Public debt and infrastructural Development in Nigeria

Abstract

The objective of this paper is to examine the differential effects of the composition of public debton infrastructural development in Nigeria from 1986 to 2021 usingAutoregressive Distributed Lag Model (ARDL) and Error Correction Model as the major econometrics' techniques of analysis.The Keynesian Growth theory was employed and the sample period covered 36 years with data obtained from World Bank Indicators (WDI) database and Nigerian Central Bank Statistics Bulletin (CBN, 2024).From the findings, the CointEq(-1) has 94% speed of adjustment to the long run or equilibrium value. The short-run findings show that external debt, debt servicing and exchange rate are statistically significant with negative influence on Access to Electricity (AE) as a proxy forinfrastructural development, while only domestic debt exhibits positive impact in the short-run.In the long-run, both domestic and external debts have positive long-run impact on AE. However, debt servicing, inflation rate and interest rate have negative impact on AE in the long run. The study concludedthat external dept has not been impactful on infrastructural development in Nigeria. It is therefore recommended that Nigeria government should cut down excessive external borrowings inorder to keep down the negative impact of debt servicing. Also,economics policy that will ensure macroeconomic stability such as price stability, job creation, increased output, political stability should be adopted.

Key words: External Debt, Domestic debt, Infrastructure, Development, Debt servicing.

1.0 Introduction

Public debt and infrastructural development in Nigeria have become critical topics due to the country's rising debt levels and the need to address infrastructure gaps. The increasing public debt in Nigeria has raised concerns about its impact on economic growth, investment, and the ability to finance critical infrastructure like electricity, education, and healthcare. Nigeria's public debt reached $108.3 billion in 2023, marking a significant increase of 123% since 2012, far outpacing the country's GDP growth rate.

The rise in debt is attributed to various factors, including the COVID-19 pandemic and global economic pressures, leading to challenges in servicing the debt and hindering development efforts. The composition of Nigeria's debt has shifted towards more external borrowing, with external debt accounting for a larger share of the total debt from 14% in 2012 to 40% in 2022.

Infrastructural developmentrefers to a general condition of advancement of the basic organizational and physical structures and facilities, such as buildings, roads, and electrical power that are required for the operation of a society or industry. Given the extent of government's constant demand for loans and inability to generate sufficient revenue to cover her recurrent budgetary expenses over the past five years have raised serious concerns and queries about the long-term implications of debt accumulation. For instance, in Q4 2023, Debt Management Office (DMO, 2023) reported that Nigeria now owes N97.34 trillion or USD108.23 billion in national debt, which represents 46% rise over the N66.25 trillion or USD103,110.84 billion values recorded as at December 31, 2022.

This raises serious concern to investors because inv5estors are also worried about high debt-to-GDP ratios since they may hinder a country's stride for economic development (Saungweme and

Odhiambo, 2019). Ekperiware and Oladeji (2012) also asserted that decision-makers and multilateral lenders can gain trustworthy insight and understanding about a nation's capacity to pay back its obligations by analyzing the ratio of public debt to GDP of the nation. For instance, Nigeria's debt to GDP ratio has risen from 29.17 in 2019 to 43.74% as at 2023. This is can be considered so high when compared to the debt to GDP ratio recommended for developing nations by the International Monetary Fund (IMF, 2023).Besides, even while public debt could stimulate the economy, it can also result in debt distress when it becomes unmanageable (IMF 2020). Debt defaults can also result in market access losses, increased borrowing costs, and the loss of a valuable asset to the lender (UNCTAD, 2022). For example, in December 2017 China take-over the management of Hambantota Port from Sri Lanka's for 99 years due to $8 billion debt (Benabdallah, 2018). Similarly, the higher debt payment may be over-bearing, adversely affecting efforts to achieve targeted economic development policy objectives (Johnny &Johnny Walker, 2018).

Of course, Nigeria's successive governments have claimed and maintained that the country has made great strides in the provision of critical infrastructure and basic needs, but the reality is that, Nigerians are worse-off on international development metrics like Global Infrastructure Outlook. According to the Global Infrastructure Hub's (2017) forecast, between 2016 and 2040, the global economy would invest roughly $3.7 trillion annually to boost infrastructure, which is 20% greater than the trend in GDP. The finance gap will also quadruple when the additional investment needed to achieve SDGs, targets is taken into account (Alaeddine, 2022). Despite the Federal Government's assertion that it has borrowed money to build infrastructure, the World Bank (2021) rated Nigeria's infrastructure quality low. World Bank (2021) argued that Nigeria's gap in infrastructural development in 30 years to come will probably approach $3 trillion. It states, "Nigeria is ranked 132 in the 2018 by Global Competitive Index out of 137 nations for

infrastructure index, demonstrating the poor level and quality of the nation's infrastructure". It concluded that Nigeria infrastructural development is among the worst in the world, which suggested a need for significant public spending.

According to a World Bank survey (2017), one of the most important infrastructures in Nigeria is energy access, which also seems to be one of the main problems facing Nigerian businesses. According to a survey of 1,891 businesses, there were typically 27 power outages per month, which is more above the global and regional averages. Also, Energy Progress Report (2022) stated that Nigerians electricity access low in the world, with 92 million of its 200 million residents living without electricity access. According to Ogundipe et al., (2015), the lack of power has been a serious issue in Nigeria. Adesoji, (2009) also buttress this assertion," The main infrastructure difficulty that Nigeria is currently facing is the investment in power supply", even though all vital infrastructures are necessary to guide economic development.Also, Odili, 2022, asserts debt service to income ratio is over 60% in Nigeria, meaning that for every N100 earned, it spends N60 on debt servicing, which is far above World Bank recommendation of 22.5%.

Finally,Several empirical studies (Mbah, Umunna&Agu, 2016; Onwuka, C. E. (2021).Udofia&Akpanah, 2016; Ugwuegbe, Okafor &Azino, 2016; Ndubuisi, 2017; Elwasila, 2018; Matuka&Asafo, 2018; Matandare& Tito, 2018; Said & Yusuf, 2018; have examined the relationship between public debt and infrastructural development using input variables, such as government capital expenditure, capital expenditure, etc., which according to economic standards can only result in economic growth. Unlike previous studies, since the focus of this study is on development, emphasis on infrastructural development will be shifted to output indicator, represented by Access to Electricity (AE) as percentage of population.

2.0 Literature review

This covers theoretical and empirical literature on public debt and infrastructure

2.1.1 Theoretical literature:Threetheories are considered suitable for this study:

2.1.1.1 Keynesian theory of public debt

John Maynard Keynes developed the public debt theory in 1935 and argued that debt does not obstruct an economy's growth and development but rather raises the value of that growth and development. He continued by saying that this value may be reached if the debt taken on was used to finance profitable and beneficial capital projects (Keynes, 1936). According to the argument, borrowing must be necessary for economic development and growth in developing nations. Therefore, capital projects must be the focus of the money. The country will undoubtedly fall into debt traps if this money is not used into capital development. According to Keynes' public debt theory, debt accumulation through capital accumulation is an important aspect to take into account when evaluating the overall rate of economic growth. In support of this claim, Habib and Zurawicki (2002) contend that domestic income, foreign aid, and direct foreign investment can all be used to increase capital formation that will lead to economic growth. This does not signify that significant borrowing leads directly to economic growth.

2.1.1.2 Dual gap model

The concept, which is an expansion of the Harrod-Domar growth model, was put forth by Chenery in 1966. While the Model is relevant in an open economy, the Harrod-Domar model deals with closed economies. The two gap model postulates existence of two gaps which are: first, the expansion of less developed nations is hampered by an imbalance between national savings and investment, where domestic savings are not enough to support the rate of development. Second, the foreign exchange gap, which happens when capital transfers plus

import value are not enough to support the rate of growth in imports. This model is commonly employed to investigate the necessity of borrowing foreign capital or receiving foreign aid in order to bridge the two disparities that exist in developing and less developed countries. According to Rostow's thesis, "Stages of Economic development," it will be simpler for economics to advance to the take-off stage if the gap is closed (Rostow, 1960; Summers, 1987; Barro, 1991)

2.1.2 The debt overhang hypothesis

The notion of the debt overhang contends that excessive borrowing causes high debt that may lead to debt traps and consequently hamper economic development. The debt overhang hypothesis states that anticipated debt servicing costs may deter further domestic and international investment if there is a chance that the government debt may grow in the future beyond the country's ability to pay back. Prospective investors may be deterred by the notion that as production rises, governments would tax them more harshly in order to pay off the public debt, resulting in an avoidance of current investment costs in order to raise output in the future (Gordon &Cosimo, 2018).

2.2 Empirical Review

This subsection covers a few empirical studies from Nigeria and other countries that look at the connection between Public debt and infrastructural development.

2.2.1 Public Debt and Infrastructural Development

Amaefule and Ernest (2016) assessed how borrowing by the government affects infrastructure development as measured by capital expenditures made by the Nigerian federal government between 1986 and 2015. The OLS Regression technique was utilized to ascertain the relationships between the variables. The findings indicated a transient relationship between the variables. The analysis also revealed that there was no relationship between capital spending and

foreign debt, but a positive correlation between capital spending and domestic debt for the federal government.

Aladejana*et al.* (2021) examined Nigeria's debt load and its effects on the country's infrastructure development from 1986 to 2019. The study used Fully Modified Ordinary Least Squares (FMOLS) estimation techniques on yearly time-series data. The findings demonstrated that, while the relationship between external debt and infrastructure development is negative and not statistically significant during the study period, the relationship between domestic debt and infrastructure development exhibited a positive and statistically significant relationship.

Using annual data from 1978 to 2015, Thilanka and Ranjith (2018) investigated how Sri Lanka's public debt affects private investment. The study used a few econometric techniques, including the unit root test, the Johansen co-integration test, and lastly the Vector Error Correction Model (VECM), to determine the long-term effect. The study's empirical results demonstrated that public debt has a long-term crowding-in effect on private investment, indicating that the government has redirected borrowing money to support the private sector. Additionally, real GDP influences private investment favorably, indicating that the economy will inevitably continue to grow.

Ogunjimi (2019), using an ARDL approach, looked at the effects of the public debt stock's composition on various kinds of investment in Nigeria from 1981 to 2016. The findings showed that internal borrowing encourages investment by the public and private sectors. While external debt deterred private investment over the long term, domestic debt discouraged investment by the public as well. Kehinde et al. (2015) used the Vector Error Correction Model (VECM), the Johansen Cointegration test, and the Auto-Regressive Distributed Lag (ARDL) to investigate the impact of Nigeria's public debt on private investment. Their long-run and short-run findings indicated that internal loans discouraged domestic investment, which is in stark contrast to

Ogunjimi's (2019) findings. The outcome, however, shows that over time, external debt drove out domestic investment.

However, some others contended that debt-driven infrastructure improvements have no beneficial effect on the overall economic performance of a country (Soludo, 2004; Mojekwu and Ogege, 2012; Essien, Ngozi, Michael, and Ogochukwu, 2016; Isibor, Babajide, Akinjare, Oladeji, and Osuma, 2018). The lack of general agreement on the issue has made it necessary to look into the relationship between public debt and infrastructure development.

3.0methodology

To achieve the differential impact of domestic and external debt on infrastructural development, the study makes use Autoregressive Distribution Lag (ARDL)and Vector Error Correction Model (ECM) to capture the degree of impact in the short run and long run period of study.

3.1 Theoretical Framework and Model specification

The focus of this study is to examine the differential effects of the composition of public debt on infrastructural development in Nigeria. The theoretical foundation of the study revolved around the Keynesians propositions that the government intervention in economic activities can help spur long term growth by ensuring efficiency in resource allocation, regulation of markets, stabilization of the economy and infrastructural development (Keynes, 1936). According to Keynes, government spending, if exceeds government revenue can be augmented with the public debt to boost economic activities. However, such debts will achieve the intended results only if it expended on infrastructural projects which are expected to stimulate private investment. In addition, while Neoclassical school of thought believed that government actions cause distortions to private investment thereby retards economic growth, Keynes believed that government policy actions that lead to internalization of externalities by private agents may induce efficiency in

resource allocation, stimulate private investment and foster growth (For instance, while public expenditure may displace private sector output, it may also improve private sector productivity). Therefore, fiscal policy variables could be manipulated to enhance economic growth through their influence on private investments with the relatively significant role of government in the capital formation especially in developing countries (Blejer& Khan, 2001; Sorensen, 1992).

3.2 Model specification

The differential impact of Domestic debt, external debt and other control variables on Infrastructural Development Index (IFD) are therefore specified as follows:

$$IFD_t = b_{10} + \Sigma_{i=1}^{p} a_{11} IFD_{t-1} + \Sigma_{i=1}^{p} a_{21} D.DEBT_{t-1} + \Sigma_{i=1}^{p} a_{31} E.DEBT_{t-1} + \Sigma_{i=1}^{p} a_{41} lnAGG.EX_{t-1} + \Sigma_{i=1}^{p} a_{51} DEBT\text{-}SER_{t-1} + \Sigma_{i=1}^{p} a_{61} EXC.RATE_{t-1} + \Sigma_{i=1}^{p} a_{71} INF.RATE_{t-1} + U_{it}$$

Where,

b_{10} = intercept in the models

p = lag of both dependent and independent variables

a_{j1} = coefficient of the independent variables (where j = 1,2,3 4,5,6,7)

U_{it} = vector of error terms

Definition of Terms

IFD –this represents infrastructural development refers to the creation and improvement of foundational products and services aimed at enhancing the quality of life and fostering long-term economic growth. This is proxy by Access to Electricity.

D.DEBT – this represents domestic debt which is the component of the total government debt in a country that is owed to lenders within the country.

E.DEBT –this is the external debt which is the portion of a country's debt that is borrowed from foreign lenders, including commercial banks, governments, or international financial institutions.

AGG.EX – this represents the aggregation of total government spending which comprises of current and capital expenditure.

DEBT.SER – this is the debt servicing which refers to the money required to cover the payment of interest and principal on a loan or other debt for a particular time period. The term can apply both to individual debts and government debt such as business loans and debt-based securities such as bonds.

EXC.RAT –An exchange rate is a relative price of one currency expressed in terms of another currency.

INF.RAT –Inflation rate which captures the general price level rises, consequently, inflation rate corresponds to a reduction in the purchasing power of money (Walgenbach, Dittrich, & Hanson, 1973)

4.0 Empirical Results

It is important to run descriptive summary of all variables and other diagnostic before starting the estimating technique. Table 1 below shows the descriptive statistics and properties of the variables.

Table 1 Descriptive Statistic of Variables

	AE	D_DEBT	E_DEBT	AGG__EXP	INF_RAT	DEBT_SER	EXC_RAT
Mean	44.84533	3871.372	2166.179	2668.858	19.44256	2.542914	122.9967
Median	46.49368	1350.005	806.8600	1344.044	12.70720	1.933496	123.1931
Maximum	59.30000	15121.61	7945.430	11667.62	72.83550	6.521339	401.1520
Minimum	25.30000	28.44000	41.45000	16.22370	5.388008	0.100218	1.754523
Std. Dev.	9.897696	4801.974	2335.226	3071.509	17.57477	2.065407	109.2979
Skewness	-0.568622	1.123782	1.150676	1.330236	1.737863	0.523826	0.861062
Kurtosis	2.259490	2.782641	3.064042	4.067682	4.700181	1.919113	3.019887
Jarque-Bera	2.762520	7.648189	7.950486	12.32709	22.45693	3.398834	4.449157
Probability	0.251262	0.021838	0.018775	0.002105	0.000013	0.182790	0.108113
Sum	1614.432	139369.4	77982.43	96078.87	699.9322	91.54489	4427.882
Sum Sq. Dev.	3428.753	8.07E+08	1.91E+08	3.30E+08	10810.54	149.3067	418111.2
Observations	36	36	36	36	36	36	36

Author's computation

Table 1 above shows the descriptive statistics as provided in the raw data of the variables used in this study. It is evidence that both mean and median values of each variable fall within their corresponding maximum and minimum values, which is an indication of high level of consistency. If otherwise, it implies that data series are not normally distributed.

The Access to Electricity (AE) and Debt Services appeared to maintain low standard deviation values, implying low level of changes over the years under consideration, while domestic debt, external debt, aggregate expenditure and exchange rate maintain relatively high volatility.

Table.2 Correlation Matrix

Variables	AE	D_DEBT	E_DEBT	AG__EXP	INF_CP	DT_SER	EX_Rt	RINT
AE	1.000							
D_DEBT	0.753	1.000						
	0.000							
E_DEBT	0.595	0.747	1.000					
	0.000	0.000						
AGG__EXP	0.758	0.962	0.756	1.000				
	0.000	0.000	0.000					
INF_CP	-0.425	-0.294	-0.239	-0.326	1.000			
	0.010	0.082	0.161	0.053				
DEBT_SER	-0.757	-0.570	-0.339	-0.585	0.578	1.000		
	0.000	0.000	0.043	0.000	0.000			
EXC_RATE	0.834	0.941	0.848	0.954	-0.378	-0.623	1.000	
	0.000	0.000	0.000	0.000	0.023	0.000		

Source: Author's Computation, 2024.

From the table 2, while D. DEBT, E_DEBT, AGG_EXP, and EXC_RATE have positive relationship withAE, DEBT_SER and INF-CP have a negative relationship. It can also be observed from the table that correlation coefficients above the threshold of 0.8, indicating the tendency for presence of multicollinearity in the model surfaced only in the control variables, especially in Government Aggregate expenditure and exchange rate. Hence, the little concern about multicollinearity.

4.1. Unit Root Test

It is important to carry out unit-root test to determine the stationarity of each of the variable series so as to justify the model's estimation techniques employed in this study and also to avoid spurious regression. This study employs Augmented Dickey-Fuller (ADF) and Philips-Peron (PP) test and the test was conducted using the available roots (with constant, with constant and trends and without constant and trend). The results of the unit root test are shown mixture of I (1) and I (0) in the table.3 below.

Table 3: The Results Summary of Augmented Dickey-Fuller and Phillips-Perron Tests

Phillips-Perron (PP)				**Augmented Dickey-Fuller (ADF)**		
Variable	Level	First Difference	Order of Integration	Level	First difference	Order of Integration
AE	0.12	0.00***	I (1)	0.00***		I (0)
LD_DT	0.07	0.00***	I (1)	0.52	0.04**	I (1)
LE_DT	0.21	0.00***	I (1)	0.45	0.01***	I (1)
LAGEX	0.01***		I (0)	0.04**		I (0)
LEX_RT	0.03**		I (0)	0.06	0.00***	I (1)
DT_SER	0.37	0.00***	I (1)	0.33	0.00***	I (1)
INF_CP	0.54	0.00***	I (1)	0.00***		I (0)

Note: (***) and (**) indicate 1 percent and 5 percent levels of significance respectively.

Source: Author's Computation, 2023.

4.2 **Cointegration Test**

The Result of Bound Test and Pesaran et al (2001) Critical Value in the model

Table 4 Null Hypothesis: No long-run relationships exist

Test Statistic	Value	K
F-Statistic	6.7548	7
Critical Value Bounds		
Significance	I(0) Bound	I(1) Bound
10%	2.03	3.13
5%	2.32	3.50
2.5%	2.60	3.84
1%	2.96	4.26

Source: Author's Computation, 2024.

Table 4 shows the bound test for the model. The comparison of F-statistics value (6.75) from the bound test to the critical values of lower bound (2.32) and upper bound (3.5), exceed their corresponding lower and upper bounds at 5 percent level of significance which imply that the null hypotheses of no long-run relationship among the variables for each of the models be rejected. Therefore, there is long run relationship between the dependent variable and the independent variables.

4.3.1 **Hypothesis 1**

H0: No significant relationship between Public debt and Nigeria infrastructural developmentin the short run

H1: Significant relationship exist between Public debt and Nigeria infrastructural development in the short run

4.3.2 **Hypothesis 2**

H0: No significant relationship between Public debt and Nigeria infrastructural development in thelong run

H1: There is a significant relationship between Public debt and Nigeria infrastructural development in the long run

4.4. Estimating ARDL ECM Result of Hypothesis 1

The short-run analysis results of the differential impacts of domestic and external debt on infrastructural development proxy by Access to Electricity show that domestic debt, debt servicing and exchange rate are statistically significant. Domestic debt had a positive impact, while external debt, debt servicing, aggregate expenditure, inflation, exchange rate and real interest rate had negative impact in the short run. The result is inagreement with Abula and Ben (2016) position that foreign loans and their servicing had an adverse effect on Economic development in short run.

Table 5 ARDL ECM Result of Model

Dependent Variable: LAE; Selected Model: ARDL(1, 2, 1, 0, 2, 2, 1, 1)

Cointegrating Form				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob**
D(LD_DEBT)	0.164011	0.058264	2.814949	0.0125
D(LD_DEBT(-1))	0.147372	0.073408	2.007578	0.0619
D(LE_DEBT)	-0.024015	0.037667	-0.637562	0.5328
D(LAGG__EXP)	-0.019608	0.058207	-0.336871	0.7406
D(LDEBT_SER)	-0.063494	0.023417	-2.711422	0.0154
D(LDEBT_SER(-1))	-0.039577	0.014837	-2.667486	0.0169
D(LEXC_RATE)	0.079927	0.058797	1.359378	0.1929
D(LEXC_RATE(-1))	-0.082129	0.034989	-2.347268	0.0321
D(INF_CP)	-0.001402	0.001043	-1.345269	0.1973
D(RINT)	-0.001508	0.001860	-0.810781	0.4294
CointEq(-2)	-0.941637	0.158483	-5.941574	0.0000

Cointeq = LAE - (0.1102*LD_DEBT + 0.0856*LE_DEBT -0.0208 *LAGG__EXP -0.0524*LDEBT_SER -0.0476*LEXC_RATE -0.0039 *INF_CP -0.0059*RINT + 2.8306)

Source: Author's Computation, 2024.

Also, the coefficient shows 94% speed of adjustment to long run if there arise a distortion in the short run. The model R-squared is 0.83 denoting that 83% variation in infrastructural development (FD) is explained by the explanatory variables (domestic and external debt) and the

other control variables (debt service, aggregate expenditure, exchange rate, inflation rate and real interest rate) in the short run.

4.5 Long RunARDL Result of Hypothesis 2

From Table 6 below, domestic debt, external debt, debt service, inflation rate and interest rate were significant and had a long run impact on Access to Electricity. Both domestic and external debts have positive long-run impact on AE. A 1% increase in domestic and external debt the long run, will lead to 0.11 and 0.08 increase in AE respectively. Debt servicing, inflation rate and interest rate have negative impact on AE. 1% increase in debt service, will lead to 0.05 reduction in AE, while a 1% increase in inflation rate and interest rate will lead 10% falls in AE. Though aggregate expenditure and exchange rate are insignificant, yet they have negative impact on AE in the long run.

Table 6 Long Run ARDL Coefficients of Model 2

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LD_DEBT	0.110205	0.043419	2.538147	0.0219
LE_DEBT	0.085586	0.032784	2.610600	0.0189
LAGG__EXP	-0.020823	0.062594	-0.332676	0.7437
LDEBT_SER	-0.052410	0.024715	-2.120582	0.0499
LEXC_RATE	-0.047554	0.057266	-0.830412	0.4185
INF_CP	-0.003892	0.001548	-2.514963	0.0230
RINT	-0.005878	0.002567	-2.290066	0.0359
C	2.830613	0.147675	19.167890	0.0000

Source: Author's Computation, 2023.

5 Conclusion

The study concluded that both domestic and external debt have positive long run impact on infrastructural development, however, in the short run, only domestic debt exerts positive influence on infrastructural development. Debt service, inflation rate and interest rate also erode the potentials of Nigerians to infrastructural development drive in the long run. To achieve substantial improvement and significant increase in infrastructural development level in Nigeria, it is therefore recommended that, since domestic and external debts have not impacted

infrastructural development significantly despite their surge in the recent years, there is need for Nigerian government to review how the borrowed funds were spent and redirect the use of public fund to more profitable venture while preventing linkages. Government must also put in place adequate measures to reduce the cost of debt servicing in order to have more income that will be channeled to improve health condition, education and poverty and put the economy on the part of development. Since inflation and interest rateswere also established as impediments to infrastructural development, there is need toembark on aggressive policies aimed at reducing cost of borrowing to stimulate private investment thereby boosting productivity which is expected to bring down inflation rate.

Disclaimer (Artificial intelligence)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of manuscripts.

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