

# Fiscal Policy and Sustainability of Public Debt: The Nigerian Experience

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## Research

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## Abstract

This paper examines the relationship between fiscal policy and public debt sustainability in Nigeria within a multivariate framework from 1970–2019. The autoregressive distributed lag (ARDL) bounds test is employed to determine the long run relationship among the variables. The results of the ARDL test reveal that there is a long run relationship between the variables used in this study. Specifically, the result shows that budget deficit has a positive and significant impact on public debt both in the short run and long, while interest rate, real gross domestic product and inflation rate were statistically insignificant irrespective of the period and thus had no impact on public debt. Thus, it was recommended that the budgeting procedure at the federal and state levels in Nigeria need to reassessed to make sure that allocative efficiency is achieved in the budgeting system.

## 1.0 Introduction

Globally, in most economies, the mounting difficulty of rising fiscal deficits and high levels of public debt combined with the Eurozone area debt crisis has particularly stirred up interests from macroeconomic policy makers in the direction of a transformed focal point on fiscal policy and sustainability of public debts both in advanced and developing countries. The significance of this is that failures in fiscal sustainability inflicts a number of restrictions on the debtor countries growth and development, hinders their debt serviceability as well as constitutes a drain on their human and physical resources. This statement is supported by Curtasu (2011), who asserted that when fiscal policies are not sustained, it could make countries more susceptible to exogenous shocks and worsen their macroeconomic situation. Furthermore, he added that fiscal policy could damage the welfare state via increase in inflation rate, inefficient mobilization and allocation of resources, huge fiscal deficits and excessive public debt stock.

The Nigerian federal government in previous years has made use of fiscal and monetary policies to attain macroeconomic stability of the economy. While monetary policies entail the procedure through which the apex monetary authority, for instance, the Central Bank of Nigeria regulates the supply of money, with the goal of controlling interest rates or inflation to realize price stability as well as improve the general confidence of the public on our currency; in contrast, fiscal policy involves the utilization of government revenues mainly from taxes and expenditure to manipulate economic activities. Each time a country's revenue surpasses its expenditure, this brings about a fiscal surplus; conversely, when government expenditure exceeds its revenue, this results in fiscal deficit. Also, fiscal deficit may occur due to inefficiency of the government, for example, evasion of taxes, wasteful spending on frivolities rather than on productive investment, etc.

Nigeria's fiscal deficit situation is not a new occurrence since the nation recorded its first fiscal deficit of N455.10 million in 1970 (CBN, 2019). Ever since then, the Nigerian economy has persistently been on a continuous course of deficit financing employing the tool of public debt. Though, it was in the early 1980s that the debt problems in the country became a serious issue when its foreign exchange earnings plummeted significantly as a result of the fall in crude oil prices in the international market. This became more noticeable because Nigeria is a mono-product economy with huge reliance on crude oil as a key source of revenue.

From Fig. 1, it could be observed that public domestic and external debt in Nigeria have been increasing gradually. From 1970–1985, both domestic and external borrowing was below N50 billion. This was as a result of the revenue generated at that time from the oil boom which provided financial resources for projects, thus public debt was not high. However, from 1986–2005, external debt formed the bulk of public debt implying that the nation relied heavily on external debt to finance its expenditure. In 2006, the trend changed significantly as external debt plummeted from N2,695.07 trillion in 2005 to N451.46 billion in 2006, indicating a fall of approximately 83%, whereas domestic debt increased from N1,525.91 trillion in 2005 to N1,753.26 trillion in 2006, representing a rise of about 15%. According to Nya & Onyimadu (2019), this fall in external debt may be attributed to the following: a. the Paris Club debt relief in 2006 which decreased Nigeria's debt. b. the medium term debt strategy established by the Federal Ministry of Finance combined with limited external and domestic borrowing that is deemed suitable for the economy. This strategic combination of raising the nation's domestic debt as well as reducing its external debt is believed to apt on the basis that external debt is dependent on exchange rates that is capable of affecting the country's debt repayment as well as further aggravating her debt burden whereas domestic debt, whose denomination is in local currency is not subject to fluctuations in exchange rates, thus making sure that there is stability in debt repayment programmes. The debt combination is confirmed from the trend analysis in Fig. 1 as domestic debt remained ahead of external debt from the period of 2006–2019. Thus, the objective of this paper is to examine the relationship between fiscal policy and public debt sustainability in Nigeria.

The means which the government utilize in financing its total fiscal deficit is referred to as deficit financing and its option via borrowing is deemed the most appropriate stimulant for the economy both in the short run and in the long run. This is due to the fact that it represents a drag on the economy owing to accrual of interest rate. Apart from financing fiscal deficits via borrowing from domestic and external sources, other options include quantitative easing (QE) and withdrawal from the country's external reserves (Nya & Onyimadu 2019). In Nigeria and other developing nations, quantitative easing is not a recommended for deficit financing owing to the fact that these are consumption based nations and the employment of quantitative easing in the long run could lead to hyper inflation as a result of a rise in money supply. Printing of money is extremely inflationary as a rise in the volume of money does not correspond to a rise in productive activities in the economy (Umo, 1986).

For most part, these constant deficits had been financed by the government via borrowing from internal or external sources as explained above, and from time to time through external reserves reduction. A number of the projects funded by debt included Port Harcourt refinery, Ajaokuta Steel Company, Kaduna refinery, Delta Steel Company, etc. It is imperative to assert that the Ajaokuta and Delta Steel Companies, which were considered as forerunners for the process of Nigeria's industrialization, were totally disposed of while the refineries capacity utilisation till date are inadequate and inefficient due to greed, corruption as well as inconsistent macroeconomic policy alterations of the federal government. These worthy projects would have guaranteed increase in productive activities, generated employment, reduced poverty as well as positioned the economy on the path of growth and development. This thus questions one of the

functions of the Debt Management Office (DMO), that money borrowed from appropriate sources and are wisely used with good analytical and regulatory structure will ensure serviceability and amortisation of the nation's debt as at when due. A reason for this failure might be that the responsibilities given to Debt Management Office (DMO) were lacking direct projects monitoring and evaluation to make certain that funds are rightly channelled to the intention it was meant for, hence assuring debt serviceability or payback (Nya & Onyimadu 2019).

This paper will be of importance to macroeconomic policy makers, analysts and academics in formulating effective fiscal policies and debt management measures that will ensure adequate economic growth and development of the country. Also, it will help in enlightening the public that increasing public debt does not mean it is unsustainable and that the country is not at the verge of total collapse. Hence, there is the need to provide sufficient knowledge and clarify Nigeria's fiscal policy and public debt sustainability position.

## 2.0 Theoretical Literature

Contemporary studies on public debt sustainability policies that employs statistical tests commenced with the work by Hamilton & Flavin (1986) who investigated if America's public debt series had a bubble. Since then, numerous articles have been published that endeavour to answer the question of if certain debt policies can be deemed sustainable. The concern in that question is partly owing to the fact that the latter question is not merely of academic importance but that it has practical significance as well. Therefore, if tests concludes that certain debt policies cannot be deemed sustainable, government must embark on corrective measures (Greiner & Fincke 2015).

A vital role in most of those studies on public debt sustainability is the role of interest rate, a feature that was pointed out by Wilcox (1989). Bringing to mind that the interporal budget constraint of the government necessitates that the present value of public debt asymptotically converge to zero, the function of interest rate that is employed so as to discount the flow of public debt becomes obvious right away. Thus, several tests have been formulated that arrived at results which are not dependent on interest rate. One of such test is to examine if public debts inclusive of interest rate mainly increase linearly as put forward by Trehan & Walsh (1991). If this feature is satisfied, a given series of public debt is sustainable since any time series that increases linearly converges to zero if it is exponentially discounted, given that the real interest rate is positive. Representing public debt by  $\beta$  and interest rate by  $r$ , another test suggested by Trehan & Walsh (1991) is to examine if a quasi-difference of public debt  $\beta_t - \theta\beta_{t-1}$  with  $0 \leq \theta < 1 + r$ , is stationary and if public debt and primary surpluses are co-integrated. If government debt is quasi-difference stationary and public debt as well as primary surpluses are co-integrated, public debt is sustainable. Therefore, these two test offer options where the result is independent of the precise numerical value of the interest rate. A survey on studies that tested public debt sustainability can be obtained in Afonso (2005), Bohn (2008), Neck & Sturm (2008).

Another test that has gotten huge awareness in economics literature is that offered by Bohn (1995). He proposed to test if the primary surplus relative to GDP is a direct function of the debt to GDP ratio. If this feature holds, a certain public debt policy can be deemed sustainable. This test is very credible since it possess a good economic instinct: if government experience debt now, they have to embark on corrective measures in the future by raising the primary surplus, or else, public debt will not be sustainable (Greiner & Fincke 2015). Examining real world debt policies for this feature, we can certainly obtain proof that countries act in this manner (see for instance, Bohn 1998, for the USA and Ballabriga & Martinez-Mongay 2005, Greiner, Köller & Semmler 2007, Greiner & Kauermann 2008, Fincke & Greiner 2011, for some selected counries in the euro area).

From a statistical viewpoint, an increase in primary surpluses as a response to larger government debts means that the series of public debt relative to GDP ought to become a mean-regressing procedure. This process holds since higher debt ratios bring about a rise in the primary surplus relative to GDP, causing the debt ratio to fall and go back to its mean. Nonetheless, mean-regression only takes place if the response coefficient, that determines how strongly the primary surpluses reacts as public debt increases is adequate.

## 2.1 Empirical Literature

The relationship between fiscal policy and public debt sustainability has generated empirical studies with mixed up results using ordinary least square (OLS) method, vector autoregressive (VAR) method, panel data method and vector error correction (VECM) method employing data that ranges from time series to cross-sectional and panel. In a cross-country study, Kalulumia (2002) examined the effect of government debt on interest rates of United States, Germany, the United Kingdom and Canada with the aid of the error-correction model (ECM) and the general portfolio balance model. The variables employed for the study were interest rate, exchange rate, stock of domestic assets and real GDP. The proof in general showed the absence of causality in the long-run, between government debt and interest-rate related variables for the four countries, which signified that government debt had no permanent positive impact on any of the variables of interest, for instance, interest rates, money demand and the exchange rate.

In order to examine the debt servicing capacity of the Nigerian economy, Adam (2007) used survey method and the accounting measurement of debt to GDP ratio and asserted that the debt situation in the country to a large extent is highly unsustainable. He opined that the Nigeria's debt being not sustainable could be related with huge trade deficits, inadequate real GDP growth, high interest rates and high initial debt stock. He concluded that the country's debt being highly unsustainable might be partly right because the debt/export ratios and external debt /GDP with values of 64.4 and 176.9 were high against the international benchmark of 50 and 150 respectively.

Foneska & Ranasinghe (2007) performed a research on sustainability of Sri Lanka's public debt employing the conventional maximum ratios as well as the theoretical model method to measure liquidity and solvency of domestic and external debt. Their result showed that Sri Lanka was unsuccessful in achieving the debt sustainability placed by international agencies as every macroeconomic indicator surpassed the upper threshold limits. In addition, they contended that if such conditions continue, the nation will fall into a severe debt trap, and will not be able to obtain funds from both local and international sources at reasonable cost.

In an empirical assessment of the relationship between domestic debt and Nigeria's economic growth, Adofu & Abula (2010) employed ordinary least square regression techniques in examining the relationship between the country's domestic debt and economic growth. Their result revealed that domestic debt has a negative impact on the growth of the economy. Thus, they recommended that government domestic borrowing ought to be discouraged and that increasing the revenue base via tax reform programmes should be encouraged.

Curtasu (2011) carried out a study on how to assess public debt sustainability: empirical evidence from advanced European countries, employing annual time series data from 1970–2012. His findings showed that few countries, for instance, Sweden, Netherlands, Finland and Denmark would not encounter the solvency risk in the future, as the sustainability of their fiscal stance was created by public debt ratio that did not exceed the limit by a primary surplus large enough to conceal the stabilizer one (apart from the Netherlands). Though the study revealed that the remaining countries such as UK, Ireland, Spain, France, Italy and Portugal were over-indebted and the credit markets were by now worried about their capability to service their debts, shown by their enormous debt ratios and the fact that they as well operate primary deficits or depleted surpluses, that cannot go with the primary balance-to-GDP ratio needed to stabilize debt.

The ordinary least square technique in an augmented Cobb Douglas model was employed by Obademi (2012) in examining the effect of public debt on Nigeria's economic growth. Total debt, external debt, budget deficit and domestic debt were the variables utilized for this study. He discovered that there was a significant negative relationship between debt and economic growth in the long-run although in the short-run the effect was positive. Thus, he came to conclusion that although the effect of public debt on the Nigerian economy was positive in the short-run, its effect in the long-run slow down the growth of the economy due to inefficient debt management.

Udoka & Ogege (2012) analyzed the degree of public debt crisis and its effects on economic development in Nigeria from 1970 to 2010. They used the error correction modeling framework with co-integration techniques to examine the relationship between debt service payment, foreign reserve, investment, debt stock and per-capita GDP. They discovered that political instability might decrease the level of development and that other independent variables were responsible for the country's level of underdevelopment. Thus, they proposed that public debt ought to be reduced to a minimal level in order to avoid underdevelopment of the Nigerian economy.

The sustainability of fiscal policy in Nigeria from 1980–2010 was examined by Oyeleke & Ajilore (2014) using the Error Correction Model (ECM) with the aim of finding out if the government has breached inter temporal government budget restrictions. Their findings showed that fiscal policy was inadequately sustainable in Nigeria's economy. Thus, they recommended improvement on tax revenue generation as well as other sources of income by the government with restriction of its spending to growth enhancing projects

Essien, Onumonu, Agboegbulem & Mba (2016) examined the effect of public debt on the Nigerian economy employing a number of important macroeconomic variables such as prime lending rate, headline inflation and GDP growth. Their findings revealed that while the level of external and domestic debts had no significant effect on economic growth and inflation, they had an impact on the level of interest rates prevailing in the economy during the period of study. Thus, they recommended that the present method of borrowing from the long-term market by the government through the DMO should be sustained.

Nigeria's fiscal policy and public debt sustainability was analyzed from 1990 and 2017 by Nya & Onyimadu (2019) using econometric techniques and the IMF/World Bank debt burden indicators. The results from the IMF/World Bank debt burden indicators showed that the country's debt was sustainable in the last 8–10 years implying its ability to meet its long term debt liabilities. In addition, the liquidity indicator revealed that Nigeria was able to meet its short term liabilities. With regards to fiscal policy sustainability, the empirical result using co-integration test showed that government revenues and expenditures were co-integrated; implying that fiscal policy in Nigeria was sustainable, though it was weak. Thus, they recommended that government should introduced debt ceilings so as to avert explosion of the initial stock of debt arising from arbitrary borrowings by state governments.

## 3.0 Methodology

Quasi experimental design was employed for this research; annual secondary times series data from 1970–2019 were utilized for the analysis. The researcher used descriptive statistics, unit root test, ARDL co-integration test, error correction model and stability test in assessing the relationship between the dependent variable (public debt) and the independent variables (budget deficit, interest rate, real gross domestic product and inflation). The data used for this study were obtained from the statistical bulletin of the Central Bank of Nigeria (CBN) and the National Bureau of Statistics (NBS).

## 3.1 Model Specification

The variables selected for the model was obtained from the literature. The model follows the contention of Nya & Onyimadu (2019); Aimola & Odhiambo (2021). Specifically, the study examines fiscal policy and public debt sustainability in Nigeria. In line with the above, the functional relationship between the variables is stated as:

$$PD = f(BD, INTR, RGDP, INFR) \quad 3.1$$

Specifying Eq. 3.1 in linear form becomes

$$PD = a_0 + a_1BD + a_2INTR + a_3RGDP + a_4INFL + \mu \quad 3.2$$

Where PD = Public Debt; BD = Budget Deficit; INTR = Interest Rate; RGDP = Real Gross Domestic Product; INFL = Inflation Rate;  $a_0, a_1, a_2, a_3, a_4$  = Parameters and  $\mu$  = Error term.

The economic expectations of each the parameters of the explanatory variables in relationship with the dependent variable is stated as:  $a_1 > 0$ ,  $a_2 > 0$ ,  $a_3 < 0$ ,  $a_4 > 0$

## 3.2 Estimation Technique

The research used the autoregressive distributed lag (ARDL) bounds testing approach by Pesaran, Shin, & Smith (2001) to check the existence of a co-integration relationship among the variables employed in this study. The underlying principle for adopting this technique, amongst others, is the robust capacity of the ARDL technique in evaluating short-run and long-run dynamic relationships in small sample sizes (Pesaran, Shin, & Smith 2001; Narayan & Smyth 2005; Imoisi 2020). Prior to estimating the co-integration relationship, a unit root test to ensure stationarity of the variables employed for the study was performed. Hence, the estimated ARDL specification is expressed as:

$$\Delta(\text{PD}) = \alpha_1 + \sum_{i=1}^n \beta_1 \Delta(\text{PD})_{t-1} + \sum_{i=1}^n \beta_2 \Delta(\text{BD})_{t-1} + \sum_{i=1}^n \beta_3 \Delta(\text{INTR})_{t-1} + \sum_{i=1}^n \beta_4 \Delta(\text{RGDP})_{t-1} + \sum_{i=1}^n \beta_5 \Delta(\text{INFL})_{t-1} + \gamma_1 \text{PD}_{t-1} + \gamma_2 \text{BD}_{t-1} + \gamma_3 \text{INTR}_{t-1} + \gamma_4 \text{RGDP}_{t-1} + \gamma_5 \text{INFL}_{t-1} + \mu_t \quad 3.3$$

The variables are defined in 3.2 and  $\alpha_1$  is the constants,  $\beta_1 - \beta_5$  are the respective short run coefficients,  $\gamma_1 - \gamma_5$  are the respective long run coefficients,  $\mu_{t1}$  is the mutually independent

white-noise residuals,  $\Delta$  symbolizes the difference operator,  $n$  is the lag length and  $t$  is the time period.. Long run estimates from Eq. 3.3 were subjected to the F-test to find out the existence of a long run relationship among the variables in the equation. The computed F-statistic was compared with the appropriate asymptotic critical values created by Pesaran, Shin, & Smith (2001). According to Pesaran, Shin, & Smith (2001), if the computed F-statistic exceeds the upper critical bound value; the null hypothesis of no co-integration is rejected. Conversely, if the computed F-statistic is below the lower critical bound value, the null hypothesis of no co-integration is accepted. If the F-statistic falls between the lower and upper critical bounds, the test is inconclusive. The error correction model of Eq. 3.3 is specified in Eq. 3.4.

$$\Delta(\text{PD}) = \alpha_1 + \sum_{i=1}^n \beta_1 \Delta(\text{PD})_{t-1} + \sum_{i=1}^n \beta_2 \Delta(\text{BD})_{t-1} + \sum_{i=1}^n \beta_3 \Delta(\text{INTR})_{t-1} + \sum_{i=1}^n \beta_4 \Delta(\text{RGDP})_{t-1} + \sum_{i=1}^n \beta_5 \Delta(\text{INFL})_{t-1} + \gamma_1 \text{ECM}_{t-1} + \mu_t \quad 3.4$$

Where all variables remain as defined in Eq. 3.2 and 3.3. The error-correction term is lagged once ( $\text{ECM}_{t-1}$ ) and obtained from the estimated co-integrated equation. The coefficient of the lagged error-correction term  $\gamma_1$  is estimated to be negative and statistically significant, implying the adjustment speed to equilibrium after a shock to the system.

## 4.0 Results And Discussion

### 4.1 Trend Analysis of the Variables in the Model

The graphs above displays the data for public debt (PD), budget deficit (BD), interest rate (INTR), real gross domestic product (RGDP) and inflation rate (INFL) from 1970–2019. It can be seen that public debt has been on the increase from 1970–1995 between ₦ 1.27 billion and ₦1,194.60 billion. With fluctuations in the trend from 1996 to 2008, there was a sharp increase in public debt in 2009 to 2019. Numerous factors contributed to the increased size of Nigeria's external debt and domestic debt. The major factors include the rapid growth of public expenditure, particularly that on capital projects, borrowing from the international community at non-concessional interest rates, decline in oil earnings from the late 1970s and the dependence on imports, which contributed to the emergence of trade arrears. The above developments resulted in the bunching of debt service, thus compounding the debt situation. Furthermore, upward movements in the interest rate affected the size of the external debt stock. On the other hand, it can be noticed that the trend of budget deficit reflects a mirror of public debt. This implies that most borrowings by the government were used to finance deficits in the budget as government spending overlaps the revenue generated within the period under review.

Interest rate in Nigeria was stable from 1970–1975 at 4.5%, however, due to the liberalization of interest rate by the Central Bank of Nigeria (CBN) in 1986, interest rate has been fluctuating. For instance, it rose from 10% in 1986 to 18.5% in 1990, but fell to 13.5% in 1996 and later rose to 16.25% in 2000; it rose further to 17.5% in 2009 but later dropped to 6.48% in 2019. Similarly, Nigeria's inflation rate has also been fluctuating for the period under review. For example, inflation rate fell from 13.76% in 1970 to 9.97% in 1980; it later rose to 13.01% in 1991 and dropped to 5.39% in 2007. In 2019, the inflation rate in the country was 11.40%. Real gross domestic product has been rising for the period under review. It grew from 94,686 million US dollars in 1970 to 477,162 million US dollars in 2019 growing at an average annual rate of 3.51%.

### 4.2 Descriptive Statistics Analysis of Variables

The descriptive analysis of the macro-economic variables used in this study is presented in Table 1 below.

Table 1  
Descriptive Statistics Analysis of Variables

	PD	BD	INTR	RGDP	INFL
Mean	3626.271	-490.7728	15.15880	27062.99	18.00002
Median	1046.846	-37.64385	16.75711	20166.16	12.94143
Maximum	23295.05	32.04940	29.80000	71387.83	72.80000
Minimum	1.252900	-4913.816	6.000000	4.219000	3.200000
Std. Dev.	5513.401	1054.222	6.031295	22980.71	14.97514
Skewness	2.051374	-2.758989	0.052705	0.620633	1.929049
Kurtosis	6.801445	10.12406	2.383422	2.204298	6.294941
Sum	181313.5	-24538.64	757.9399	1353150.	900.0011
Sum Sq. Dev.	1.49E + 09	54457821	1782.449	2.59E + 10	10988.48
Observations	50	50	50	50	50
<i>Source: Researchers' computation using E-views10</i>					

Mean measures the average value of the series and from table 1 above, we see that the mean for PD, BD, INTR, RGDP and INFL are 3626.271, -490.7728, 15.15880, 27062.99 and 18.00002 respectively. Median is the mid value of the series when the values are arranged in an ascending order and from the table 1, the median for PD, BD, INTR, RGDP and INFL are 1046.846, -37.64385, 16.75711, 20166.16 and 12.94143 respectively.

Maximum and minimum are the maximum and minimum values of the series in the present sample. The maximum (minimum) values for PD, BD, INTR, RGDP and INFL are 23295.05 (1.252900), 32.04940(-4913.816), 29.80000(6.000000) 71387.83(4.219000) and 72.80000(3.200000) respectively. Standard Deviation measures the dispersion in the series and from table 1 above the standard deviation for PD, BD, INTR, RGDP and INFL are 1612.76, 0.15, 2.26 and 72.04 respectively.

Skewness measures the asymmetry of the distribution of the series around its mean. The skewness of a normal distribution is zero. Positive skewness implies that the distribution has a long right tail and negative skewness implies that the distribution has a long left tail. From the above table we observe that all variables except BD have positive skewness and as such they have long right.

Kurtosis measures the peaked or flatness of the distribution of the series. If the kurtosis is above 3, the distribution is peaked or leptokurtic relative to the normal and if the kurtosis is less than three, the distribution is flat or platykurtic relative to normal. From table 1 above PD, BD, and INFL are peaked or leptokurtic while INTR and RGDP are flat or platykurtic relative to normal.

### 4.3 Unit Root Test

Prior to estimating the relationship between public debt, budget deficit, interest rate, real gross domestic product and inflation, it is imperative to test the stationarity of the variables. The Augmented Dickey-Fuller (ADF) and the Phillips-Perron (PP) unit root tests have been used to ensure that the variables are stationary and the result is presented below.

Table 2  
Unit Root Test Result

Variables	ADF – statistics	Philips-Perron	Critical values	Order of Integration
PD	6.032028	5.143139	1% level-3.571310 5% level-2.922449 10% level-2.599224	I(0)
BD	5.746659	4.635367	1% level-3.605593 5% level-2.936942 10% level-2.606857	I(0)
INTR	-10.944890	-9.035633	1% level-3.574446 5% level-2.923780 10% level-2.599925	I(1)
RGDP	-6.049902	-6.150124	1% level-3.574446 5% level-2.923780 10% level-2.599925	I(1)
INFL	-3.746911	-4.546373	1% level-3.571310 5% level-2.922449 10% level-2.599224	I(0)
<i>Source: Author's computation using E-views10</i>				

The results of the ADF and PP unit root tests in table 2 above shows that the variables are integrated at different order (i.e. I (0) and I (1)). Consequently, the study rejects the null hypothesis of a unit root in the model. The combination of both I(0) and I(1) variables would not be feasible under the Johansen method. This justifies the use of the ARDL approach which was put forward by Pesaran, Shin and Smith (2001).

Having examined the time series features of our data, the next step is to analyze the long-run relationship among the variables. However, it is a pre-requisite to choose a suitable lag length before proceeding to the ARDL co-integration test. From table 3 below, Lag 2 is deemed as the suitable lag length for the series and it is utilized in computing the F-statistics for co-integration based on the minimum values of FPE, AIC, SC and HQ criterion as shown below.

Table 3  
Lag Length Selection

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-237.3823	NA	1187427.	15.72178	16.00861	15.78155
1	-198.76154	80.02368	50071.80	12.54706	12.78061	12.62177
2	-195.0867*	5.028521*	40704.01*	12.36207*	12.64231*	12.45172*
3	-195.0862	0.000620	43721.82	12.42871	12.75565	12.53330
4	-194.2685	1.061748	454777.43	12.44754	12.82118	12.56706
5	-192.1006	2.024053	41588.03	12.27166	12.81002	12.50414
6	-192.1776	0.020351	454812.62	12.43482	13.02309	12.58423
<i>Source: Author's computation using E-views10</i>						

### 4.3 ARDL Bounds Co-integration Test

The results of the ARDL bounds co-integration test is revealed in Table 4 below. It enables us to know if a long run relationship exists among the variables in the model.

Table 4  
ARDL Bounds Co-integration Test

F-Bounds Test		Null Hypothesis: No levels relationship		
Test Statistic	Value	Signif.	I(0)	I(1)
Asymptotic: n = 1000				
F-statistic	22.85640	10%	2.2	3.09
K	4	5%	2.56	3.49
		2.5%	2.88	3.87
		1%	3.29	4.37
<i>Source: Author's computation using E-views10</i>				

Table 4 above shows that the calculated F-statistic exceeds the upper bound critical value. Thus, the research rejects the null hypothesis of no co-integration, indicating the existence of a long-run relationship between public debt, budget deficit, interest rate, real gross domestic product and inflation.

#### 4.4. Long-Run and Short-Run Estimates

Given the presence of a long-run relationship between public debt and the regressors, long run and short run estimates were estimated for Eq. 3.3. These results are presented in Table 5 below.

Table 5  
Long-Run and Short-Run Estimates

Panel A: Long-run coefficients (dependent variable is PD)			
Regressors	Coefficient	T-statistic	P-value
Constant	-192.5562	-0.779436	0.4400
Budget Deficit	1.528778	6.367195	0.0000
Interest Rate	31.06324	1.615028	0.1136
Real Gross Domestic Product	0.011102	1.286692	0.2051
Inflation Rate	-8.007973	-1.215186	0.2309
Panel B: Short-run results (dependent variable $\Delta$ PD)			
Regressors	Coefficient	T-statistic	P-value
$\Delta$ Budget Deficit	2.056671	6.548584	0.0000
$\Delta$ Interest Rate	19.81846	0.742585	0.4620
$\Delta$ Real Gross Domestic Product	0.013737	0.363014	0.7185
$\Delta$ Inflation Rate	-4.432614	-0.639124	0.5263
ECM <sub>t-1</sub>	-0.255401	-3.177092	0.0028
R <sup>2</sup> = 0.695710		Adjusted R <sup>2</sup> = 0.651180	
F- statistic = 15.62334		Prob (F statistic = 0.000000)	
<i>Source: Author's computation using E-views10</i>			

The long run and short run results presented in Table 5 (Panel A and Panel B) reveals that the coefficient of budget deficit is positive and statistically significant, irrespective of the period. For instance, a unit increase in budget deficit brings about a 1.53 unit increase in public debt in the long run and a 2.06 unit increase in public debt in the short run. These results imply that budget deficit plays an important role in public debt levels in Nigeria, both in the long-run or in the short-run. An apparent implication of this result is that public debt in Nigeria is caused by government budget deficit, both at the federal and state levels. The reason for government budget deficit might be attributed to the rapid increase of government expenditure, particularly that on capital projects such as the construction of Abuja – Kaduna railway; Lagos – Ibadan railway; construction of the 2nd river Niger bridge; 3050MW Mambilla Hydro Power Plant etc. This finding is consistent with the studies of Warega (2012), Folorunso & Falade (2013), Uguru (2016) and Liyambo & Kaulihowa (2020) that discovered a positive connection between public debt and budget deficit.

The result also reveals that though the coefficient of interest rate is positive both in the short run and long run, it was statistically insignificant irrespective of the period and thus had no impact on public debt. Contrary to the expectation of the study, the coefficient of real gross domestic product as shown from the result is positive both in the short run and long run, however, it was statistically insignificant irrespective of the period, hence, it had no effect on public debt. Similarly, the negative coefficient of inflation rate as seen from the result is different from the expectation of the study and it was statistically insignificant both in the short run and long run.

The coefficient of the ECM (-1) as seen from the result is -0.255401 and it is statistically significant with a P value of 0.0028. This signifies that the speed of adjustment between the short run dynamics and the long run equilibrium is 25.54% in absolute value. The computed coefficient of determination ( $R^2 = 0.695710$ ) shows that approximately 70% of the total variation in public debt is accounted for by the variation in budget deficit, interest rate, real gross domestic product and inflation rate while about 30% of the total variation in public debt is attributed to the influence of other factors not included in the model for the period under review. The F – statistics of 15.62334, with p value of 0.000000 implies that the influence of budget deficit, interest rate, real gross domestic product and inflation rate on public debt is statistically significant.

## 4.5 Residual Diagnostic Result

To ensure the robustness of the estimates, a number of diagnostic tests were carried out. These include the test for autocorrelation using the Breusch-Godfrey Serial Correlation LM Test, the heteroskedasticity test using the White test and the normality test was performed using the Jarque-Bera. Table 4 below illustrates these results from the diagnostic tests.

Table 6  
Diagnostic Test Results

Test	Null Hypothesis	Prob. Val.	Prob. (5%)
Langrage Multiplier (LM)	No serial correlation 0.8	0.36	0.05
Test	Null Hypothesis	JB value	Prob. (5%)
Jarque Bera (JB)	There is a normal distribution	4.47	0.03
Test	Null Hypothesis	X <sup>2</sup> cal	X <sup>2</sup> tab
White (CH sq)	No conditional heteroskedasticity	14.25	17.12
<i>Source: Author's computation using E-views10</i>			

From Table 6 above, no econometric quandary was discovered meaning that the error terms in the short run models are normally distributed, free of heteroscedasticity and have no serial correlation.

## 4.6 Stability Test

To test the stability of the long-run coefficients along with the short-run dynamics, the cumulative sum (CUSUM) is applied. A graphical representation of CUSUM is depicted below.

Figure 3 above shows the cumulative sum (CUSUM) tests, which imply no structural instability in the residuals of equation which characterizes the dynamics of public debt with respect to budget deficit, interest rate, real gross domestic product and inflation rate. Figures 2 depicts that the plot of the CUSUM statistics fluctuate within the 5% critical bounds. Therefore, the estimated coefficients are stable over the period under review from 1970 to 2019.

## 5.0 Conclusion And Recommendations

This paper examined the relationship between fiscal policy and public debt sustainability in Nigeria by employing the ARDL bounds testing approach to discover the long run equilibrium relationship. Interest rate, real gross domestic product and inflation rate were added to budget deficit to form multivariate framework from 1970 to 2019. The result from the ARDL bounds test reveal the presence of a long run relationship between budget deficit, interest rate, real gross domestic product, inflation rate and public debt. The coefficient of budget deficit is positive and statistically significant both in the short and long run, implying that a rise in budget deficit increases public debt. However, it was discovered that interest rate, real gross domestic product and inflation rate were statistically insignificant irrespective of the period and therefore had no impact on public debt. The findings from this paper provide economic policy makers a better understanding of the importance of an effective fiscal policy on public debt sustainability. This is because fiscal policy is essential in ascertaining the limits of public debt which ought to reveal the presence of budget deficit. In addition, research into this subject matter increases the knowledge of improved public debt sustainability due to effective fiscal policy. Therefore, it is very important to find a balance between effective fiscal policy and sustainability of public debt by economic policy makers. Based on this, the following recommendations were proffered: the budgeting procedure at the federal and state levels need to reassessed to make sure that allocative efficiency is achieved in the budgeting system; budget deficit financed through internal and external borrowing must be carried out in an objective and realistic manner; introducing zero based budgeting and planning programming budgeting system in our public finance both at the federal and state levels to replace the present system of incremental budgeting.

## Declarations

### Availability of data and materials

The datasets generated and/or analysed during the current study are available publicly and electronically in the [Central Bank of Nigeria 2019] and [National Bureau of Statistics] repository, [<http://statistics.cbn.gov.ng/cbn-onlinestats/>] and [<https://nigerianstat.gov.ng/elibrary>]

### Competing interests

The author declare that he has no competing interests" in this section.

### Funding

Not Applicable

## Authors' contributions

The corresponding author solely contributed to the entire work

## Acknowledgements

Not Applicable

## Ethics approval and consent to participate

This article is original, has not already been published in a journal, and is not currently under consideration by another journal

## Consent for publication

The author has given his consent for publication of the article.

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## Figures

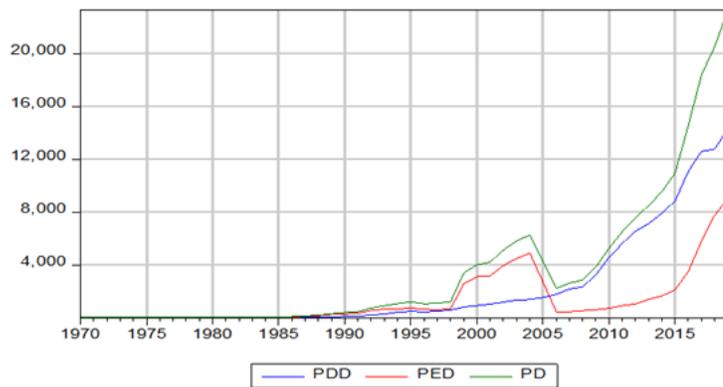


Figure 1

Trends of Nigeria's Public Domestic Debt, Public External Debt and Public Debt from 1970-2019) Source: Author's Compilation 2021

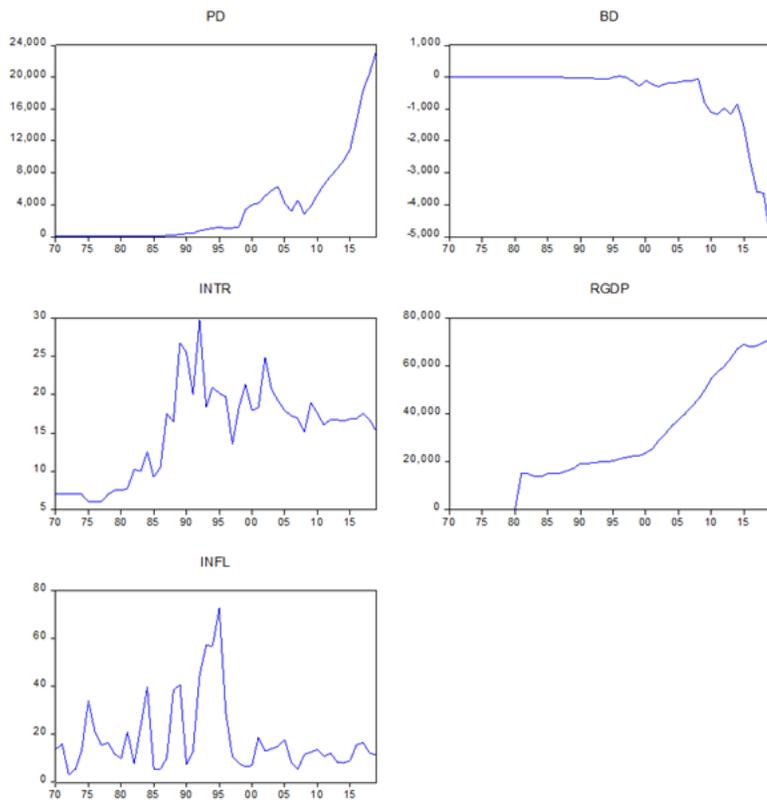


Figure 2

Trends of Public Debt, Interest Rate, Real Gross Domestic Product and Inflation Rate from 1970 - 2019 Source: Author's Compilation 2021

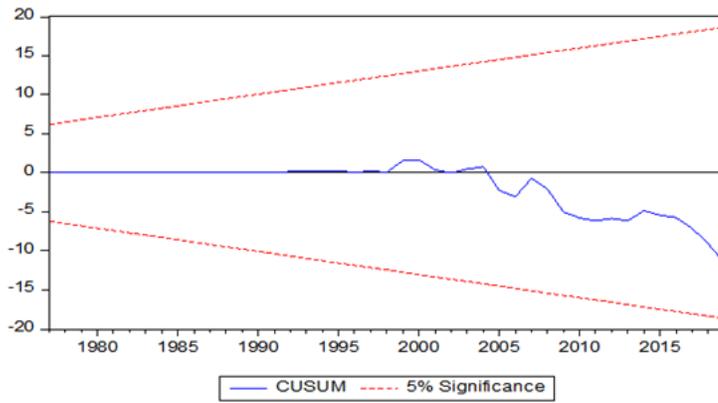


Figure 3

Stability Test Source: Researchers' computation using E-views10