 2012).
   b) The second group estimated the crowding-out/crowding-in effects of debt on investments (Aliu *et al.*, 2021; Chukwu *et al.*, 2021; Mugumisi, 2021; Anoke *et al.*, 2021; Kia, 2020; Ogunjimi, 2019; Kasele *et al.*, 2019; Mabula & Mutasa, 2019; Omodero, 2019; Thilanka & Ranjith, 2018; Oche *et al.*, 2016; Kamundia *et al.*, 2015).
   c) The third strand of studies examined the relationship between debt and economic performance based on the debt overhang theory (Yussuf & Mohd, 2021; Onyele & Nwadike, 2021; Nzeh, 2020; Al-Dughme, 2019; Jilenga *et al.*, 2016).
2. Non-methodological reasons for the lack of a common consensus are variations in the macroeconomic policies of various countries. Ndoricimpa (2020) showed that no single threshold applies to all countries. Thilanka & Ranjith (2018) demonstrated that the threshold effect of public debt varies among countries.
3. The authors of this paper did not come across any empirical study that investigated the threshold effects of government debt on disaggregated investments (public, private, and foreign investments) amidst macroeconomic swings in Nigeria. However, in some studies, the effects of debt on private and public investments were estimated, but the aspect of FDI is scanty (Anoke *et al.*, 2021; Chukwu *et al.*, 2021; Omodero, 2019; Ogunjimi, 2019).

Conceptual Framework

The first viewpoint in the literature stresses that, in the nascent stages of national development, resource-scarce countries require borrowing to finance economic development. The second view

states that a rise in the debt burden could exert a crowding-out effect on public investment capital which could be transmitted to private and foreign investments. In situations where it is complex to reduce current expenditure or to increase taxes, capital expenditures may be reviewed downwards, and domestic production falls below debt service capacity, a process known as debt overhang (IMF, 2020). Consequently, a direct effect occurs by a decrease in aggregate investments, especially in developing economies where public investment is a crucial part of aggregate investments. In contrast, an indirect effect occurs due to the complementarity that may arise between private and public investments (Sunday *et al.*, 2018). In debt sustainability analysis, liquidity and solvency debt measures are usually applied. Solvency risk focuses on the overall viability and ability of a country's economic size to accommodate and cover debt obligations – measured total debt to GDP ratio relative to a specified limit (threshold). On the other hand, liquidity risk reflects a country's capacity to meet and manage debt service obligations satisfactorily – measured as debt service cost (% of revenue and/or % of export earnings). These two categories of risks may not be congruent in all cases – a country could be distressed in one aspect but free in the other (Were & Mollel, 2020). Hence, it is paramount to consider these debt ratios along with macroeconomic dynamics that could ascertain the actual investment position in the medium to long term (World Bank, 2019).

Evidence shows that macroeconomic imbalances directly result in debt crises (Knapkova *et al.*, 2019; Dawood *et al.*, 2017). For this purpose, Omotor (2021), along with Sinha, Arora & Bansal (2011), pointed out that the impact of macroeconomic indicators is different in countries with different levels of economic development. There are differences, for example, in the effects of FDI, which has a greater impact on the indebtedness of the countries that belong to the middle-income group of countries compared to high-income countries. The second difference is that inflation and interest rates are important indicators for middle-income countries but not high-income countries (Akitoby *et al.*, 2017; Reinhart & Rogoff, 2010). The high variability of any change in interest rates or inflation thus has a significant impact on government borrowing costs. It has been reported that the variability of interest rates and inflation weakens the purchasing power of money and therefore causes exchange rate depreciations in an indebted country because more domestic currency would be required to service debt denominated in foreign currencies. These macroeconomic imbalances hinder the potency of debt, leading to debt crises, low investments, and low economic growth (Onyele & Nwadike, 2021).

Figure 4: Conceptual Framework
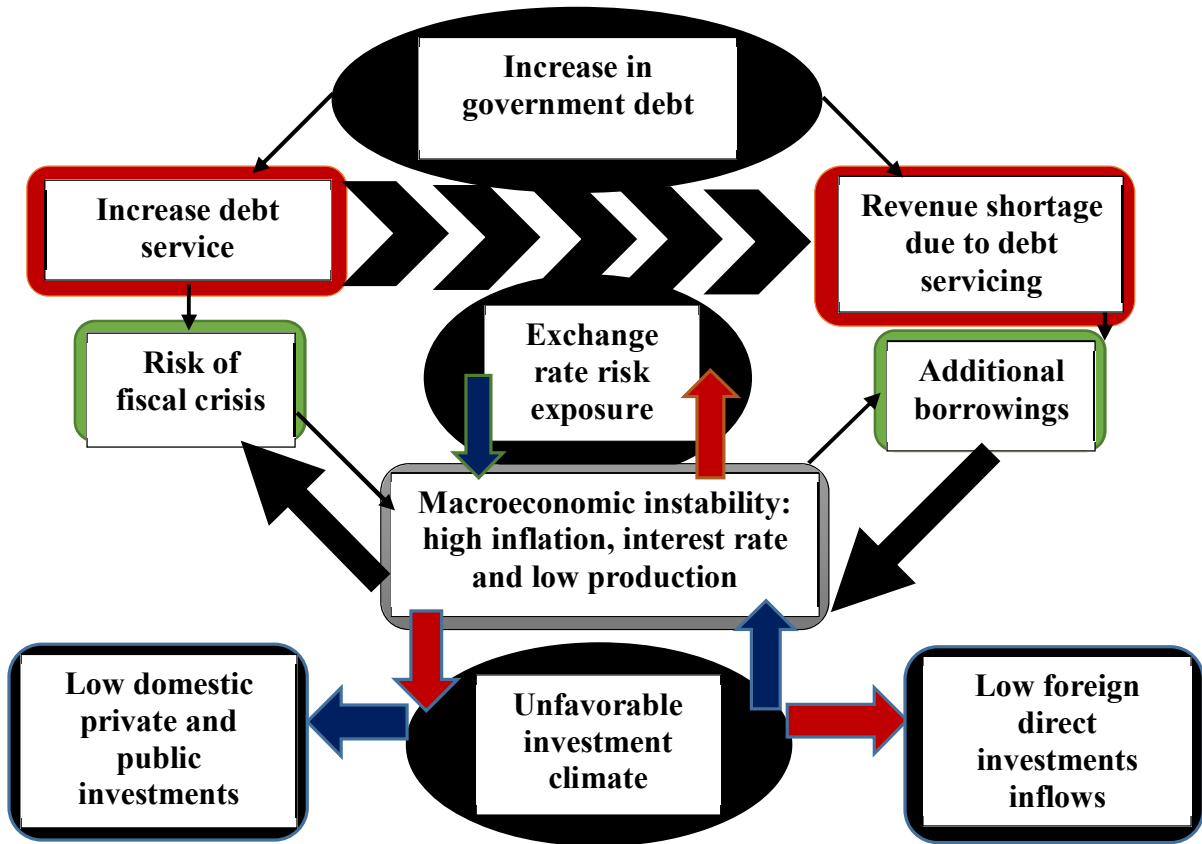
Research Methodology

Investment (domestic public, private, and foreign direct investments) was used as the dependent variable. Public investment (PBI) is measured by total government capital expenditure (% of GDP), private investment (PRI) is measured by gross fixed capital formation (% of GDP) and foreign direct investment (FD) is measured by total FDI net inflow (% of GDP). Debt sustainability is divided into debt liquidity (debt service to revenue ratio) and solvency (total debt stock to GDP ratio), and macroeconomic variables (exchange rate, inflation rate, and monetary policy rate) as the explanatory variables. Theoretically, macroeconomic variables are key determinants of investments that inform their inclusion in the empirical model. Data spanning from 1981 to 2020 were sourced from the Central Bank of Nigeria (CBN) and World

Development Indicators (WDI). With these datasets, threshold estimation was carried out to show Nigeria's optimal level of public debt sustainability.

Based on the crowding-out effect theory, this paper adopted the model specified in the empirical work of Ogunjimi (2019) as specified in equations 1 to 3:

$$LPRINV_t = \beta_0 + \beta_1 LEXDBT_t + \beta_2 LDMDBT_t + \beta_3 LRGDP_t + \beta_4 INT_t + \varepsilon_t \qquad \text{Eq. (1)}$$

$$LPUINV_t = \beta_0 + \beta_1 LEXDBT_t + \beta_2 LDMDBT_t + \beta_3 LRGDP_t + \beta_4 INT_t + \varepsilon_t \qquad \text{Eq. (2)}$$

$$LFDI_t = \beta_0 + \beta_1 LEXDBT_t + \beta_2 LDMDBT_t + \beta_3 LRGDP_t + \beta_4 INT_t + \varepsilon_t \qquad \text{Eq. (3)}$$

LPRINV = Log of Private Investment

LPUINV = Log of Public Investment

LFDI = Log of Foreign Direct Investment Net Inflow

LEXDBT = Log of External Debt

LDMDBT = Log of Domestic Debt

LRGDP = Log of Real Gross Domestic Product

INT = Interest Rate (Monetary Policy Rate)

ε_t = White noise stochastic error term

The models applied in Ogunjimi's (2019) work were modified by taking debt sustainability measures such as debt service to revenue and total debt to GDP ratios to replace LEXDBT and LDMDBT. Hence, in this study, the following models are estimated for the threshold effect of debt sustainability on investments (public, private, and foreign direct investments):

$$PBI_t = \beta_0 + \beta_1 DBS\_REV_t + \beta_2 EXR_t + \beta_3 INF_t + \beta_4 MPR_t + \mu_t \qquad \text{Eq. (4a)}$$

$$PBI_t = \beta_0 + \beta_1 TDB\_GDP_t + \beta_2 EXR_t + \beta_3 INF_t + \beta_4 MPR_t + \mu_t \qquad \text{Eq. (4b)}$$

$$PRI_t = \beta_0 + \beta_1 DBS\_REV_t + \beta_2 EXR_t + \beta_3 INF_t + \beta_4 MPR_t + \mu_t \qquad \text{Eq. (5a)}$$

$$PRI_t = \beta_0 + \beta_1 TDB\_GDP_t + \beta_2 EXR_t + \beta_3 INF_t + \beta_4 MPR_t + \mu_t \qquad \text{Eq. (5b)}$$

$$FDI_t = \beta_0 + DBS\_REV_t + \beta_2 EXR_t + \beta_3 INF_t + \beta_4 MPR_t + \mu_t \qquad \text{Eq. (6a)}$$

$$FDI_t = \beta_0 + \beta_1 TDB\_GDP_t + \beta_2 EXR_t + \beta_3 INF_t + \beta_4 MPR_t + \mu_t \qquad \text{Eq. (6b)}$$

where, β_0 is the constant, β_1, β_2, β_3 and β_4 denotes the coefficient parameters of the explanatory variables. The dependent variables are public investment (PBI), private investment (PRI) and foreign direct investment (FDI). DBS_REV denotes debt service (% of revenue), while TDB_GDP is total debt stock (% of GDP). Macroeconomic factors such as exchange rate,

inflation rate, and monetary policy rate are represented by EXR, INF, and MPR, respectively where μ_t is the error term.

To establish a threshold model between debt sustainability and investments in Nigeria, the following threshold least squares were considered:

$$I_t = \gamma_t(S_t \leq S^*) + \gamma_t(S_t > S^*) + \lambda_{1t}X_{1t}(S_t \leq S^*) + \lambda_{2t}X_{2t}(S_t > S^*) + \lambda_{3t}X_{1t}(S_t \leq S^*) + \lambda_{4t}X_{1t}(S_t > S^*) + \zeta \qquad \text{Eq. (7)}$$

Where I_t represents the dependent variables (i.e., public, private, and foreign investments), X_{it} is a matrix of controls, S_t is the debt sustainability measures (DBS_REV and TDB_GDP), and S^* is the debt sustainability threshold; thus, $S_t \leq S^*$ is an indicator function.

From the models, debt sustainability can be interpreted as the result of the interaction between deficit financing and the macroeconomic environment (Were & Mollel, 2020). To prevent over-indebtedness, policymakers usually respond to the dynamic conditions of macroeconomic factors (Aderemi *et al.*, 2020). As such, public debt levels can be low, but if the macroeconomic variables are not prudently managed, more debt would be accumulated, leading to sustainability challenges and low investments (IMF, 2014).

Table 4: Description of model variables and data sources

Dependent variables			
Variable	**Measurement**	**Source**	**Description**
Public investment (PBI)	Total capital expenditure (% of GDP)	CBN (2020)	This variable is used to measure public investments as it captures the contribution of government capital expenditure to GDP.
Private investment (PRI)	Gross fixed capital formation (% of GDP)	CBN (2020)	This ratio indicates how much aggregate factor income is ploughed back into fixed assets.
Foreign direct investment (FDI)	Foreign direct investment (% of GDP)	WDI (2020)	This assesses investment integration with the global economy. A rate of $5 - 6\%$ is recommended.
Independent variables {debt sustainability}:			
Liquidity risk	Debt service (% of revenue) (DBS_REV)	CBN (2020)	This variable denotes liquidity risk which reflects a country's ability to meet its debt repayment from the generated revenue. It ranges between 28% -30% (IMF, 2020).

| Solvency risk	Total debt (% of GDP) (TDB_GDP)	CBN (2020)	This variable focuses on solvency risk which implies the ability of a country's GDP to cover debt obligations. The ratio should be below 60% (Jensen, 2021).
Independent variables {macroeconomic variables}:			
Exchange rate (EXR)	Naira – Dollar rate	CBN (2020)	Fluctuations in exchange rate stimulate or dampen investments by affecting demand in both the export and domestic markets.
Inflation rate (INF)	Annual % change in the consumer price index	CBN (2020)	Uncontrolled inflation poses a threat to investors because it erodes investment returns.
Monetary policy rate (MPR)	CBN monetary policy rate	CBN (2020)	Directly, MPR impacts investment through interest rates, its indirect impact is seen through expectations of future inflation.

Source: Authors' compilation

Findings and Discussion

Descriptive Analysis of Data

The descriptive analysis shows the basic properties of the data used for the time series analysis (see appendix for the data). The results of the descriptive analysis are displayed in Figure 5.

Figure 5: Descriptive Statistic
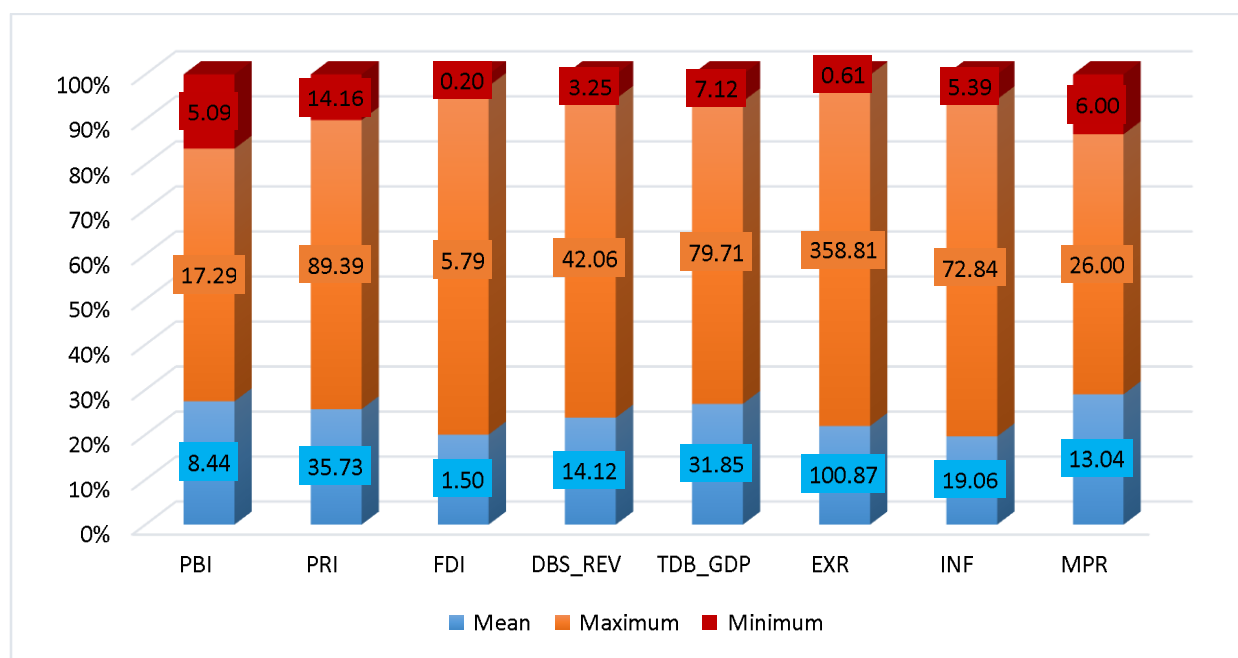
Source: Own computation (2021)

The mean values of the various categories of investments, PBI (8.44%), PRI (35.73%), and FDI (1.50%), suggest that investment in Nigeria is generally dismal, especially FDI. The minimum and maximum values show that PBI ranged from 5.09% to 17.29%, PRI ranged from 14.16% to 89.39%, while FDI ranged from 0.20% to 5.79%. Looking at the descriptive analysis, it was observed that though the components of investment recorded some periods of increase, however; the mean values suggest that their performance over the period (1981 to 2020) was low. Apart from the unstable macroeconomic cited, corruption and insecurity are serious hindrances to the country's investment opportunities and are often cited by foreign and domestic investors as a significant obstacle to doing business. Insecurity includes the ongoing religious tensions, terrorism, and ethnic tensions, military in politics, corruption, and (civil) war experienced in Nigeria over the last decades (Danjuma, 2021). The impact of the Covid-19 pandemic played a part, with many businesses across the globe practically shut down for months. The fall in domestic private investments could imply that Nigerian investors are relocating to other countries for safety, while the fall in FDI means that overseas companies setting up in Nigeria has drastically reduced. Figure 6 presents the diagrammatical representation of the time series data associated with the various investments.

Figure 6: Time plot of investments
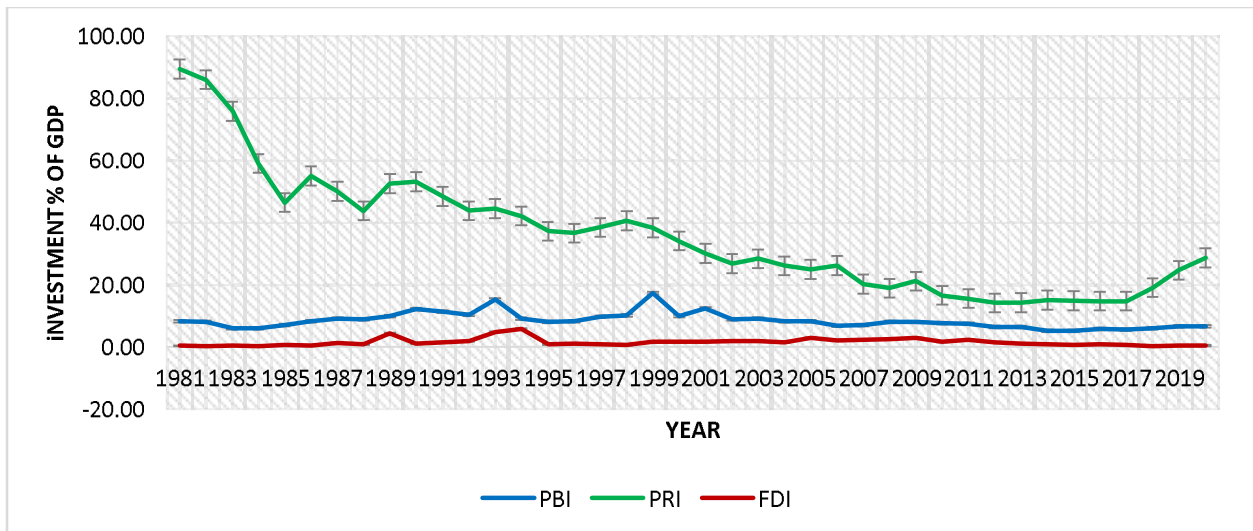
Source: Computed by authors using data from the Central Bank of Nigeria Statistical Bulletin (2020) and World Development Indicators

As earlier stated in the introductory section of this paper, Nigeria's debt profile has been rising rapidly even after the debt relief of 2005, while its revenue generation capacity has been shrinking alongside its GDP, as shown by the mean values of DBS_REV (14.12%) and TDB_GDP (31.85%). This is evident in the countries' debt service to revenue ratio and total debt to GDP ratio, has been largely below the globally recommended threshold of 28% to 30% and 60%, respectively, for indebted developing countries like Nigeria, as shown by the mean values (Onyele & Nwadike, 2021). The minimum and maximum values for DBS_REV indicate values ranging from 3.25% to 42.06%, indicating the rising cost of debt servicing and low revenue. TDB_GDP shows value ranging from 7.12% to 79.71%, implying that Nigeria's GDP could not cover the value of its total debt, that is, Nigeria's production value was less than its debt stock. The trend of DBS_REV and TDB_GDP is plausibly due to the fact that Nigeria is highly indebted but has been unable to repay its debt due to low revenue generation and a poor macroeconomic environment that has undermined investments requisite for revenue generation. The time plot of the government debt series is plotted in Figure 7.

Figure 7: Time Plot of Government Debt
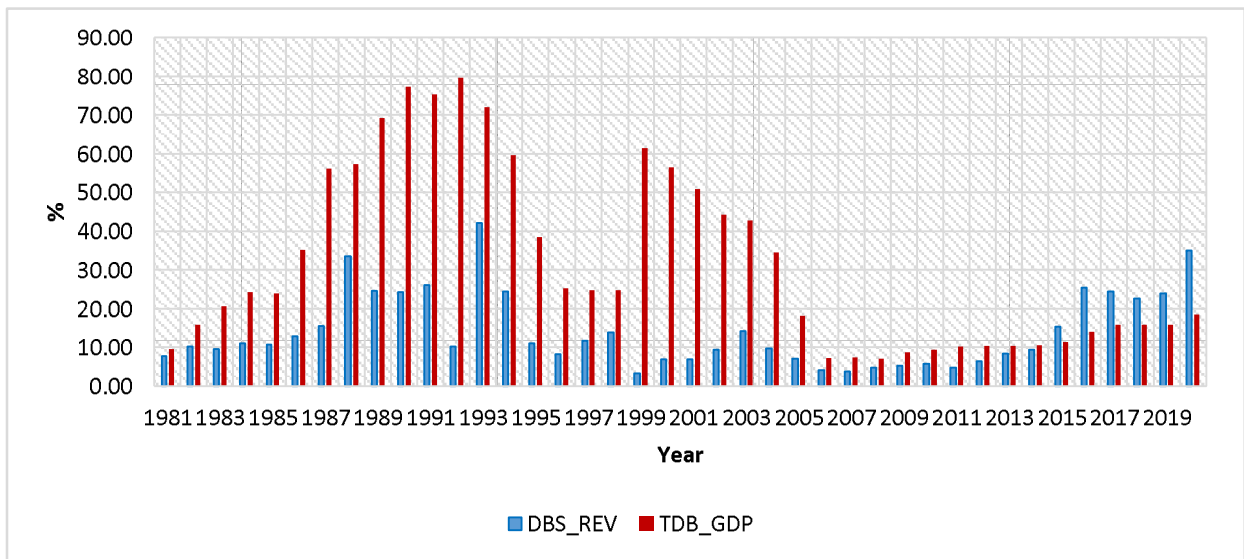
Source: Computed by authors using data from the Central Bank of Nigeria Statistical Bulletin (2020)

The descriptive analysis also indicates a worsening macroeconomic environment as the Nigerian economy is failing to sustain its growth and stable momentum experienced in the mid-1980s. The descriptive analysis buttresses this point by showing an average (mean) EXR (₦100.87/$1) with values ranging from ₦0.61/$1 to ₦358.81/$1, indicating substantial currency depreciation

in Nigeria. The high exchange rate between the naira and the US dollar has been attributed to the fact that Nigeria is an import-dependent economy coupled with the fact that the oil sector, which happens to be the mainstay of the economy, remains stuck in negative territory due to oil price volatility (OPEC, 2021). Also, inflation (INF) hit the double digits at 19.06% on average with a series that ranged between 5.39% and 72.84%, implying that the Nigerian macro economy has been experiencing high price levels, which has been adduced to a disruption in the supply of food products, the rising cost of fuel, high import costs, unstable exchange rate and a general increase in production costs (Aigheyisi, 2018). To contain the surge in EXR and INF, the Central Bank would often adjust the monetary policy rate (MPR) either upwards or downwards. The MPR averaged 13.04%, which values ranging from 6.00% to 26.00%, showing that the lending rate would also rise higher since the MPR is the rate the commercial banks borrow from the Central Bank, which could further worsen the macroeconomic situation. The annual trend of the aforementioned macroeconomic variables is displayed in Figure 8.

Figure 8: Trend of macroeconomic variables
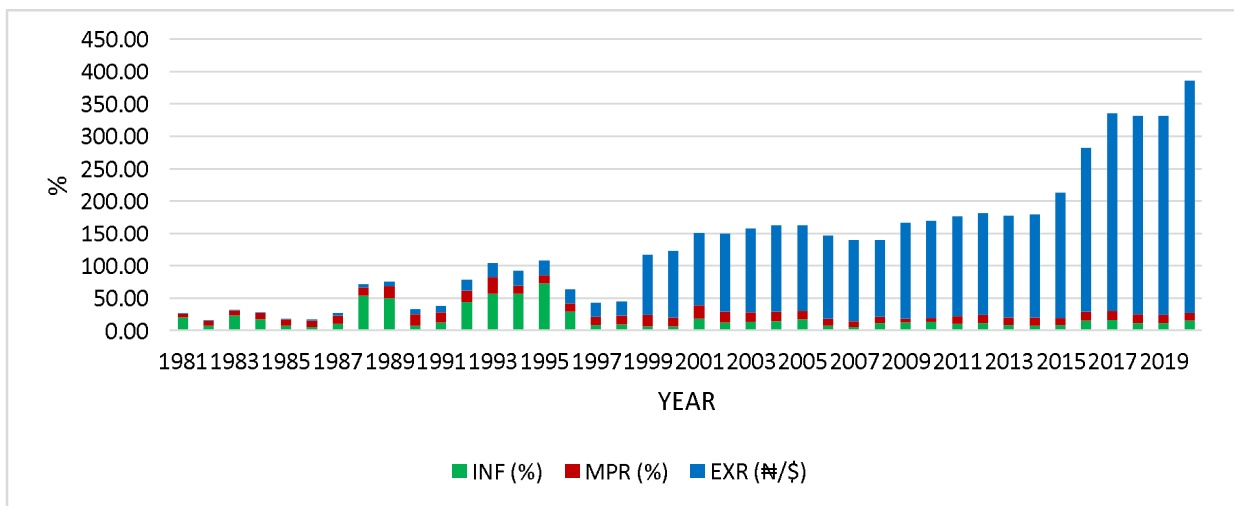
Source: Computed by authors using data from the Central Bank of Nigeria Statistical Bulletin (2020)

Econometric Results

Before the econometric analysis, the unit root test was done to find out the stationarity of the variables, and a check for cointegration test was carried out to ascertain the existence of a long-run relationship among the model variables.

Unit Root Test Results

Testing for unit root is crucial in determining the integration order of the variables and circumventing the potential of spurious regression. Augmented Dickey-Fuller (ADF) unit root test is the popularly used stationary test but may need to be more reliable in detecting structural breaks. Structural breaks could occur due to recession, policy change, pandemic, and others, affecting the stationarity of time series data. So, unit root tests without looking into structural breaks could erroneously reject the stationarity of data. To address the limitations of the standard ADF test, the Zivot-Andrews (1992) unit-root test was conducted to take cognizance of possible endogenous structural breaks to ascertain the robustness of the stationarity results. Also, a modified approach in which the data series has been transformed by a generalized least-squares regression known as the Dickey-Fuller generalized least squares (DF-GLS) de-trending test was carried out.

Table 5: Unit-root test results

Variables	DF-GLS t-Statistic		Zivot-Andrews t-Statistic		Break Date	Order of Integration
	I(0)	I(1)	I(0)	I(1)		
PBI	-2.1803	-10.259	-5.0126	-	1988	Level, I(0)
PRI	-1.967	-5.383	-3.711	-7.328	1985	First difference, I(1)
FDI	-3.733	-	-4.886	-	1988	Level, I(0)
DBS_REV	-2.615	-8.608	-3.921	-9.905	1995	First difference, I(1)
TDB_GDP	-2.170	-4.333	-6.353	-	1999	Level, I(0)
EXR	-0.753	-4.829	-3.286	-5.602	2014	First difference, I(1)
INF	-3.200	-	-6.230	-	2003	Level, I(0)
MPR	-2.912	-8.725	-4.292	-10.404	1993	First difference, I(1)
Test critical values:	1% level	-3.770	1% level	-5.347		
	5% level	-3.190	5% level	-4.860		

Source: Own computation (2021)

In both DF-GLS and Zivot-Andrews tests, the null hypothesis is that the data series contain unit root (non-stationary) against the alternative hypothesis of a stationary process. As can be observed in Table 5, both approaches to unit root testing indicate that the order of integration for the variables is different. PBI, FDI, TDB_GDP, and INF are stationary at levels, while the rest of

the variables attained stationarity after their first differences. It should be noted that the test rejects the null hypothesis of non-stationarity if the test statistic values are more significant than the critical values at a 5% level of significance.

Looking at the break date, structural breaks in investments (PBI, PRI, and FDI) took place between 1985 and 1988, which happens to be the window of the Structural Adjustment Program (SAP). The structural break for DBS_REV took place in 1995 plausibly due to the fiscal austerity measures that lasted from the 1980s to the late-1990s coupled with the institution of a controlled exchange rate regime in 1994, which was reestablished under the foreign exchange decree of 1995, indicating that changes in macroeconomic policies could affect debt sustainability (Ogunlana, 2016). The break date of TDB_GDP could be attributed to the transition from a military to a democratic regime in 1999, showing that the system of governance could affect the government's ability to sustain its debt (Muhammad & Taofik, 2018; Dinneya, 2006). The break date of the exchange rate (EXR) could be associated with the depreciation that occurred in 2014 due to the scarcity of dollars in the market, which was further oscillated by banks' refusal to sell dollars to Bureau De Change (BDCs) operators (Omoh, 2014). The break date for inflation (INF) was observed in 2003, probably due to the decline in oil prices and high import costs (Chukwuogor & Ndu, 2018). The 1993 break date for the monetary policy rate (MPR) could be attributed to the later part of the austerity measure aimed at reducing inflation and easing pressure on the external sector and balance of payment.

Cointegration Test

Following that, the model variables are found to be integrated in a different order; the Pesaran, Shin & Smith (2001) bounds test is employed for the cointegration test to ascertain the presence of a long-run cointegrating relationship among the variables. The bounds testing method assumes a null hypothesis of no cointegration that can be rejected if the F-statistic exceeds the upper bound, I(1) critical value at 5% level and vice versa if the F-statistic falls below the lower bound critical value, I(0). Table 6 presents the Pesaran *et al.* (2001) bounds test results for cointegration.

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Table 6: Bounds test for cointegration

	Model with PBI	Model with PRI	Model with FDI
DBS_REV, EXR, INF and MPR			
F-statistic:	3.675	5.173	3.860
Critical values:	Lower bound {2.56} Upper bound {3.49}	Lower bound {2.56} Upper bound {3.49}	Lower bound {2.56} Upper bound {3.49}
Wald test (P-value)	262.690 {0.000}***	46.360 {0.000}***	19.164 {0.000}***
TDB_GDP, EXR, INF and MPR			
F-statistic:	8.918	4.273	
Critical values:	Lower bound {2.56} Upper bound {3.49}	Lower bound {2.56} Upper bound {3.49}	Lower bound {2.56} Upper bound {3.49}
Wald test (P-value)	16.731 {0.000}***	61.138 {0.000}***	5.414 {0.000}***

Source: Own computation (2021)

Table 6 indicates that the bounds test is conclusive and shows the existence of cointegration as the F-statistic exceeds the critical values of the lower and upper bounds at a 5% significance level. Besides, the Wald test was performed to ascertain whether the long-run estimates are statistically significant, confirming the presence of a long-run cointegrating association in all the models at a 1% significance level.

Threshold auto-regressive (TAR) model

As earlier defined, debt sustainability deals with a country's ability to maintain adequate liquidity and solvency thresholds to ensure efficient debt servicing and carriage within the economy. By debt liquidity, it is implied that the government generates adequate revenue for debt servicing, while debt solvency means that the indebted economy has the necessary investment outlets to accommodate the borrowed funds (DMO, 2019). As such, undertaking a threshold analysis for debt service (% of revenue) and total debt stock (% of GDP) is important.

Before embarking on the threshold analysis, a test for the presence of significant debt threshold effects was carried out using the Bai & Perron (1998) testing approach.

Table 7: Threshold test

Threshold test	Scaled F-statistic			
	DBS_REV	**TDB_GDP**	**Critical value**	**Remark**
Equation 4: PBI	**A**	**B**		
H_O: no threshold H_1: one threshold	24.787*	18.663*	11.47	Nonlinear relationship
H_O: one threshold H_1: two threshold	1.255	17.441*	12.95	
Equation 5: PRI	**A**	**B**		
H_O: no threshold H_1: one threshold	12.014	25.489*	11.47	Nonlinear relationship
H_O: one threshold H_1: two threshold	-	-	12.95	
Equation 6: FDI	**A**	**B**		
H_O: no threshold H_1: one threshold	15.588*	15.383*	11.47	Nonlinear relationship
H_O: one threshold H_1: two threshold	4.339	15.905*	12.95	

Source: Own computation (2021)

As reported in Table 7, the null hypothesis of no threshold (linear model) is rejected in favor of one threshold of DBS_REV in the case of equation 4(a), while the null hypothesis of one threshold (two-regime) of TDB_GDP was rejected in favor of two thresholds for equation 4(b). Further, in equation 5(a), the null hypothesis of no threshold of DBS_REV was accepted, while the alternative of one threshold of TDB_GDP was accepted for equation 5(b). In equation 6(a), the null hypothesis of no threshold was rejected in favor of the alternative hypothesis of a single threshold of DBS_REV, while in equation 6(b), the alternative hypothesis of two thresholds for TDB_GDP was accepted. In summary, the threshold test results indicate the existence of varying threshold values (two-regime model) for different investment categories in the analysis except for equation 5(a), where no threshold was found for DBS_REV. The outcome shows evidence of a threshold relationship (non-linear) between debt sustainability (DBS_REV and TDB_GDP) and investments (PBI, PRI, and FDI) since their respective F-statistic values are lower than the Bai-Perron critical Following the presence of significant non-linear relationships across the

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model, the TAR model ascertained the effects of debt on investments below and above the threshold values.

TAR Model for DBS_REV and Investments

Considering the case of DBS_REV as a threshold variable in Table 8, the results from the TAR model indicate that the optimal threshold of the DBS_REV ratio was not consistent for PBI, PRI and FDI. However, the varying signs of the coefficients below and above the threshold value indicate that the relationship between DBS_REV and the three investment categories (PBI, PRI, and FDI) followed a non-linear path throughout the study. The nonlinearity shows that investment changes do not directly affect variations in the DBS_REV ratio.

Table 8: TAR model result for DBS_REV and investments

	PBI	PRI	FDI
Threshold (T):			
First regime	8.206	10.913	11.760
Threshold variable			
DBS_REV < T	-0.463{0.096}*	3.016{0.045}**	-0.353{0.000}***
DBS_REV > T	0.072{0.036}**	-1.975{0.178}	0.006{0.874}
Non-threshold variables:			
EXR	-0.014{0.000}**	-0.155{0.000}***	-0.002{0.389}
INF	-0.027{0.085}*	-0.207{0.237}	0.036{0.006}***
MPR	0.448{0.000}***	-1.339{0.027}**	-0.141{0.000}***
R-squared	0.785	0.678	0.612
Adj. R-squared	0.745	0.594	0.523
F-statistic	20.030{0.000}***	8.141{0.000}***	5.774{0.000}***
Model diagnostics:			
Serial Correlation	1.26896{0.3031}	1.92058{0.1021}	0.04242{0.9585}
Heteroskedasticity	1.42790{0.3661}	1.31377{0.2840}	0.24726{0.3097}
Jarque-Bera test	4.35655{0.1132}	4.84070{0.0889}	1.93753{0.5930}
CUSUM test	Stable	Stable	Stable

Source: Own computation (2021)

Specifically, it was found that below each threshold, DBS_REV have a diminishing effect on public investment (PBI) and foreign direct investment (FDI), while its impact on private investment (PRI) was found to be positive. Also, the effect of DBS_REV below the threshold value was significant for PRI and FDI but insignificant for PBI, while it was only significant for PBI above the threshold value. The reason for the negative and significant effect of DBS_REV below the threshold could be that a liquidity crisis has trapped the Nigerian government, hence is

not generating adequate revenue to clear outstanding debt, which has lowered public investment and discouraged foreign investors due to the fear that government would increase taxes to service the outstanding debt. This negates the assumption that public debt will only distort investments when exceeding the debt threshold. As such, there needs to be evidence to support the presence of debt sustainability in Nigeria, even below the threshold values, as investments are being crowded out. The coefficients of the threshold variables indicate a non-linear relationship between DBS_REV and investments (PBI, PRI, and FDI).

Regardless of the level of DBS_REV, the exchange rate (EXR) harms PBI, PRI, and FDI but is significant for PBI and PRI. The inflation rate (INF) harms PBI and PRI and positively and significantly affects FDI. It was also found that despite the level of DBS_REV, the monetary policy rate (MPR) had a significant effect on PBI, PRI, and FDI. This shows that the effect of DBS_REV is transmitted to different classes of investments through its effects on macroeconomic variables. This is because high debt servicing brings about revenue losses and low public expenditure, hence low productivity, high inflation rate, exchange rate depreciation, and high-interest rates, which automatically distort investments.

Consequently, with insufficient revenue generation and the need for debt servicing in the face of macroeconomic instability, investments are persistently undermined, leading to further borrowing (over-indebtedness) as supported by the endogenous growth theory (Knapkova *et al.*, 2019; Dawood *et al.*, 2017). The coefficient of multiple determination (Adj. R-squared) shows that the collective effects of DBS_REV and macroeconomic variables (EXR, INF, and MPR) explained approximately 75%, 59%, and 52% of the total variations in PBI, PRI, and FDI, respectively while the F-statistic signifies that this collective effect is statistically significant. Again, the diagnostic test results show that the models have an insignificant problem of serial correlation and heteroskedasticity, and the residuals are normally distributed.

TAR Model for TDB_GDP and Investments

The results of the TAR model for TDB_GDP and investments are reported in Table 9. The threshold values, TDB_GDP, exerted positive and significant effects on PBI and PRI but negative and insignificant for FDI. When the TDB_GDP exceeds the threshold value for the first

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regime, PBI is positively and significantly affected, while PRI is negatively and insignificantly affected, and FDI is positive, but the effect is statistically insignificant. During the second regime, both PBI and FDI were significantly and negatively affected when the TDB_GDP exceeded the threshold of approximately 62% and 60%, respectively. These findings imply varying thresholds for different investment categories. Also, the varying estimated coefficients of the threshold variable (TDB_GDP) imply a non-linear relationship; that is, an increase in TDB_GDP will not result in corresponding investments.

Table 9: TAR model result for TDB_GDP and investments

	PBI	PRI	FDI
Threshold (T):			
First regime	10.234	24.091	10.500
Second regime	61.510	--	59.724
Third regime	61.510	--	59.724
Threshold variable			
TDB_GDP < T	0.292{0.000}***	3.123{0.000}***	-0.300{0.197}
TDB_GDP ≥ T	0.047{0.008}***	-0.252{0.113}	0.001{0.923}
TDB_GDP > T	-0.295{0.000}***	-	-0.141{0.003}***
Non-threshold variables:			
EXR	-0.007{0.005}***	-0.164{0.000}***	-0.000{0.945}
INF	-0.033{0.009}***	-0.083{0.475}	0.019{0.044}**
MPR	0.372{0.000}***	-1.202{0.104}	0.116{0.048}**
R-squared	0.860	0.752	0.666
Adj. R-squared	0.824	0.707	0.579
F-statistic	23.769{0.000}***	16.707{0.000}***	7.714{0.000}***
Model diagnostics:			
Serial Correlation	1.370{0.270}	1.867{0.172}	0.311{0.735}
Heteroskedasticity	1.428{0.366}	1.764{0.137}	2.141{0.062}
Jarque-Bera test	4.766{0.092}	2.143{0.343}	2.825{0.244}
CUSUM test	Stable	Stable	Stable

Source: Own computation (2021)

From the coefficients of the non-threshold variables, it was found that irrespective of the level of the TDB_GDP ratio, the exchange rate (EXR) had a negative effect across the investment categories but did not exert a significant effect on FDI. Inflation (INF), on the other hand, exerted a negative effect on PBI and PRI and a positive effect on FDI, with its effects on PBI and FDI being significant. Monetary policy rate (MPR) had a positive and significant effect on PBI and FDI, while INF exerted a negative and insignificant effect on PRI.

Based on the coefficient of multiple determination (denoted by Adj. R-squared) indicates that the total variations in PBI, PRI, and FDI accounted by TDB_GDP and macroeconomic variables (EXR, INF, and MPR) were approximately 82%, 71%, and 58%, respectively. The F-statistic confirms that the collective effects of the threshold variable and macroeconomic variables are statistically significant. The diagnostic test confirms the models' absence of serious serial correlation, heteroskedasticity, and distribution problems.

Granger Causality

The study went further to test the direction of the relationship existing among the variables. The Granger causality test in Table 10 below indicates that causality flowed from DBS_REV to TDB_GDP, not the other way round. This implies that the major problem facing Nigeria is that of lack of revenue (high liquidity risk) to adequately service outstanding debt, thus affecting the country's capacity to accommodate further borrowing (solvency risk), thus, causing unsustainable debt regimes that have pushed the country into the debt trap. It was also found that TDB_GDP Granger caused all the categories of investments considered in the study. On the other hand, a one-way causal flow was found from EXR to DBS_REV and TDB_GDP, indicating that the exchange rate could influence debt sustainability.

Table 10: Granger causality test

Direction of causality	Obs	F-Statistic	Prob.
DBS_REV does not Granger Cause PBI	38	4.143	0.031
PBI does not Granger Cause DBS_REV		1.353	0.273
TDB_GDP does not Granger Cause PBI	38	1.143	0.331
PBI does not Granger Cause TDB_GDP		0.286	0.753
FDI does not Granger Cause PRI	38	0.510	0.605
PRI does not Granger Cause FDI		0.375	0.690
DBS_REV does not Granger Cause PRI	38	3.944	0.027
PRI does not Granger Cause DBS_REV		0.048	0.953
TDB_GDP does not Granger Cause PRI	38	5.033	0.007
PRI does not Granger Cause TDB_GDP		2.793	0.076
DBS_REV does not Granger Cause FDI	38	3.741	0.034

FDI does not Granger Cause DBS_REV		3.776	0.033
TDB_GDP does not Granger Cause FDI	38	3.775	0.033
FDI does not Granger Cause TDB_GDP		2.503	0.097
TDB_GDP does not Granger Cause DBS_REV	38	2.621	0.088
DBS_REV does not Granger Cause TDB_GDP		4.753	0.015
EXR does not Granger Cause DBS_REV	38	4.423	0.028
DBS_REV does not Granger Cause EXR		0.543	0.586
INF does not Granger Cause DBS_REV	38	1.032	0.368
DBS_REV does not Granger Cause INF		3.901	0.041
MPR does not Granger Cause DBS_REV	38	1.873	0.170
DBS_REV does not Granger Cause MPR		0.983	0.385
EXR does not Granger Cause TDB_GDP	38	3.989	0.033
TDB_GDP does not Granger Cause EXR		0.209	0.813
INF does not Granger Cause TDB_GDP	38	0.249	0.781
TDB_GDP does not Granger Cause INF		5.532	0.009
MPR does not Granger Cause TDB_GDP	38	0.924	0.407
TDB_GDP does not Granger Cause MPR		4.753	0.015

Source: Own computation (2021)

Conclusion

This paper analyzed the threshold effects of debt sustainability on Nigeria's investment profile amidst macroeconomic swings. Based on the trend analysis, the study found evidence of over-indebtedness, macroeconomic swings, low investments, and lack of debt sustainability in Nigeria. The study showed that the measures of debt sustainability, that is, debt service (% of revenue) and total debt (% of GDP), have a non-linear relationship with public, private, and foreign investments in Nigeria, even in the face of macroeconomic fluctuations, meaning that an increase in government borrowing reduced investments. This implies that Nigeria's increasing debt profile could have been more favorable, suggesting poor debt sustainability measures. This is why it would be rational to peg borrowing within a reasonable limit that can be serviced with the revenue-generating capacity of the government.

In determining the threshold effect of debt on investments, it was generally indicated that public, private, and foreign investments respond differently at various threshold levels. This reveals that there is no generally applicable optimal level of debt in Nigeria and that debt optimality depends

on the indebted country's macroeconomic characteristics and the government's fiscal behavior. Since a causal flow emanated from DBS_REV to TDB_GDP, it is concluded that debt sustainability is hinged on the government's ability to service debt from its revenue. It means that the government focuses on an optimal threshold for debt service (% revenue) rather than just measuring its debt sustainability with the total debt stock (% of GDP). As such, the Nigerian government should deepen economic diversification, reduce its reliance on oil revenue, produce more for exports, and maintain the debt service (% of revenue) between 8% and 12%, strengthening the economy and encouraging growth in investments.

Again, it is observed that exchange rate Granger caused debt service (% of revenue), implying that the lack of debt sustainability could be transmitted through exchange rate fluctuations. This is because Nigeria largely borrows in hard currencies and has yet to generate adequate foreign exchange rate revenue to repay these debts, probably due to the fluctuations in the global oil market on which its economy depends. Consequently, the Nigerian government should focus on macroeconomic stabilization by ensuring that domestic production is enhanced to increase export earnings to service the outstanding debt and avert the exchange rate risk inherent in public debt since Nigeria's debt is largely denominated in foreign currencies.

Future Scope of Research

The findings from this research suggest there is much room for further studies. While there exists an empirical link between government debt, macroeconomic factors, and investments of various types, yet, there still needs to be more knowledge to support the intermediating roles of various macroeconomic variables in Nigeria. Future analysis along these and similar lines appears to be a promising avenue for further research.

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Appendix

Data used for the time series analysis

YEAR	PBI	PRI	FDI	DBS_REV	TDB_GDP	EXR	INF	MPR
1981	8.19	89.39	0.33	7.73	9.71	0.61	20.81	6.00
1982	8.00	85.94	0.30	10.21	15.99	0.67	7.70	8.00
1983	6.07	75.76	0.38	9.58	20.66	0.72	23.21	8.00
1984	5.99	58.96	0.26	10.98	24.41	0.76	17.82	10.00
1985	6.94	46.40	0.66	10.67	24.09	0.89	7.44	10.00
1986	8.19	54.95	0.35	12.95	35.28	2.02	5.72	10.00

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1987	9.00	50.05	1.16	15.48	56.23	4.02	11.29	12.75
1988	8.79	43.75	0.76	33.48	57.34	4.54	54.51	12.75
1989	9.89	52.49	4.28	24.64	69.29	7.39	50.47	18.50
1990	12.18	53.12	1.09	24.28	77.37	8.04	7.36	18.50
1991	11.28	48.40	1.45	26.16	75.36	9.91	13.01	15.50
1992	10.24	43.77	1.88	10.19	79.71	17.30	44.59	17.50
1993	15.21	44.48	4.85	42.06	72.14	22.05	57.17	26.00
1994	9.10	42.07	5.79	24.47	59.72	21.89	57.03	13.50
1995	8.02	37.21	0.76	11.10	38.53	21.89	72.84	13.50
1996	8.25	36.58	0.98	8.21	25.39	21.89	29.27	13.50
1997	9.69	38.42	0.86	11.76	24.84	21.89	8.53	13.50
1998	10.14	40.55	0.55	13.89	24.85	21.89	10.00	13.50
1999	17.29	38.28	1.69	3.25	61.51	92.69	6.62	18.00
2000	9.93	34.05	1.64	6.87	56.57	102.11	6.93	14.00
2001	12.36	30.04	1.61	6.96	50.92	111.94	18.87	20.50
2002	8.85	26.77	1.96	9.46	44.33	120.97	12.88	16.50
2003	9.04	28.37	1.91	14.12	42.84	129.36	14.03	15.00
2004	8.30	26.06	1.37	9.76	34.54	133.50	15.00	15.00
2005	8.30	24.97	2.83	7.10	18.26	132.15	17.86	13.00
2006	6.71	26.17	2.06	4.18	7.26	128.65	8.23	10.00
2007	7.07	20.18	2.19	3.73	7.52	125.83	5.39	9.50
2008	8.11	18.86	2.43	4.85	7.12	118.57	11.58	9.75
2009	7.94	21.12	2.93	5.20	8.79	148.88	12.55	6.00
2010	7.56	16.56	1.67	5.69	9.45	150.30	13.72	6.25
2011	7.40	15.53	2.18	4.74	10.23	153.86	10.84	12.00
2012	6.34	14.16	1.55	6.38	10.42	157.50	12.22	12.00
2013	6.40	14.17	1.09	8.48	10.50	157.31	8.48	12.00
2014	5.09	15.08	0.86	9.35	10.58	158.55	8.06	13.00
2015	5.24	14.83	0.63	15.34	11.50	193.28	9.01	11.00
2016	5.71	14.72	0.85	25.39	14.17	253.49	15.68	14.00
2017	5.62	14.72	0.64	24.50	15.99	305.79	16.52	14.00
2018	6.05	19.02	0.20	22.63	15.91	306.08	12.09	14.00
2019	6.67	24.63	0.51	23.91	16.00	306.92	11.40	13.50
2020	6.59	28.65	0.38	35.10	18.63	358.81	15.75	11.50

Source: Central Bank of Nigeria Statistical Bulletin (2020) and World Development Indicators