PUBLIC DOMESTIC DEBT AND INTEREST RATE IN NIGERIA: AN ARDL BOUNDS TEST ANALYSIS

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ABSTRACT

The paper investigated the relationship between public domestic debt and interest rate in Nigeria using data from 1981Q1 to 2018Q4. Applying the Autoregressive Distributed Lag (ARDL) bound test, we confirmed the existence of a long run relationship among the model variables; namely interest rate, domestic debt, money supply and capital inflows. The results affirm the positive and significant effect of domestic debt on interest rate in Nigeria. Therefore, managing the growth of domestic debt is pertinent in moderating the high interest rate The empirical impact of money supply on interest rate was found to be in line with theoretical expectation. However, the variable of foreign capital inflow was found to be positively related to interest rate against expectation. This imples that the inflows have not been large enough to make a dent on market interest rates. The error correction term was found to be significant and indicating that 16.4 per cent of the disequilibrium will be dissipated before the next period, which, in order words is the speed at which the interest rate will return to its long-run equilibrium following changes in domestic debt, money supply and foreign capital inflow in the short-run. The paper concludes that given the significant effect of public domestic debt on market interest rate, continuous borrowing from the domestic market by government would have the adverse effect of keeping interest rate high, which can be a disncentive to private investment. The paper also suggest the optimisation of heterodox approach in managing liquidity to influence interest rate downward, given the significance of money supply, with eye on price stability.

Key words: Interest rate, Public Domestic debt, Capital Inflows, ARDL
JEL classification: C51, E43, E62, H63

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Introduction

Owing to insufficiency of government revenue to meet the financing needs for development, fiscal deficit has remained a prime feature of Nigeria's fiscal policy. Consequently, the Nigerian government has over the years relied on borrowing from both domestic and external sources to finance deficits. The bulk of government borrowing to finance deficits prior to Paris club debt settlement of 2004 came largely from external sources, but thereafter, domestic borrowing assumed prominence. The implication has been both in terms of increasing costs of debt servicing (DMO, 2017) and the supposed credit crowding–out effect on private investment (Omitogun, 2018)[2].

The nation's total debt stock stood at N6.3 trillion as at Q3 2004 but was brought down with Nigeria's exit from the Paris Club of Creditors to N2.2 trillion by Q4 2006. The respite of a low debt environment was shortlived as the nation resumed borrowing, especially following oil price downturn and the global financial crisis of 2008. By 2014, the debt stock had risen astronomically to N10.8 trillion and as at December 31, 2018 it stood at N24.4 trillion. In terms of the debt composition, Nigeria's external debt as at December 31, 2018 stood at US$25.3 billion (31.8%) of total debt stock while domestic debt amounted to US$54.2 billion (69.2%).

As countries make the post-Global Financial Crisis (GFC) transition back to sustainable growth, the fiscal measures taken to mitigate the impact have led to huge and nearly unsustainable sovereign debts in many advanced and emerging market economies (Gooptu et al, 2010). Brumby and Verhoeven (2010) noted how unease economists are on how unsustainable fiscal aggregates are becoming and countries that have had huge government borrowing, either to bail out institutions by providing guarantee in period of financial crisis, have now found themselves confronted with huge debt obligations (Gooptu and Primo Braga, 2010). Discussions about the consequences of borrowings, while not new, have shifted emphasis over time. In the 1970s, concern was on the inflationary consequences of rising government deficits. However, from the 1980s, attention shifted to the implications of rising public debt on interest rate and risk to financial market stability (Hernando, 2005 and Das et al. 2010)[3].

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[2]Although Omitogun (2018) had also shown that the crowding-out effect is dependent on the type of public expenditure, as some expenditure tends to exert crowding -in effect on private investment. For example, expenditure on key physical and social infrastructure tends to reduce cost of doing business and incentivizes private investment.

[3] Increases in debt levels can heighten pressure on markets to meet the higher funding needs of governments, with the risks of driving up yields and generating a suboptimal portfolio of assets of credit institutions (see also Janáèek et al,2012).

The observed growth in government borrowing has reawakened attention on its consequences on interest rates. Although the impact of rising public debt on the economy can run through different channels,4 the potential interest rates effect has received significant attention. Higher interest rates caused by expanding government debt can reduce available fund for private investment, constrain interest-sensitive consumption expenditures on durable goods and reduce the value of households' held asstes. The extent to which these potential adverse effects are manifest in an economy depends on the level to which growing public domestic debt raises interest rates.

The literature is replete with discussion on the effects of public domestic debt on interest rates, but with little empirical consensus about the magnitude of the effect. Differences in views held on the relationship had been quite wide. While some analysts hold the view that there is a significant and large positive effect of domestic debt on interest rates (Cebula and Koch, 1989; Baer, 2003; and Dai and Philippon, 2004), others, informed by their findings argued that there is no such evidence (Aschauer, 1989; Findlay, 1990; and Kormendi and Protopapadaki, 2005). In other words, theory and empirical analysis of the relationship between public debt and interest rates remain inconclusive.

The objective of this paper, therefore, is to analyse the relationship between public domestic debt and interest rate in Nigeria. The persistent high interest rate in Nigeria has inhibited growth in credit, and by implication demand for durables, and access to affordable capital for plant expansion or new investment (Ikhide, 1996; Nwandu, 2016). The situation has also seen government debt servicing increasing, and raising the recurrent component of public budget while at the same time necessitating further borrowing to finance the capital component of the budget. While a number of studies on public debt and interest rate in Nigerian have been carried, two areas this paper wish to enrich the discussion are; given the change in government borrowing programme towards more of domestic borrowing relative to foreign borrowing, can high interest rate in the market be explained by rising public domestic debt? Again, with increase flow of international capital following globalization, to what extend has foreign capital inflow enhanced market liquidity and, therefore, moderated interest rate pressure?

The rest of the paper is organised into 5 sections. Following the introduction is a review of theoretical and empirical literature. Under this section, we review

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[4]In addition to the interest rate channel are the private savings, investment and total productivity channels. The investment channel is argued on the basis of the hypothesis of debt overhang which contends that as a country accumulates more debt, it increases the expectations of imposition of higher taxes going forward. With such expectation, investors become hesitant in new investment decision as their expectations on the future returns decline. In effect, domestic and foreign investment in the country become discouraged. The total factor productivity channel posits that huge public debt constrains growth by lowering the total factor productivity growth. See Riffat and Munir, 2015; Checherita-Westphal and Rother, 2011.

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The rest of the paper is organised into 5 sections. Following the introduction is a review of theoretical and empirical literature. Under this section, we review recent discussions on domestic debt and interest rate nexus as well as the role of international capital flow in the relationship. In section 3 we describe the data and present the empirical methodology. This is followed by the findings and discussion in section 4. The paper concludes with policy implications in section 5.

Literature Review
2.1   Theoretical Issues
High public debt is the economic challenge of many countries but more evident in developing countries owing to weak public revenue profile. They depend on limited sources, inefficiency in revenue collection, absence of a strong private sector and the desire to accelerate development through programmes and projects whose financing demands outweigh available revenues. Again, because these economies are deprived of efficient private sector, governmental activities tend to be extended with the share of government in economic activities or total demand higher compared to what obtains in advanced economies.[5] Therefore, given the enormous financing demand on government in the face of limited resources, the result is continuous government borrowing[6].

The early theorization on budget deficit was on whether government borrowing is growth-promoting or growth-neutral. Keynesian macroeconomics posits that budget deficit should be employed as a policy for enhancing economic growth. The argument is that because government plays a central role in economic advancement by way of providing and sustaining the fundamentals necessary to

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[5] In Nigeria, for example, the commanding heights of the economy; the seaports, the railways and highways, airports, tertiary educational and health institutions, a large arm of the power sector (generation and transmission), the iron and steel industry, oil refining and a number of other economic activities are government managed.

[6] Governments in developing countries are constrained in raising revenue owing to limited set of policy instruments, rigid structure of expenditures and low level of income. There is also the effect of the loss of reliable source of income from tariffs due to trade liberalization which should have prompted major tax reforms. There is also the challenge of limited access to international credit markets' finance (see Shetta and Kamaly, 2014).

support private sector activities, it sometimes become necessary that government engages in deficit budgeting. The transmission is budget deficit arising from either tax reduction or financed through new liquidity injection into the economy, would stimulate households' consumption thus, increasing aggregate demand. The increase in aggregate demand would incentivize increase in investment, through expansion in plant size or green field investments, in response to higher price signals. The net effect is higher demand, investment, employment and growth (Ihori and Kindo, 2002).

The Ricardian neutrality argument, on the other hand, proceeds on the rational expectation assumption that households are forward-looking and tend to envision the direction of future taxation. If government had to borrow to finance deficit because of reduction in the current level of taxes, government would have to pay the principal and the interest of the borrowed funds in the future by way of higher taxes.[7] Thus, households believe that the increase in their disposable income from lower taxes at the present time is only temporal and therefore, will choose to save rather than spend the extra new income. For this reason, the expected increase in aggregate demand get muted with little or no incentive for growth in private investment. Net national savings and interest rate remain unchanged as augmenting private savings would net out the decrease in government savings. In a nutshell, the Ricardian equivalence argues that budget deficits arising from tax cuts have no effect on consumption, national savings and interest rate (Arjomand et al, 2016). This analogy is, however, premised on the implicit notion of monetary accommodation of budget deficits and income threshold that enables financing of basic household demands. In economic climes where basic household consumption demands are hardly met, any increase in income will be accompanied by increase in consumption. Similarly, if there is no monetary accommodation of deficit financing, it is likely that the cost of private credit will rise.

Government borrowing can push interest rates up if there is no monetary accommodation, that is, if there is no increase in money growth in response to higher deficits. This can happen if the central bank does not purchase the debt instruments issued by government. On the other hand, fiscal deficit can be inflationary if there is increase in money growth to mute the resulting

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[7]In other words, the amount of the new debt is viewed as the present value of the future tax burden. The debt does not amount to a net addition to wealth and so does not affect the demand for money and, therefore, interest rate remains unchanged.

pressure on interest rates. In other words, if the central bank purchased the debt instruments issued by government to finance its expenditure to ward off pressure on interest rate because of increase in private sector preference for government instruments, such response would result in increase in money supply, spurring aggregate demand and inflationary pressure (Driessen, 2019).

The implications of government borrowing on interest rate is premised on an expectation that there will not be monetary accommodation of fiscal deficit by the central bank (Driessen, 2019). Meaning the monetary authority will allow interest rates to rise to levels considered to be appropriate with keeping aggregate demand and inflation under control. This, therefore, means that monetary policy can keep inflation low even in the face of large government domestic borrowing. Deficits matter to interest rates because the nominal interest rate is a sum of a real rate of return and an expected-inflation component. Thus, where monetary policy is not accommodative, the expected–inflation component of nominal interest rate remain unchanged even when government borrowing is high. This means that central bank will have to accept upward pressure on real interest rates that comes from increase government borrowing from the domestic market.

Going by the transmission mechanism, it means without monetary accommodation of fiscal deficit by monetary authority, government will have to induce households to increase their subscriptions to government instruments. With no one-for-one increase in the volume of household savings as borrowing increases, additional government debt will reduce available finance for private sector investment in activities such as real estates, plant expansion and factory equipment. As government instruments attracts funds from the private sector activities, real interest rate rises, exerting the effects of reducing private sector's demand for capital (Labonte, 2005 and Driessen, 2019). In other words, as government borrowing increases, it takes some loanable funds from savers which become scarcer for private investors, while lenders demand higher interest rates such that fewer private investments get carried out. Therefore, deficit financing with no monetary accommodation reduces household saving and supply of capital to the private sector. This is to say that the effect of increased government deficit is not only partly in the form of reduced private investment, but also partly in the form of higher interest rates (Correia, and Stemitsiotis, 1995).

Further polemic on the effects of government borrowing on real interest rates also include arguments on whether borrowing reflect changes in government expenditures or in the timing of taxes, and on households' portfolio plan regarding holding of their assets in government instruments and payment of taxes (Driessen, 2019). Empirical evidence in explaining these postulations remained ambiguous. A key source of this empirical ambiguity lies in isolating the effects of fiscal policy from other factors that influence interest rates. If government borrowing raises domestic fiscal injection during economic downturns, while at the same time interest rates fall due to easing by the monetary authority, interest rates and domestic debt would be negatively correlated even if the partial effect of debt on interest rates is positive.

The conventional argument on government borrowing in an economy with underemployment presents a different view (Labonte, 2005). For an economy in recession or experiencing low growth, deficit financing as a policy decision would not be a zero-sum game. This is because higher aggregate spending resulting from budget deficits enables the employment of idle resources, thus, generating new aggregate output to match the increase without generating inflationary pressure in the economy. Therefore, expansionary fiscal policy is usually resorted to in periods of recession to stimulate the economy. In an economy with underemployment, the deficit is expected to generate a multiplier spending effect, so that the total increase in aggregate spending is a multiple of the increase in budget deficit. Under such an economic condition, higher government spending would be unlikely to have much effect on interest rates compare to the case of an economy that is at or near full employment level.

A caveat to the foregoing analogy is that there can be a problem of supply rigidities constraining supply response to increase in aggregate demand in an economy with sufficiently large spare capacity. In that case, the deficit spending will translate into demand-induced inflationary pressures and higher interest rate in effort to ensure that real rate of returns remain positive.

Government borrowing can be both favorable and unfavorable for any economy. If borrowings are because of expansionary fiscal policy, then it could be seen as beneficial to the economy in the long term where the expenditure is directed at building infrastructure to expand production capacity and reduce cost of doing business in the economy. The effect is, however, unfavourable when the deficit is incurred for increased financing of recurrent activities of government and

so with no effect of expanding production capacity or reducing cost of doing business.

2.2   *Empirical Issues*

As mentioned earlier, the relationship between public domestic debt and interest rates have not been clearly defined due to several other factors that could affect their interaction. For example, the way domestic debt affect interest rates in Nigeria may differ from the way it does on interest rates in Canada and this could be due to differences in country-specific factors.[8] In some climes, the evidence may show domestic debt to have no effect on interest rates. This explains why the literature has come to identify four alternatives, yet equally plausible hypotheses on the relationship between government domestic borrowing and interest rates. These are: (i) public domestic debts cause high interest rates as government borrowing crowd- out private funds; (ii) high interest rates cause government borrowing as cost of servicing debt increases, rendering available revenues insufficient and therefore, necessitating more borrowing to bridge the financing gap; (iii) both i and ii are valid implying bi-directional causality; and (iv) neither i nor ii is valid, implying causal independence or the Ricardian equivalence proposition. As a result, a number of empirical works have been carried out to quantify the link between public domestic debt and interest rates.

Early studies to empirically investigate the association between fiscal variables and interest rates are those of Plosser (1982) and Evans (1987a&b). The work of Plosser (1982) employed a rational expectations model of term structure with a VAR macro- econometric model from where it derived a reduced form equation for the end-period return on fiscal variables. Using the US quarterly data, the investigation revealed that tax reduction financed by bond issues has an insignificant effect on interest rates. This informed the conclusion that the proposition that an increase in government debt drives yields upward has no empirical evidence. In refining the earlier work to capture the effects of real interest rate, Plosser (1987) found only insignificant evidence of relationship between interest rates and government debt. A disaggregation of government debt into external and domestic would have possibly led to a different result. This is because while government debt financed by domestic economic agents

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[8]The financial sector in a developed economy is more likely to have a lower risk assessment relative to that of a developing economy, and in that case more likely to have a diverse asset portfolio and able to raise capital to maintain a sound liquidity level. As a result, interest rate pressure may be minimal notwithstanding the level of government borrowing in the market.

can crowd-out capital for domestic investors, external financing is expected to crowd-in private capital. A gap in that work was that the study did not discuss the role of international capital and whether the bonds issued were subscribed largely by domestic or foreign investors. In advanced economies with developed financial markets, public bond issues can attract foreign subscription and with a liberalized capital account, capital can flow in to take up the instruments, so that government borrowing would have no effect on available funds for private sector borrowing.

Evans (1987a) extended the work of Plosser (1982) by applying the framework for all G7 countries except Italy and found that tax reduction had a significant negative effect on interest rates in some countries in the model. However, when tested against various types of interest rates and different sample periods, Evans (1987b) obtained evidence inconsistent with the view that increase in government borrowing raises interest rate.

Barro (1987) focused on government spending, interest rate and budget deficits in the United Kingdom between the periods of 1701 -1918 and found that temporary increases in government spending, especially wartime spending, raised long-term interest rates but the spending also increased the growth of money and prices only during when the gold standard was suspended (1797-1827 and 1914- 1918).[9] When fiscal deficit is construed to mean excess demand for funds by government from the public and the countercyclical changes in the revenue shortfall figures are adjusted for, Zahid (1988) found that government borrowing had significant positive impact on real interest rate in the US for the period of 1971- 1980. This finding was corroborated by Cebula (1988 and 1991) also using the US data and showed that federal deficits exert positive effect on nominal long-term interest rates. Similarly, Kamenda (2008) using the Japanese data to establish the link between government debt and interest rates, showed that a significant and positive relationship between deficit-Gross Domestic Product (GDP) ratio and debt-to-GDP ratio with real 10-year and 5-year interest rates exist. Vamvoukas and Bovenberg (2007) using Greece data also found a positive and significant effect of government debt on interest rates, with growth in government debt driving market interest rates up. On the term structure of interest rates effect of government budget deficits in Italy, Ewing and Yanochik (1999) found that the long-term government bond and the 3-month treasury bill

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[9]The gold standard is a monetary system where a country's currency or paper money has a value directly linked to gold (Lioudis, 2018).

rate yield spread increases with deficits.

A further review of empirical works showed absence of consensus on the government borrowing – interest rate relationship. For instance, some studies [Hoelscher (1986), Maki (1983), Aschauer (1989), Findlay (1990), Darrat (1989;1990), and Kormendi and Protopapadakis (2005)] found the relationship to be insignificant. However, some other studies [Hutchinson and Pyle (1984), Tanzi (1985), Bath et al (1985), Hoelscher (1986), Watchtel and Young (1987), Cebula (1988), Cebula and Koch (1989), Knoester and Mark (1994), Baer (2003, and Dai and Philippon (2004)] found a positive and significant relationship between large government deficits and interest rate. Correia & Stemitsiotis (1995) employed loanable funds model which allows the incorporation of the features of the term-structure with policy variables that influences long-term interest rates. Using the appproach that combines rational expectations with sticky prices and slow adjustment, it found a statistically strong and robust relationship between large deficit and high interest rates in ten major industial countries over the period, 1970-1993.

While the foregoing empirical studies used data from advanced economies, works on the relationship between government deficits and interest rates in Emerging Market and Developing Economies (EMDEs) remain limited. Using Pakistani data, Burney and Yasmeen (1989), Ahmad (1994) and Mukhtar and Zakaria (2008) regress interest rates against a number of variables including fiscal deficits and found no link between fiscal deficits and nominal interest rates, upholding the Ricardian neutrality hypothesis. However, when the ratio of budget deficit to GDP is used as a regressor, the effect on nominal interest rate was found to be positive and significant.

Kumar and Rani (2017) included money supply and inflation as additional variables to fiscal deficit and real interest rate relationship using Indian data. The bounds test results confirmed a long-run equilibrium relationship among the included variables and a positive long run relationship between rate of interest and fiscal deficit, whereas money supply and inflation were found to be negatively related and statistically significant. Similarly, Modeste (2000) applied the loanable fund model of interest rate determination in Jamaica over the period 1964 – 1996 and found a positive and significant effect of government budget deficits on the long-term interest rate. For these results, one can adduce that the significant and positive effect of fiscal deficits on interest rates might be

because the financial markets of EMDEs are less advanced and so do not attract foreign capital in sufficient level and, in some cases, their capital accounts are not fully liberalized to allow for free flow of capital. In addition, the risks profile of this group of economies is relatively high compared to advanced economies and, thus, less attractive to foreign investors. Therefore, fiscal deficits tend to be largely financed by domestic capital. A summary of empirical studies on advanced and emerging economies is presented in the table below.

Table 1: Summary of some empirical studies on advanced and emerging economies

1998	Ussher/Emerging & Advanced countries	Cross -country Analysis	OLS	Mixed result	Appropriate monetary - fiscal policy mix	Country peculiarities And Second order tests were not carried out
2008	Vamvoukas, Gargalas & Lehman/ Greece	Time Series/ country specific	Granger Causality test	Budget deficit does not influence in terest rate	Supporting Keynes proposition	Omitted variable bias exists in bivariate test
2008	Aisen & Hauner/ Emerging/Advanced countries	Cross -country Analysis	Simultaneous Equation model	Result vary from country to country	Mixed result len ding credence to country specific	Country peculiarities
2010	Yan & Brittle/ Australia	Time series/country specific	A general ECM	General government debt has no significant impact on short run interest rate margin	External factor such as US government net debt tends to exact more impact on Interest rate margin in Australia	Country peculiarities
2012	Chakraborty/ India	Time series/ country specific	Asymmetry VECM	Weak interest rate effect of fiscal deficits but strong e ffec t of volatility in capital flo ws	Suggest the need to lower interest rates as h igh interest rate has negative e ffe c t on India's economic growth	Country peculariaties

2014	Cebula /USA	Time series/country specific	Autoregressive 2SLS	Federal budget deficit showed significant and positive effect on real interest rate yield.	Although no evidence of crowding out, it suggested the need for further work that links investment in new plant and equipment to budget deficits	Problem of omitted variables
2017	Totterman/ OECD Countries	Panel data/2 9OECD economies	Fixed effect estimation	Found weak interest effect of the public debt-to-gdp ratio	Once sovereign creditworthiness is controlled for with another measure, the public debt-to-GDP ratio becomes irrelevant for long-term interest rates.	Country peculiarities
2018	Tund/Vietnam	Time Series/Country specific	Cointegration and ECM	Fiscal deficit hurts gross output and private investment	Reduce fiscal deficit to achieve a more sustainable growth	Problem of omitted variables

In Nigeria, studies have been carried out linking budget deficits and some key macroeconomic variables such as inflation, economic growth and demand for money. For instance, works by Oyejide (1972), Egwaikhide et al (1994), Ezeabasili et al (2012), Bakare (2014) and Ogunsakin and Olalere (2017) dwelled more on the relationship between budget deficits and inflation, while Mbanefor (1992), Oladipo and Akinbobola (2011) focused on budget deficit and the macro economy. Ibrahim (2017) examined budget deficit – money demand nexus in Nigeria. Other works on the subject include those of Obi and Nurudeen (2009) and Odionye and Kalu (2013). Obi and Nurudeen(2009) investigated the effect of fiscal deficits and government debt on interest rate. Using VAR approach, the result showed a positive relationship, thus, informing the conclusion that higher fiscal deficit and debt are associated with higher interest rates. Similarly, Odionye and Kalu (2013) investigated the relationship between budget deficit and interest rate in Nigeria over the period 1970 - 2010 using the Vector Error Correction Model (VECM). The result showed a positive impact of budget deficit on interest rate in the long run. A summary of some of the empirical studies on Nigeria is presented in Table 2 below.

Table 2: Summary of some empirical studies on the Nigerian economy

Year	Author/Location	Nature of Study/data	Methodology	Findings	Recommendations	Limitations
2013	Odionye & Kalu/Nigeria	Time Series/Country Specific	VECM	budget deficit showed positive and significant impact on interest rate in the country	Suggests appropriate monetary-fiscal policy mix for optimal fiscal financing.	Problem of omitted variable bias
2016	Senibi et al/Nigeria	Time series/country specific	Johansen cointegration and FMOLS	Public debt has a positive and significant effect of external reserves	Government should negotiate for fixed interest payment and varying amortization schemes	Did not address the sustainability implication of rising public debt.
2018	Aero and Ogundipe/Nigeria	Time series/Country specific	Threshold Autoregressive model	Significant negative relationship between fiscal deficits, financial depth and economic growth in Nigeria	Increase capital spending and strive to achieve an optimal fiscal deficit threshold of 5%	Problem of omitted variables
2017	Nwaeze/Nigeria	Time series/Country specific	VAR	Domestic public borrowing crowd-out private investment	Moderate domestic borrowing to finance public expenditure in favour of concessional external financing	Problem of omitted variables
2017	Abdu/Nigeria	Time series/Country specific	ARDL Bound test	Foreign debt has positive but insignificant effect on economic growth	Apply caution in borrowing externally	Problem of omitted variables. Not accounting for structural changes in the economy
2008	Obi & Nurudeen/Nigeria	Time Series/Country Specific	VAR Model	Positive effect of fiscal deficit on interest rate	Fiscal rationalization through reduction in unnecessary spending.	VAR is sensitive to lag length but this was not tested.
2015	Akomolafe et al/Nigeria	Time series/Country specific	Johansen Cointegration and VECM	Domestic debt crowd-out domestic investment in the long run	Reduce public debt profile, diversify the economy and improve revenue base	Problem of omitted variables
2016	Nwali & Nkwede/Nigeria	Time series/Country Specific	VECM	Public debt negative short and long-run effect of economic growth	Maintain debt-gdp ratio within global threshold to achieve debt sustainability	A low Debt-gdp ratio is not the best guide for debt sustainability

In summary, public debt or fiscal deficit-interest rate relationship in Nigeria, from the reviewed works, has been more of the classical type as against the Keynesian or the Ricardian neutrality arguments. In this study, we extended the discussion by assessing validity of the conclusions using a more recent data, taking into cognizance the role of foreign capital inflows, and other developments in the economy in the last two decades since the return to civil rule as well as using a more market driven interest rate – the treasury bill rate.[10]

3.0   Methodology
3.1   Data and Method of Analysis

The paper used quarterly secondary data spanning the period 1981Q1 – 2018Q4. The data is obtained from the Central Bank of Nigeria Statistical Bulletin and the Central Bank of Nigeria Statistical Database.[11]

The method of analysis employed in investigating the relationship among the variables follows three steps. The first is to test the order of integration of the variables using both the Augmented Dickey-Fuller (ADF) and Phillip-Perron (PP) unit root tests for stationarity.

Specification of this study alongside other variables that may influence interest rate behaviour is of the form;

$$TBR_t = \lambda_0 + \lambda_1 DDT_t + \lambda_2 CF_t + \lambda_3 MS_t + \varepsilon_t \qquad \text{...} \quad (1)$$

Apriori, $?_1 > 0$, $?_2 < 0$, $?_3 \lessgtr 0$,

Where *TBR* is the 3-Month Nigerian Treasury bill rate; *DDT* is public domestic debt; *CF* is foreign capital inflows; *MS* is broad money supply and C white noise or error term. All variables are transformed into the natural logarithms to estimate elasticities. The expected sign on the public domestic debt variable is positive to reflect the conventional argument that the financing of government budget deficit, tends to drive interest yields upward as it competes with the private sector to attract funds. The expected sign on the money supply variable is negative because the higher the magnitude of the money supply relative to GDP the more the offset to new government debt issues, *ceteris paribus*. The

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[10] Some of these developments include; financial sector liberalization and reforms and the use of market-driven policy instruments, capital account liberalization and the increasing importance of international capital flows, and government debt restructuring effort towards less external debt relative to domestic debt.

[11] The online statistical database can be accessed on www.cbn.gov.ng/stat/database.html

hypothesized sign for the capital flow variable is negative as net positive flows is expected to reduce the interest rate effect of higher domestic public debt.

The choice of the 3-month treasury bills rate as representative interest rate in this model is informed by the fact that deposit rates in Nigeria are generally low and disincentive to savings while maximum lending rates are very high and disincentive to investment. The treasury bill rates signals cost of borrowing to government, more attractive to households as means of holding their liquid wealth or assets, and for the banking sector, treasury bills are fixed income security that guarantee risk-free return. Thus, when households acquire treasury instruments, they have transformed their savings into investment interest earning government securities and become richer. Although it is an investment on the part of the households, it is not a form of investment that result in the construction of new building or plant expansion or other private investment. It is simply a creation of a new paper asset and no physical investment. Similarly, when financial institutions acquire government instruments, they have simply transformed the liability side of their balance sheet into secured or risk-free assets that are not available for physical investment by the private sector. To government, the treasury instruments enable her to spend more than the revenue generated, with an intergenerational implication of higher future taxes (Labonte, 2005 and Drissen, 2019). Therefore, increase in the issuance of treasury instruments by government to bridge her financing gap translates into increase borrowing and by implication higher government domestic debt accumulation. Increase in government borrowing through issuance of more treasury instruments can drive interest rate higher.[12]

On the inclusion of money supply in the equation, the standard argument is that increase in money supply increases the volume of liquidity available for loans. As profit maximization agents, banks would want to optimize their portfolio of assets and liabilities and in doing so would not want to keep idle funds in their portfolio. In order to create more assets, banks would want to give out more loans and borrowers would be incentivized only through lower interest rate. The relationship, therefore, between money supply and interest rate is inverse.

The inclusion of net foreign capital flow is informed by the idea that Nigeria is a small open economy enabling international capital transfer from capital

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[12]To make the instruments attractive for subscription by economic agents, the issuing rate may have to be high to keep the real rate of return positive.

surplus to capital deficit destinations. Owing to the country liberalized capital account, foreign capital can take advantage of earnings opportunity in Nigeria, thus, bridging capital shortfall and moderating the possible hike in retail interest rate. The expected relationship, therefore, is that increase in netflow of foreign capital would exert a decreasing effect on interest rate.

3.1.2 Autoregressive Distributed Lag (ARDL) Bounds Test for Cointegration

The study employed the Autoregressive Distributed Lag (ARDL) model by Pesaran and Shin (1999) and Pesaran, Shin and Smith (2001) to determine the relationship between public domestic debt and interest rates. This is informed by the advantages that the ARDL approach to cointegration has over the Johansen approach to cointegration. In the first instance, the ARDL model provides a more appropriate approach for determining the cointegration relation in small samples (Pesaran et al, 2001; Ghatak &Siddiki, 2001). The Johansen cointegration techniques, on the other hand, requires large sample for validity. In addition, the ARDL approach can be applied where the variables are I(0) and I(1) and so helps to overcome the pre-testing challenge common with standard cointegration, which requires that variables be classified into I(1) or I(0) (Pesaran et al., 2001). The ARDL approach to cointegration involves estimating the short-run and long-run elasticities by employing the Error Correction Model (unrestricted) informed by the assumptions in Pesaran et al. (2001). The empirical specification for this study, therefore, is;

$$\Delta TBR_t = \varphi_o + \varphi_1 TBR_{t-1} + \varphi_2 DDT_{t-1} + \varphi_3 CF_{t-1} + \varphi_4 MS_{t-1} + \sum_{i=0}^{p} \lambda_{1i} \Delta TBR_{t-i} + \sum_{i=0}^{q} \lambda_{2i} \Delta DDT_{t-i} + \sum_{i=0}^{r} \lambda_{3i} \Delta CF_{t-i} + \sum_{i=0}^{k} \lambda_{4i} \Delta MS_{t-i} + \varepsilon_t \quad \ldots\ldots\ldots\ldots (2)$$

The parameters φ_1, φ_2, φ_3 and φ_4 are coefficients of the long-run relationship of the underlying ARDL model while the parameters $\lambda_{1,} \lambda_{2i,} \lambda_{3i \text{ and }} \lambda_{4i}$ represents the short-run dynamics of the model. Δ denotes the first difference operator; φ_0 = the drift component; ε_t = the white noise residuals. The hypothesis that the coefficients of the lag level variables are zero is to be tested.

$H_0: \varphi_1 = \varphi_2 = \varphi_3 = \varphi_4 = 0$; while $H_1: \varphi_1 \neq \varphi_2 \neq \varphi_3 \neq \varphi_4 \neq 0$

Equation 2 is the interest rate model to be estimated. The first four terms on the left-hand side (LHS) of the equation correspond to the long-run multipliers, while the short-run dynamics of the model are captured by the variables in their first differences. Should the null hypothesis hold, then there is no long-run relationship among the variables in the model. However, should the alternative hypothesis hold, it means the variables are cointegrated.[14]

4.0   Findings and Discussion

4.1   Pre-estimation tests

Summary results of the unit root test from the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) methods are presented in table 3. From the results, log of domestic debt (*LDDT*), money supply (*LMS*) and capital flows (*LCF*) appeared stationary only at their first difference, while treasury bills rate (*LTBR*) was found to be stationary at level. The varying order of stationarity informed the choice of ARDL method of analysis for this study.

Table 3: ADF and Phillips-Perron Stationarity tests

Variable	ADF t-Statistic	Stationarity	Phillips-Perron t-Statistic	Stationarity
LDDT	-3.4304* (-0.0114)	I(I)	-5.9569* (0.0000)	I(I)
LTBR	-2.9058* (-0.047)	I(0)	-3.2885* (-0.0171)	I(0)
LMS	-12.7386* (0.0000)	I(I)	-12.7898* (0.0000)	I(I)
LCF	-15.2321* (0.0000)	I(I)	-17.5539* (0.0000)	I(I)

*Note: P-Values in parentheses. * Rejection of H at 5% $_0$*
Source: Author's computation

4.2   Long-run ARDL Estimates

The result of long-run estimate of the ARDL model is presented in table 4. Log of domestic debt and money supply were found to be significant and satisfied the apriori expectation. The result affirms the positive relationship between domestic debt and interest rate in Nigeria. On the other hand, interest rate was found to relate inversely with money supply. Capital inflows was also found to be significant although the direction of influence was not in line with apriori

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[13] The Error Correction Model (ECM) has been interpreted as "a method of adjusting a policy instrument to maintain a target variable close to its desire value" (see Alogoskoufis and Smith, 1991 and Phillips, 1957)

[14] Nkoro and Uko (2016) provided a succinct guide and justification on the application and interpretation of ARDL cointegration technique when variables are integrated of different orders and the robustness of its results when there is a single long-run relationship between the variables in a small sample size.

expectation.

Table 4: Long-run ARDL Estimates

Variable	Coefficient	SE	t-Stat	Prob.
LTBR(-1)	1.222	0.084	14.571	0.000
LTBR(-2)	-0.254	0.132	-1.918	0.057
LTBR(-3)	-0.132	0.081	-1.632	0.105
LDDT*	0.417	0.114	3.674	0.000
LDDT(-1)	-0.378	0.109	-3.481	0.001
LMS*	-0.086	0.027	-3.157	0.002
LCF*	0.046	0.008	5.601	0.000
LCF(-1)	-0.022	0.010	-2.188	0.030
LCF(-2)	-0.002	0.011	-0.210	0.834
LCF(-3)	0.003	0.010	0.350	0.727
LCF(-4)*	-0.018	0.009	-2.048	0.043
C	0.516	0.107	4.826	0.000
@TREND	0.004	0.001	2.706	0.008

R^2 = 0.9677; R2-Adj. = 0.9648; S.E of regression = 0.0536; F-Stat. = 336.7535;
AIC = -2.9314; SIC = -2.6681; DW-Stat = 1.9359.
*Significant at 5% level
Source: Author's computation

The ARDL bound test is based on the F-statistic with two critical values given for cointegration test (Pesaran et al, 2001). The lower critical value assumes all the variables are I(0) suggesting no cointegrating relationship between the variables, while the upper critical values suggests all variables are I(I) or the variables are cointegrated. The result of the long-run form bounds test for cointegration and the F- statistics are presented in tables 6 and 7 below.

Table 6: ARDL F-Statistics Test

Test Statistic	Value		K
F-Statistic	7.689		3
	Critical Value Bounds		
Significance level (%)	I(0) bound		I(I) bound
10	3.47		4.45
5	4.01		5.07

*P-value incompatible with t-bounds distribution
^ Variable interpreted as Z=Z(-1)+D(Z)
** Significant at 5% level
Source: Author's computation

The bound test result indicates that the variables are cointegrated and so affirms the existence of a long run relationship among the variables in the model. The F-Statistic of 7.68 is greater than the upper bound I(I) critical value at 1% level.

From the long-run form estimates, the parameter of domestic public debt was found to have positive and significant in line with our apriori expectation, suggesting that part of the interest rate behavior could be explained by growth in domestic debt. Again, in line with theoretical expectation, the result showed that interest rate relates inversely with money supply. The parameter of net foreign capital flow was also found to be significant but with an unexpected sign. The positive sign of the coefficient may be suggestive that the flows of foreign capital though significant has not been in quantity sufficient enough to exert a declining effect on interest rate. In addition, except these flows are directed as investment in private or corporate instruments, their investment in government instruments may not exert the expected interest rate effect.

4.3   Error Correction Form of the ARDL model and Estimates

Having found the variables to be cointegrated or have a long-run relationship, the Error Correction Model (ECM) was developed to test for the convergence of the variables in the model towards equilibrium and the speed of adjustment. The error correction term as a measure of feedback effect is derived from the cointegration equation 2 whose coefficient are obtained by normalizing the equation on TBR. The ARDL form of the ECM is presented in equation 3.

$$\Delta TBR_t = \lambda_o + \sum_{i=1}^{p} \lambda_{1i} \Delta TBR_{t-i} + \sum_{i=0}^{q} \lambda_{2i} \Delta DDT_{t-i} + \sum_{i=0}^{r} \lambda_{3i} \Delta CF_{t-i} + \sum_{i=0}^{K} \lambda_{4i} \Delta MS_{t-i} + \Omega Ect + \varepsilon_t \qquad \text{............. (3)}$$

It is the unrestricted version of the ARDL model and the error correction term $\grave{U}$, explains how much of the disequilibrium is being corrected. The result of the ECM estimation is presented in table 8 below.

Table 8: Error Correction regression

Variable	Coefficient	SE	t-Stat	Prob.
C	0.516	0.095	5.408	0.000
@TREND	0.004	0.001	5.667	0.000
D(LTBR(-1))	0.386	0.076	5.066	0.000
D(LTBR(-2))	0.132	0.078	1.706	0.090
D(LDDT)	0.417	0.110	3.794	0.000
D(LCF)	0.046	0.008	5.761	0.000
D(LCF(-1))	0.016	0.009	1.882	0.062
D(LCF(-2))	0.014	0.009	1.657	0.100
D(LCF(-3))	0.018	0.008	2.170	0.032
ECM(-1)*	-0.164	0.029	-5.607	0.000

R2 = 0.4687; R2-Adj. = 0.4340; S.E of regression = 0.0529; F-Stat. = 13.5251; AIC = -2.7719;   SIC = -2.7694;
DW-Stat = 1.9359

The error correction term *ECM(-1)* shows the convergence of the variables in the model and the speed of adjustment from the short-run to the long-run equilibrium. From the result, the coefficient of ECM equal -0.164 and significant but the speed of adjustment is relatively low as only about 16.4 per cent of deviation is corrected in each period/quarter.

4.4   Diagnostic and Stability tests

The model was checked against presence of Serial Correlation and Heteroscedasticity. Results of the diagnostic tests are reported in table 9. The serial correlation test result indicates acceptance of the null hypothesis of no serial correlation in the residuals. Similarly, the model was found to be homoscedastic.

Table 9: Result of diagnostic tests

Test	F-Statistic (P-values)	Null Hypothesis
Serial Correlation: Breusch -Godfrey LM Test	2.043698 (-0.1336)	No Serial correlation
Heteroscedasticity: White Test	1.032869- (0.4227)	Homoscedastic

Source: Author's computation

Stability of the parameters is analyzed by Cumulative Sum (CUSUM) test statistic (Brown, Durbin and Evans 1975) which is based on cumulative sums of scaled recursive residual test statistics defined as follows;

$$W_t = \sum_{r=k+1}^{t} \frac{w_r}{S_t}, t = k+1,... T$$

Where, w = recursive residual
S = standard error of the regression fitted to all T observations
From the CUSUM test, that regression equation was found to be stable as the statistic remain within the critical bounds of the 5 per cent level of significance over the sample period. However, the CUSUM square test indicated relative instability as shown by the spilling of the statistic outside the critical bounds at some points over the sample in period. Over all, the model was fairly stable.

CUSUM Test

CUSUM - Square Test
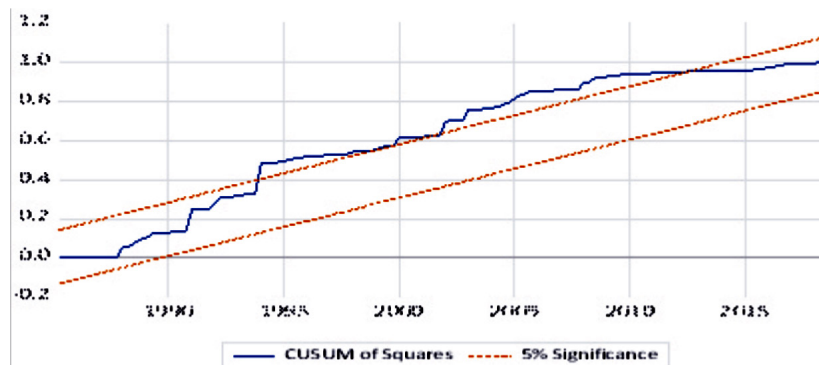
5.   Summary and Policy Implications

In efforts to accelerate development, budget shortfalls have become the fiscal experience over the years and therefore necessitating borrowing both internally and externally to bridge the financing gap. While borrowing externally complements domestic resources without the possibility of crowding out the credit market for the private sector and, therefore, driving up the cost of credit, government borrowing from the domestic market can drive interest rate up. It is this consideration that the paper attempt to investigate using the methodology of the AutoRegressive Distributed Lag (ARDL) bound test to ascertain the long run relationship among the variables in the model and whether interest rate behaviour can be explained by public domestic debt in Nigeria in any significant way. The paper also recognised the role of money supply and the net flow of foreign capital in influencing interest rate behaviour. To measure the speed of adjustment of any disequilibrium in the short run to long-run equilibrium, the paper estimated the short run error correction relationship.

The findings affirmed the apriori expectation of a positive relationship between public domestic debt and interest rate in Nigeria. Meaning that interest rate movement in Nigeria can, to a large extent, be explained the rising government borrowing from the domestic. The analogy remains that as government continually offer more risk-free instruments for private investment, deposit money banks, in particular, and the surplus spending households would rather investment in them, thus limiting the amount and raising the cost of resources available for private deficit spending economic agents. The variable of money supply was found to have an inverse relationship with interest rate, in line with what theory posits, which is that increase in money supply increases the amount of liquidity available for loans. Thus, deposit money banks, in pursuit of their profit maximization objective, would not want to keep idle funds in their portfolio. In order to optimize their portfolio of assets and liabilities, banks would rather offer lower interest rate as incentive to attract borrowers. With respect to the effect of foreign capital flows, the variable was found to be significant, although the sign of the coefficient did not follow the apriori expectation. The significance of the variable, thus, suggest the complementary importance of foreign capital to domestic resources and the need to improve the business environment to attract more foreign capital in both portfolio and foreign direct investment forms.

The policy implications of these findings include the following; (i) Given the significant effect of public domestic debt on market interest rate, continuous borrowing from the domestic market by government would have the adverse effect of keeping interest rate high, which can be a disncentive to private investment be it greenfield or brownfield. With government desire to promote a private sector-led economic growth, the fiscal authority would have to significantly cut down on its borrowing from the domestic market. Where borrowing from the domestic market becomes inevitable, the offer rates for the instruments should be made low to incentivise lending to private sector activities. Doing so would have the effect of keeping retail interest rates low. It would also have the added benefit of reducing the incentive for high patronage on government securities by private economic agents at the detriment of availing credit for private sector investment. (ii) The significance of the variable of money supply in the model implies that the monetary authority has an opportunity in using its tools to influence interest rate behaviour in Nigeria. Although price stability remains the key mandate of the Central Bank, the application of heterodox approach in managing liquidity and influencing interest rate downward to enhance credit flow to the private sector should be optimised. (iii) the findings also suggest that government should direct attention at improving the economic fundamentals that creates a business environment attractive to make Nigeria an investment hub for foreign investors. Doing so would lower the risk perception of foreign surplus spending economic agents on the economy and enhance the flow of foreign capital into the economy.

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