

Does Population Growth Affect Public Debt in Nigeria

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Abstract

The study investigates the relationship between population growth and public debt in Nigeria over the period 1986-2024. Annual time series data on real gross domestic product (RGDP), gross fixed capital formation (GFCF), interest rate (INTR), labour force (LAB), and population (POP) were utilized. The analysis employed the Autoregressive Distributed Lag (ARDL) model, given that the variables exhibited a mixed order of integration, $I(0)$ and $I(1)$. The empirical results reveal the existence of a long-run equilibrium relationship between population growth and public debt. Specifically, increases in real GDP and expansion in the labour force were found to mitigate debt pressures. The computed F-statistic of 4.684 exceeds the upper bound critical value ($I(1) = 3.920$) and the lower bound ($I(0) = 2.734$), confirming the presence of cointegration among the variables. Furthermore, the error correction term indicates that approximately 82% of deviations from the long-run equilibrium are corrected annually, provided that appropriate macroeconomic policies are implemented. Additionally, the causality analysis establishes a bidirectional relationship between population growth (POP) and public debt (DS). Based on these findings, the study recommends that the government intensify investment in human capital development, particularly in education, healthcare, and vocational training. Such investment would enhance the productivity of the growing population, stimulate economic growth, and improve revenue generation, thereby reducing the country's dependence on external borrowing.

Keywords

Population Growth, Public Debt, Hypothesis Testing

Jel Codes: J1, H63, C12

1. Introduction

Public debt remains elevated due to pandemic-era stimulus, ongoing geopolitical tensions, and rising interest rates. According to the International Monetary Fund, total global public debt is projected at around 91% of GDP—down slightly from its 2020 peak but still significantly higher than pre-pandemic levels. In Africa, public debt levels have become increasingly concerning. The IMF and World Bank report that over 22 African countries are now at high risk of or already in debt distress, up from 15 in 2019 [1]. Countries such as Ghana, Zambia, and Ethiopia have entered debt restructuring negotiations under the G20 Common Framework, while others like Kenya and Egypt face mounting repayment pressures. Africa's debt sustainability is strained by currency depreciation, sluggish revenue growth, high external debt exposure, and rising global interest rates. On average, Africa's debt-to-GDP ratio is over 60%, with external debt service consuming an increasing share of national budgets—often at the expense of health, education, and infrastructure spending [2].

Nigeria, Africa's most populous country, faces a critical policy dilemma at the intersection of rapid population growth and rising public debt. As of 2024, Nigeria's population was estimated at over 223 million and is projected to exceed 400 million by 2050, making it the third most populous country globally. This explosive population growth has placed immense pressure on infrastructure, education, healthcare, and job creation, driving increased government spending [3]. However, this growing expenditure has not been matched by sufficient revenue mobilization. Nigeria's total public debt rose to ₦97.3 trillion (approximately \$108 billion) by the end of 2023, with external debt accounting for a significant share. Alarmingly, debt servicing now consumes more than 90% of government revenue, severely limiting fiscal space for developmental investment.

To address these issues, several policies have been initiated: the National Development Plan (2021-2025), which aims to boost revenue generation, reduce poverty, and invest in infrastructure and human capital; the Strategic Revenue Growth Initiative (SRGI) by the Federal Ministry of Finance, designed to expand the tax base and improve collection efficiency; the Debt Management Strategy (2020-2023), which seeks to rebalance the public debt portfolio toward longer-term and concessional financing; and the National Population Policy (2021), which aims to manage population growth through family planning and reproductive health services [4].

Despite these efforts, coordination between demographic planning and fiscal sustainability remains weak. Implementation gaps, corruption, and inadequate investment in youth empowerment and industrialization have limited impact. If not effectively managed, the combination of high population growth and unsustainable debt levels risks deepening inequality and slowing Nigeria's long-term economic development.

Therefore, this study seeks to explore the dynamic relationship between Nigeria's population growth and public debt burden. The broad objective of the study is to analyze population growth and public debt, while the specific objectives are to: Examine the effect of population growth on public debt in Nigeria; and Examine the causal link between population growth and public debt in Nigeria [5].

2. Literature Review

Todaro and Smith (2020) define population growth as the rate of change in population size, typically expressed as a percentage. They emphasize two primary drivers: natural increase (births minus deaths) and net migration (inflow minus outflow of people). Their definition reflects the economic implications of demographic changes, noting how these rates impact labor supply, consumption patterns, and public service demand.

Dyson (2010) refers to population growth by distinguishing between absolute growth (the raw increase in population numbers) and relative growth (the proportional or percentage increase), allowing for a comparative analysis across regions and periods [6]. This differentiation is vital in demographic studies, as it helps scholars and policymakers understand both the scale and intensity of growth, which can influence infrastructure needs, urban planning, and resource allocation.

According to Weeks (2015) population growth occurs due to the combined effects of fertility (births), mortality (deaths), and migration, all of which determine the net addition or reduction in population size. His perspective highlights the biological and migratory dimensions as essential components of demographic change [7].

Buchanan (1958) extends this view by framing public debt as the obligations owed to creditors, whether domestic or foreign. His definition underlines the role of public debt in meeting budgetary deficits and funding public investments—especially infrastructure—which often has long-term economic benefits. Buchanan's classical perspective places strong emphasis on fiscal responsibility and the ethical implications of passing debt burdens to future generations [8].

The International Monetary Fund (IMF, 2022) offers a modern institutional definition, describing public debt as the gross debt of the general government sector, which includes borrowing for general fiscal purposes or specific development projects. This definition encompasses all liabilities held by the government without netting out assets and reflects international standards for assessing fiscal sustainability and risk.

Reinhart and Rogoff (2010) contribute an important macroeconomic perspective by defining public debt as the accumulated borrowing over time, highlighting its impact on the broader economy. They argue that public debt is a future obligation that must be serviced primarily through taxation or other revenue measures, and that excessive debt can have serious economic consequences such as reduced growth or financial crises. Their empirical work has strongly influenced policy debates on debt thresholds and fiscal prudence [9].

Finally, Lee (2011) offers a holistic interpretation, describing population growth as the expansion of human presence either within a specific region or globally. He attributes this growth to the interplay of fertility, mortality, and migration, indicating that these variables do not operate in isolation but are influenced by socioeconomic conditions, cultural norms, public health systems, and governmental policies.

2.1 Theoretical Framework

This study is grounded in the Keynesian theory of public debt, which advocates government borrowing as a countercyclical instrument to stimulate economic activity, especially during periods of recession or inadequate private investment. In Nigeria's context, this theory holds particular relevance given the country's rapid population growth and persistent structural challenges [10,11]. The expanding population—especially among the youth—creates increasing demand for public services, employment opportunities, and infrastructure. When effectively managed, public debt can be used to finance these needs, thereby boosting aggregate demand, enhancing human capital, and improving productivity, which collectively foster inclusive economic growth. Nonetheless, the success of this approach largely depends on how borrowed funds are utilized. In Nigeria, a considerable share of public borrowing has traditionally been directed toward recurrent expenditures rather than productive capital projects. This practice contradicts the Keynesian principle that debt should finance investments capable of generating long-term economic returns. Moreover, when debt-financed spending fails to align with the country's population-driven development priorities, it can lead to fiscal strain without yielding corresponding gains in welfare or productivity.

2.2 Empirical Review

Ngcobo et al. (2025) employed a Bayesian analytical framework to explore how public debt influences economic growth in newly democratized African nations. Their study uncovered a U-shaped relationship between debt and growth, with economic benefits rising until debt reaches about 50% of GDP, after which the relationship becomes inverted U-shaped beyond 65% of GDP, indicating diminishing returns from excessive borrowing [12].

In a related study, Olasunkanmi and Ajibowo (2024) examined the effect of public debt management on Nigeria's sustainable economic growth from 1981 to 2022 using the Autoregressive Distributed Lag (ARDL) model. Their findings revealed that both the total debt stock and the ratio of debt servicing to gross national product had positive but statistically insignificant effects on per capita income at the 5% significance level. However, the consumer price index and total government revenue were found to be positively and significantly related to economic growth [13].

Similarly, Oligbi (2024) analyzed the connection between government expenditure and public debt in Nigeria over the same period (1981-2022) using ARDL bounds testing and error correction models [14]. The results indicated that both recurrent and capital expenditures, as well as interest rates, exert a positive influence on total debt stock, whereas government revenue has a negative effect, suggesting that higher revenues can reduce borrowing dependence.

Manasseh et al. (2024) examined the impact of public debt on macroeconomic stability across Sub-Saharan Africa using the System Generalized Method of Moments (System GMM) approach. Their findings revealed that excessive debt accumulation weakens domestic revenue generation and heightens debt servicing pressures, thereby contributing to macroeconomic instability [15].

Similarly, Ekeruche et al. (2023) investigated fiscal policy strategies for addressing Nigeria's rising debt and its implications for economic growth using the ARDL model. The study reported that Nigeria's total debt stock reached \$108.3 billion in 2023, representing a 123% increase since 2012, outpacing GDP growth. The debt escalation was primarily attributed to external shocks, including the COVID-19 pandemic and global financial stress.

Aminu (2023) explored the relationship between public debt and Nigeria's economic growth from 1980 to 2022 using time series data. The study found that while external debt exerts a positive long-run impact on growth, sub-national (state-level) debt has a negative effect, implying inefficiencies in state-level borrowing and fiscal management.

In a related study, Akanbi and Olaoluwa (2022) assessed the influence of state-level public debt on Nigeria's economic performance between 1990 and 2020 using the ARDL bounds testing approach. Their findings corroborate Aminu's results, confirming that sub-national debts have an adverse effect on economic growth and emphasizing the need for stronger fiscal discipline and accountability among state governments. [16]

Fasoye and Olayiwola (2024) investigated the relationship between public debt and Nigeria's economic growth from 1981 to 2020 using the Dynamic Ordinary Least Squares (DOLS) technique. They found that increasing public debt slows economic growth by crowding out investment, highlighting the importance of directing borrowed funds toward productive sectors such as infrastructure, education, and healthcare.

Ojukwu et al. (2021) analyzed the connection between public debt and sustainable development in Nigeria from 1970 to 2019 using the ARDL model. Their study revealed that domestic debt positively influences GDP per capita, while external debt exerts no significant impact on life expectancy and has a negative effect on primary school enrolment [17].

Ajayi et al. (2021) compared the effects of public debt management on economic growth under military and civilian administrations in Nigeria between 1983 and 2015, employing the ARDL technique. The results indicated that debt management had a more favorable impact on growth during military rule, suggesting variations in fiscal discipline and policy enforcement across governance regimes.

Similarly, Omankhanlen (2021) assessed the effect of public debt on Nigeria's economic growth between 1981 and 2019 using time series analysis [18]. The findings showed that public debt negatively influences growth, reinforcing the call for institutional reforms in public financial management to ensure that borrowed resources are channeled into growth-enhancing sectors.

Akhanolu et al. (2018) analyzed the effects of public debt on Nigeria's economic growth from 1982 to 2017 using the Two-Stage Least Squares (2SLS) estimation technique. The results showed that external debt negatively affects the economy, whereas domestic debt exerts a positive impact. Moreover, GDP, total savings, and capital expenditure were significantly associated with domestic debt, implying that well-managed internal borrowing can promote growth [19].

Extending beyond Nigeria, Pharm (2018) studied the influence of public debt on economic growth in six ASEAN countries-Vietnam, Thailand, Singapore, the Philippines, Malaysia, and Indonesia-over the period 1995-2015 using the GMM approach. Controlling for FDI, real exchange rate, and gross fixed capital formation, the study concluded that public debt positively and significantly affects real GDP per capita growth.

Chudik et al. (2018) investigated the relationship between public debt accumulation and economic growth using panel data for 40 economies from 1966 to 2010. Their results showed no universal debt threshold but indicated that countries with debt-to-GDP ratios exceeding 60% tend to experience slower real output growth, suggesting that persistent debt accumulation can hinder long-term economic performance.

In Bhutan, Wangmo (2018) applied a Vector Error Correction Model (VECM) to study the effect of government debt on economic growth between 1990 and 2016. The findings revealed a statistically significant but negative relationship between debt and growth, implying that excessive borrowing constrains economic activity.

Similarly, Lartey et al. (2018) analyzed data from 50 African countries between 1980 and 2015 using both Ordinary Least Squares (OLS) and GMM estimation techniques. Their results identified a nonlinear relationship between public

debt and growth-indicating that debt can promote economic expansion up to a certain level, beyond which it becomes detrimental [20].

Thilanka and Ranjith (2018) explored the effect of public debt on private investment in Sri Lanka from 1978 to 2015 using the VECM approach. Their findings indicated a crowding-in effect, where public debt encouraged private investment in the long run. However, they cautioned that misallocation of borrowed funds may have limited potential gains for the private sector.

Eze, Nweke, and Atuma (2019) examined the impact of external and domestic debt on Nigeria's economic growth from 1981 to 2017. Their results showed that external debt significantly reduces investment and GDP, whereas domestic debt exerts an insignificant positive effect on investment and an insignificant negative impact on GDP.

Olasode and Babatunde (2016) analyzed the relationship between external debt and Nigeria's economic growth from 1981 to 2014 using the ARDL model. They found a significant negative relationship between external debt and growth, highlighting the risks of debt overhang and sustainability challenges. The study recommended that Nigeria reduce reliance on external borrowing and enhance domestic revenue generation to achieve long-term fiscal stability.

Lee and Ng (2015) examined the relationship between public debt and economic growth in Malaysia from 1991 to 2013, incorporating variables such as budget deficit, government consumption, and external debt servicing. Their results indicated that public debt has a long-term negative effect on GDP, while other macroeconomic indicators similarly dampen economic performance. In another study, Ntshakala (2015) examined the effect of public debt on economic growth in Swaziland using the Ordinary Least Squares (OLS) method with data from 1988 to 2013. The results showed no significant relationship between external debt and growth, but domestic debt positively influenced economic growth, suggesting that local borrowing may be more productive than foreign loans. The author recommended a balanced approach to sourcing both domestic and external funds [21].

Kobey (2016) analyzed the impact of public debt on Kenya's economic growth between 1994 and 2015 using a linear regression model that included unemployment and inflation rates as control variables. The findings indicated that public debt and the control variables had an insignificant negative effect on Kenya's economic growth, implying that other structural factors may be more influential in determining growth outcomes.

In Bangladesh, Saifuddin (2016) assessed how public debt affects economic growth using investment and growth models estimated through Two-Stage Least Squares (2SLS) regression with data covering 1974 to 2014. The study revealed that public debt positively influenced both investment and economic growth, suggesting that debt, when well managed, can have a multiplier effect on overall economic performance.

Likewise, Tawfiq and Shawawreh (2017) examined the impact of public debt on Jordan's economic growth between 2000 and 2015 using least squares regression analysis. Their results indicated that total public debt had a negative impact on growth, with external debt exerting a more pronounced adverse effect, emphasizing the risks of overdependence on foreign borrowing [22].

Finally, Dinca and Dinca (2013) analyzed the relationship between public debt and GDP growth in five former communist bloc countries-Bulgaria, the Czech Republic, Romania, Hungary, and Slovakia-from 1996 to 2010. The study found that public debt begins to hinder economic growth once it exceeds 44.42% of GDP, a threshold particularly critical for these economies due to structural weaknesses and limited access to financial markets during periods of economic recession.

3. Methodology

3.1 Nature and Sources of Data

The study will rely on time series secondary data covering the period 1986 to 2024. The data will be obtained from reputable sources such as the World Development Indicators (WDI), the Central Bank of Nigeria (CBN) Statistical Bulletins, and the National Bureau of Statistics (NBS) [23]. Additional information will also be gathered from relevant publications, reports, and credible online sources to support the analysis.

3.2 Model Specification

Table 1 explains how your research variables are defined, measured, and the data sources, ensuring transparency and reliability. It lets readers know what each indicator used in your research represents and the authoritative source of the data.

Table 1. Description, measurement and sources of variables.

Variable	Description/Measurement	Source
Real Gross Domestic Product (RGDP)	This adjusts nominal GDP, which is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the product, for changes in price levels/Billion naira (B'₦)	CBN (2023)
Gross Fixed Capital Formation (GFCF)	The total value of gross fixed capital formation, change in inventories, and acquisitions less disposal of valuable. (This is used as a proxy for capital)/ Billion US dollars (B'\$)	World Bank, (2023)
Size of Labour Force (LABOR)	This is measured as the adult population aged 16 and over, comprising those employed for pay or profit and those unemployed but actively seeking work during a specified period/ Number of persons	World Bank (2023)
Debt Stock (DS)	<i>Exchange rates are defined</i> as the price of one country's' currency in relation to another country's currency	World Bank (2023)
Interest Rate (INTR)	interest rate as the cost of borrowing, or the return for lending, expressed as a percentage of the principal amount	World Bank (2023)
Population (POP)	Population growth as the rate at which the number of individuals in a population increases over a specific period, generally expressed as a percentage.	World Bank (2023)

Source: Author's Compilation, 2025.

The study examined the effect of financial inclusion and agricultural output in Nigeria; the study uses the neo-classical growth model. We construct the econometric model; the study assumes that the production in the economy for control at a time is given by the following production function [24].

$$POP = F(DS, LAB, GCF, INTR, GDP) \quad (1)$$

The model above is the baseline model, and population growth (POP), gross domestic product (GDP), debt stock (DS), labour (LAB) (INF), gross capital formation (GCF) and interest rate (INTR),

The linear regression equation based on the above functional relation is stated thus:

$$POP = \beta_0 + \beta_1 DS_t + \beta_2 LAB_t + \beta_3 GCF_t + \beta_4 INTR_t + \beta_5 GDP_t + \mu_t \quad (2)$$

Where:

POP= Population growth

DS = Debt Stock

LAB = labour force

GCF = Gross capital formation

INTR = Interest rate

GDP = Gross domestic product

β_0 = Intercept/Constant

$\beta_1 - \beta_5$ = Slope

μ_t = Error Term

The a priori expectation is that $\beta_1 > 0, \beta_2 < 0, \beta_3 > 0, \beta_4 < 0, \beta_5 > 0$.

Population growth (POP), Debt Stock (DS), gross capital formation (GCF), Labour force(LAB) should increase while interest rate (INTR) should decrease, gross domestic product (GDP)

3.3 Method of Data Analyses

This will be carried out to observe and examine the direction and pattern of distribution of variables employed in the study.

Descriptive Statistics

Descriptive statistics provide a summary of the key characteristics of a dataset, whether it represents an entire population or a sample. They are generally categorized into measures of central tendency and measures of variability (or dispersion) [25]. The measures of central tendency—mean, median, and mode—describe the center or typical value of the data, while measures of variability such as standard deviation, variance, minimum, maximum, skewness, and kurtosis indicate how data points are spread or distributed. In addition, the Jarque-Bera test will be applied to assess whether the data follow a normal distribution.

3.3.1 Unit Root Test

Stationarity is an essential concept in time series analysis, as it ensures the reliability of model estimates and interpretations. A stationary time series maintains a constant mean, variance, and autocovariance across different time periods. Conversely, when a series is non-stationary, these statistical properties change over time, making the data unstable [26]. Non-stationary data can lead to spurious regression results, producing misleading, unreliable, and inaccurate conclusions. To check for stationarity, researchers commonly employ unit root tests, with the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests being the most widely used methods.

The unit root model for Perron is given below as;

$$Y_t = \mu + \theta DU_t + \beta_t + YDT_t + \delta D(T_b)_t + \alpha y_{t-1} + \sum_{i=1}^k C_i \Delta y_{t-i} + e_t \quad (3)$$

Where Y is the variable under consideration, μ is the intercept or constant, Δ is the first difference operator, t is the time trend, DT_b is the time at which structural change occurs, DT is the slope and e is the error term. The model allows for only one time change in both intercept and slope. Where X_t is an $(n \times 1)$ column vector of the variables under investigation (DS, LAB, GCF and INTR), μ is an $(n \times 1)$ vector of constant terms, Γ and Π represent co-efficient matrices, Δ is a difference operator and ε_t .

3.3.2 Co-integration Test

On a general note, the bound co-integration test of the variables would be undertaken using the ARDL method as developed by Pesaran, Shin, and Smith (2001) and as depicted by Equation 3.4

$$\Delta \ln y_t = \lambda_0 + i = 1 \sum n \lambda_0 \Delta \ln y_t - 1 + i = 1 \sum n \beta_j \ln y_t - 1 + \varepsilon_t \quad (4)$$

The ARDL bound test was used to examine the long-run relationship that exists among the variables of the study. The F-statistic is more than the critical value of the upper bound; the null hypothesis is to be rejected. On the other hand, if the lower critical bound value is more than the F-statistic, then the null hypothesis is to be accepted and establishes the presence of co-integration among the variables and vice versa.

3.4 Estimation Technique

The study will employ autoregressive distributed lag (ARDL) technique of analysis in the study.

3.4.1 Auto Regressive Distributed Lag (ARDL)

The chosen method of data analysis is suitable when the variables are integrated at different orders, such as a combination of $I(0)$ and $I(1)$ series [27]. This is because not all variables remain constant over time, as required by the Ordinary Least Squares (OLS) approach. When time-dependent variables are analyzed using OLS, the model may produce inflated t-values and artificially significant results, leading to spurious correlations. In such cases, the model's R-squared value may appear higher than the Durbin-Watson statistic, indicating unreliable outcomes.

To address this issue, the Autoregressive Distributed Lag (ARDL) model is considered the most appropriate estimation technique. One of its key advantages is that it corrects for autocorrelation in the error term (u), a situation where OLS estimators become inconsistent. The ARDL approach, therefore, serves as an instrumental variable estimation technique, providing more accurate and consistent results. The ARDL model used in this study is specified as follows:

$$\ln POP = \alpha_0 + \ln \beta_1 DS_t + \ln \beta_2 LAB_t + \ln \beta_3 GCF_t + \ln \beta_4 INTR_t + \ln \beta_5 GDP_t + \mu_t \quad (5)$$

3.4.2 Granger Causality Test

This study will also perform a granger causality to establish the direction of causality between private investment and exchange rate. This test is utilized to determine if the nexus between private investment and exchange rate has a uni-directional causality or bi-directional causality.

The granger causality model is adapted and expressed as follows;

$$Y = \sum_{i=1} Q_i Y_{t-i} + \sum_{i=1} YX_t \quad (6)$$

$$X = \sum_{i=1} Y_i X_{i-1} + \sum_{i=1} QY_i \quad (7)$$

Where Y = Population growth (POP) and X = independent variables such as DS, LAB, GCF, INTR and GDP. If the set of X and Y coefficients are statistically different from zero, then there exists Bi-Directional causation. On the other hand, Uni-Directional causation occurs when only one of the coefficients is significant (i.e. X causing Y or vice versa) and absence of causation exists if both coefficients are not significant (Engle & Granger, 1987).

3.4.3 Post Estimation Tests

Post-estimation tests like Breusch-Godfrey serial correlation LM test, heteroskedasticity test, etc. intends to be conducted to show that the model estimation is error-free

4. Presentation and Discussion of Results

Table 2. Descriptive statistics result.

	RGDP	GFCF	LAB	DS	INTR	POP
Mean	1416.198	6.02E+10	48881738	3.78E+10	18.12151	1.47E+08
Median	1250.407	4.39E+10	47613325	3.14E+10	17.55333	1.40E+08
Maximum	3200.953	2.37E+11	78576946	1.02E+11	31.65000	2.29E+08
Minimum	270.0275	1.23E+10	28325753	1.30E+10	9.959167	85804185
Std. Dev.	922.0908	5.34E+10	14086154	2.11E+10	4.156868	43392255
Skewness	0.241981	1.788097	0.402384	1.617247	0.828228	0.328188
Kurtosis	1.518665	5.760917	2.178765	4.894493	4.556904	1.868695
Jarque-Bera	3.946430	33.16922	2.148374	22.83297	8.397668	2.779853
Probability	0.139009	0.000000	0.341575	0.000011	0.015013	0.249094
Observations	39	39	39	39	39	39

Source: Author's Computation E-Views Output, Version 13

Table 2 shows the behaviour of the variables during the review period. It contains details for the mean, maximum values, minimum values, range, standard deviation, skewness, kurtosis and Jarque-Bera for 39 observations. The dependent variable is public debt which represents DS, Gross Fixed Capital Formation represent GFCF, real gross domestic product represents RGDP, labour force represent LAB, interest rate represents INTR and population growth represent POP. The result from the summary statistics showed that Jarque Bera estimates probability values are normally distributed due to their probability value which is greater than the probability of 0.05 RGDP, LAB, and POP with probability values of 0.139009, 0.341575, 0.249094, while gross fixed capital formation, debt stock and interest rate probability is less than 0.05 0.000000, 0.000011, 0.015013. According to Central Limit Theorem, non-normality of the descriptive statistics does not affect the result because ARDL result is mean itself [28].

4.1 Unit Root Test

The data analysis begins with unit root test on each of the variables to determine the stationary property of the time series variables. The Augmented Dickey-Fuller test was used to test for unit root. All the variables were regressed on trend and intercept to determine if they have trend, it was discovered that the all the variables have trend and intercept, hence the unit root test involved trend and intercept. The result is presented in table 4.2.

Table 3. Unit root test for stationarity result.

Variables	ADF t-Statistic	P. value	Order of Integration
RGDP	-4.323067	0.0079	I(1)
GFCF	-4.116066	0.0131	I(1)
LAB	-3.997372	0.0178	I(0)
DS	-4.040217	0.0158	I(1)
INTR	-3.536254	0.0513	I(0)
POP	3.177812	0.0299	I(1)

Source: Author's Computation E-Views Output, Version 13 2025.

Table 3 list the six variables (RGDP, GFCF, LAB, DS, INTR and POP) underwent unit root test using the Augmented Dickey-Fuller (ADF) test. Some of the variables were found to be non-stationary at levels. Only INTR were stationary at I(0) while RGDP, GFCF, LAB, DS and POP were all found to be stationary at first difference.

Table 4. Co-integration bounds test result.

Test Statistic	Value
F-statistic	4.684588

Source: Author's Computation E-Views Output, Version 13 2025

Critical Value

Sample Size	10%		5%		1%	
	I(0)	I(1)	I(0)	I(1)	I(0)	I(1)
35	2.331	3.417	2.804	4.013	3.900	5.419
40	2.306	3.353	2.734	3.920	3.657	5.256
Asymptotic	2.080	3.000	2.390	3.380	3.060	4.150

Source: Author's Computation E-Views Output, Version 13 2025.

Table 4 show the results of the ARDL bounds test confirm the existence of a long-run relationship between the dependent variable and the explanatory variables in the model. This is evidenced by the computed F-statistic of 4.684, which exceeds both the lower and upper critical bounds values at the 5% significance level ($I(0) = 2.734$ and $I(1) = 3.920$). Consequently, the null hypothesis of no cointegration is rejected, indicating that a stable long-run equilibrium relationship exists among the variables.

4.2 Auto Regressive Distributed Lag (ARDL)

Table 5. Auto regressive distributed lag (ardl) test result.

Long Run				
Dependent Variable: DS				
Variable	Coefficient	Std. Error	t-Statistic	Prob.*
DS(-1)	0.925414	0.162963	5.678683	0.0000
DS(-2)	-0.751545	0.166940	-4.501885	0.0001
RGDP	-12085418	4586402.	-2.635054	0.0140
RGDP(-1)	-10777921	5679844.	-1.897573	0.0689
GFCF	0.145372	0.110691	1.313312	0.2006
INTR	3.33E+08	2.33E+08	1.430864	0.1644
LAB	-3221.417	919.4044	-3.503809	0.0017
POP	1390.144	346.3077	4.014187	0.0005
C	-9.18E+09	7.52E+09	-1.220422	0.2333
Short Run				
D(DS(-1))	0.751545	0.125204	6.002586	0.0000
D(RGDP)	-12085418	3337199.	-3.621425	0.0010
D(GFCF)	0.145372	0.070016	2.076266	0.0460
D(GFCF(-1))	0.134328	0.051291	2.618954	0.0134
COINTEQ*	-0.826131	0.130040	-6.352915	0.0000
R-squared	0.712416			
Adjusted R-squared	0.676468			
F-statistic	19.81794			
Prob(F-statistic)	0.000000			
Durbin-Watson stat	2.086487			

Source: Author's Computation E-Views Output, Version 13 2025

Table 5 showed that debt stock (DS) at its first period lag is associated with a coefficient value of 0.925414 is positive and statistically significant and in the second-year previous lag is associated with a coefficient value of -0.751545 is negative and statistically significant while in the short run D(DS(-1)) associated with a coefficient of (0.751545) is positive on its own lag and statistically significant.

Real gross domestic product (RGDP) is associated with a coefficient of (-12085418) has a negative relationship on DS and is statistically significant. This implies that 1% increase in RGDP will lead to increase on DS by (-12085418) [29]. While in the short run D(RGDP) associated with a coefficient of (-12085418) has a negative relationship on DS and is statistically significant. This implies that in the short run 1% increase in RGDP will lead to a decrease in DS by (-12085418) holding other variables constant.

Gross fixed capital formation (GFCF) is associated with a coefficient of (0.145372) has a positive relationship with DS and is statistically insignificant. This implies that 1% increase in gross fixed capital formation will increase DS by (0.145372) while in the short run D(GFCF) associated with a coefficient of (0.145372) has a positive relationship with DS and is statistically significant. Again, the previous lag of D(GFCF (-1)) is associated with a coefficient of (0.134328) has a positive relationship with DS and is statistically significant. This implies that 1% increase of GFCF will lead increase in DS by (0.134328) holding other variables constant [30].

Interest rate (INTR) is associated with a coefficient value of (3.33E+08) and has a positive relationship with DS which is statistically insignificant. This implies that 1% increase in interest rate will lead increase in debt stock (DS) by (3.33E+08), holding other variables constant. Labour force (LAB) is associated with a coefficient value of (-3221.417), which has a negative relationship with DS and is statistically significant. This implies that 1% increase in the labour force will to decrease in debt stock by (-3221.417), holding other variables constant.

Population growth (POP) is associated with a coefficient value of 1390.144, has a positive relationship with debt stock (DS) and is statistically significant. This implies that 1% increase in population growth will lead in increase in DS by (1390.144) holding other variables constant. The constant C associated with a coefficient value of (1390.144) has a positive relationship with DS. This explains the average mean of the independent variables on the dependent variable in the model [31].

In the same vein, the coefficient of determination (R^2) shows that 98% of the variations in debt stock is explained by the explanatory variables in the model which is above 50% and even after taking into consideration the degree of freedom, the adjusted coefficient of determination (adjusted R^2) still shows that, 97% variation in debt stock is explained by the explanatory variables. The F-statistic 4.828324 with the probability value of (0.000000) which confirmed the fitness of the coefficient of model and shows an overall significant level of the explanatory variables jointly in explaining dependent variable. The model showed that there is no autocorrection as reveal by Durbin-Watson stat (2.086487).

4.3 Hypothesis Decision

Based on the t-statistics table and the probability values, the hypotheses formulated in Chapter One are evaluated at a 5% level of significance. The decision rule is as follows: if the probability value (p-value) is less than 0.05, the null hypothesis (H_0) is rejected and the alternative hypothesis (H_1) is accepted; otherwise, H_0 is accepted.

For the first hypothesis, the calculated p-value for POP is 0.0005, which is below the 0.05 significance threshold. This indicates that population growth has a statistically significant effect on public debt in Nigeria, leading to the rejection of the null hypothesis [32].

Similarly, for the second hypothesis, which tests for a causal relationship between population growth and public debt, the calculated p-value is 0.0007, also less than 0.05. This result confirms that population growth exerts a significant causal effect on public debt in Nigeria.

Table 6. Post estimation test result.

	Statistics	P. Value
Normality Result	0.163025	0.921721
Breusch-Godfrey Serial Correlation Result	2.842798	0.0780
Harvey Heteroskedasticity Result	1.253499	0.3056

Source: Author's Computation E-Views Output, Version 13 2025

Table 6 list the post estimation test was conducted using residual diagnostic tests such Normality Test, Breusch-Godfrey Serial Correlation LM test and Harvey Heteroscedasticity test. The results of these tests shown that, the model passes all the diagnostic tests except normality test since the probability values of Normality which is 0.921721, Serial Correlation which is 0.0780 and Heteroscedasticity tests which is 0.3056 and the values are greater than 0.05 significance level [33]. The diagnostic tests applied to the model point out that there is no evidence of serial correlation and heteroscedasticity tests imply the correctly specified ARDL model.

4.4 Pairwise Granger Causality

Table 7. Pairwise granger causality result.

POP does not Granger Cause DS	37	9.28614	0.0007
DS does not Granger Cause POP		1.15258	0.3286

Source: Author's Computation E-Views Output, Version 13 2025

Table 7 shows that population growth granger cause public debt stock by the probability value 0.0007. This implies that population growth influence public debt as the citizens increases in number the country borrow to augment her domestic resources.

4.5 Discussion of Findings

The empirical results on Nigeria's debt stock (DS) reveal nuanced interactions with various macroeconomic indicators, which can be interpreted within established economic frameworks and supported by relevant academic literature.

In the long run, the positive and statistically significant relationship of DS with its own lag suggests path dependence. This indicates that Nigeria's current debt levels are shaped by past borrowing behaviors, consistent with the debt accumulation hypothesis, where governments borrow over time to finance persistent budget deficits. However, the two-year lag of DS is negative and statistically significant, implying corrective adjustments may follow periods of excessive borrowing-likely driven by fiscal consolidation efforts as identified by Reinhart and Rogoff. In the short run, the positive coefficient of the first difference of DS on its lagged value confirms short-run inertia, aligning with Keynesian perspectives where temporary borrowing is used to stimulate the economy.

Real Gross Domestic Product (RGDP) exhibits a negative and statistically significant relationship with DS in the long run. This somewhat contradicts classical expectations that economic growth reduces debt via enhanced government revenue. The result may reflect procyclical fiscal behavior, where governments expand spending and borrowing in response to growth, often tied to infrastructure development or social services in countries like Nigeria. In the short run, the negative relationship between the first difference of RGDP and DS suggests that immediate growth enables fiscal consolidation, potentially reducing the need for external borrowing. This aligns with counter-cyclical fiscal policy behavior observed in some developing economies.

Gross Fixed Capital Formation (GFCF) shows a positive but statistically insignificant relationship with DS in the long term, suggesting that while capital investment might lead to increased debt, the evidence is not conclusive. This aligns with the broader literature on endogenous growth theory, which posits that capital formation can drive long-term growth and, depending on its efficiency, justify borrowing. In the short term, however, GFCF (both current and one-period lag) is positively and significantly related to DS. This indicates that Nigeria is likely relying on debt to finance investment projects, especially given limited domestic resources.

Interest rates (INTR) display a positive but statistically insignificant relationship with DS, implying that increases in interest rates might raise the cost of borrowing, but the effect is not substantial enough to be statistically robust. This may be due to the dominance of concessional loans or fixed-rate borrowing in Nigeria's debt portfolio, which buffers short-term fluctuations.

The labor force (LAB) is negatively and significantly related to debt stock, implying that an expanding labor force contributes to reducing the need for public borrowing. A larger labor force can enhance economic productivity, expand the tax base, and reduce fiscal pressure, supporting supply-side economic theories that highlight the role of labor participation in sustainable economic growth.

Population growth (POP) is found to have a positive and statistically significant relationship with DS. This result supports the argument that rising population increases fiscal demand, especially in countries with young and rapidly expanding populations like Nigeria. Governments often resort to debt financing to meet growing needs in infrastructure, healthcare, and education. In this context, population dynamics are a structural factor driving debt accumulation.

5. Conclusion and Recommendations

The analysis shows that Nigeria's debt profile is shaped by both structural and macroeconomic factors. Historical borrowing patterns and short-term development financing needs continue to drive debt accumulation, reflecting an ongoing dependence on loans to fund infrastructure and public services. While economic growth and an expanding labour force have helped to ease some fiscal pressures, rapid population growth and rising capital investment demands are putting renewed strain on public finances.

To address these challenges, the following policy actions are recommended:

1. **Invest in Human Capital Development:** The government should scale up investment in education, healthcare, and skills training to harness the potential of its growing population. Transforming the population into a skilled and productive workforce will expand economic output and improve revenue generation, reducing the need for excessive borrowing.
2. **Integrate Demographic Trends into Fiscal Planning:** Policymakers should adopt long-term fiscal strategies that explicitly account for demographic pressures on infrastructure, employment, and social services. Aligning debt and budget planning with population dynamics will enhance fiscal sustainability and ensure that borrowing supports inclusive and productive growth.
3. **Promote Efficient Debt Utilization:** Strengthening public financial management and improving transparency in how borrowed funds are allocated will ensure that debt is directed toward high-impact projects in sectors such as infrastructure, education, and health. This will maximize returns on borrowing and support long-term development objectives.

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