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Public Debt, Infrastructure and Economic Growth in Nigeria

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Abstract
This study examines the effect of public debt and infrastructure on economic growth in Nigeria between 1981 to 2022. Secondary data were sourced from the Central Bank of Nigeria Statistical bulletin, Debt Management Office and the World Bank. The primary objective is to analyze the effects of public debt on Nigeria's real GDP growth rate and to evaluate the significance of infrastructure in driving economic growth. The unit root tests- the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests were employed to assess the stationarity of the variables while the cointegration tests were conducted to explore long-term relationships among the variables. The findings reveal that external debt has a significant negative impact on Nigeria's economic growth, while internal debt shows no significant effect. Infrastructure demonstrates a significant positive impact on economic growth. The study concludes that prudent external debt management and strategic infrastructure are crucial for fostering sustainable economic growth in Nigeria. Based on these findings, several recommendations are proposed; Policymakers should prioritize borrowing from concessional sources to minimize the external debt burden, place embargo on new loans and implement stringent debt management policies. Developing a robust domestic debt market through regulatory enhancements and private sector incentives can provide a stable funding source for developmental projects. Additionally, strategic investments in critical infrastructure sectors, supported by public-private partnerships (PPPs), can address bottlenecks and encourage foreign direct investments.
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1.0 Introduction

In Nigeria, public debt can impact infrastructure and economic growth in several ways. When used effectively, public debt can finance infrastructure projects, such as roads, bridges, and utilities, which are crucial for economic development. Improved infrastructure can enhance productivity, attract investment, and stimulate economic growth. However, excessive public debt can also pose risks, including higher debt servicing costs, crowding out private investment, and potential fiscal instability. Economic growth is pivotal for a nation's development, significantly influencing a country's overall socio-economic landscape. It represents the increase in a country's output of goods and services, reflecting higher productivity levels and improvements in the standard of living. The importance of economic growth cannot be overstated as it leads to job creation, enhanced public services, and improved infrastructure, fostering a cycle of sustained development. For instance, the research by Adams, Zubair, and Olatunde-Aiyedun (2022) underscores the role of social infrastructure indicators, such as education and healthcare, in propelling economic growth in Nigeria. Similarly, Babatunde (2018) highlights that government spending on infrastructure is a critical driver of economic growth, underlining the importance of strategic investments in roads, electricity, and telecommunications. The nexus between infrastructure quality and economic performance is further elaborated by Chakamera and Alagidede (2018), who find that both the quantity and quality of infrastructure significantly impact economic growth in Sub-Saharan Africa.

Moreover, David (2019) emphasizes the role of telecommunication infrastructures in enhancing economic growth and development in Africa, illustrating how technological advancements can spur economic activities. Conversely, the issue of public debt poses a complex challenge; while necessary for funding growth-enhancing projects, excessive debt can impede economic growth. Public debt, encompassing both internal and external borrowings, plays a critical role in financing infrastructure projects that are essential for economic growth. Internal debt refers to borrowings from domestic sources, while external debt is sourced from international lenders. These funds are often directed towards infrastructure development, which is a cornerstone of economic progress. Infrastructure investments, such as roads, bridges, and telecommunication systems, enhance productivity by reducing transaction costs and improving market access. Ajayi and Edewusi (2020) and Akhanolu et al. (2018) provide empirical evidence on the adverse effects of public debt on Nigeria's economic growth, highlighting the delicate balance policymakers must maintain.

Consequently, economic growth is indispensable for national development, providing the foundation for sustainable progress and improved living standards. However, the relationship between public debt and economic growth is complex. While public debt can finance crucial infrastructure projects, excessive debt levels can strain an economy. Thus, the rising levels of public debt pose significant challenges to economic stability, with mixed evidence regarding their effectiveness in promoting economic growth. Some studies indicate that moderate levels of public debt can stimulate economic activity by financing essential infrastructure and development projects. For example, Babatunde (2018) argues that government spending on infrastructure can enhance economic growth by improving productivity and efficiency. Conversely, high debt levels can crowd out private investment and lead to economic instability, as highlighted by Ndoricimpa (2020), who found threshold effects of public debt on economic growth in Africa, indicating that beyond a certain level, debt becomes detrimental.

Public debt, infrastructure, and economic growth are intricately linked elements of a country's development trajectory. Nigeria is one of the most indebted nations in Sub-Saharan Africa at the moment, with a slow GDP growth rate, stalled export growth, declining per capita income, and rising rates of poverty. To make matters worse, the nation's key exports are seeing a decline in global pricing, which forces it to borrow additional money (Ogunjimi, 2019). Although Nigeria's historical background of external debt dates to 1958, when it obtained a loan of £28 million from the World Bank (then known as the International Bank for Reconstruction and Development), before it gained independence, its prominence was quite modest until 1978. The substantial revenue influx from oil during the oil price boom of 1973–1976 initially offset the early impacts of external indebtedness. However, a decline in oil prices in 1977 and 1978 prompted Nigeria to seek its first major loan exceeding $1 billion USD from the international financial market. Subsequently, Nigeria's external debt escalated rapidly, reaching $8.855 billion by 1980 and approximately $19 billion by 1985. While Nigeria received debt relief in 2005, its public debt has since surged. From 1999 to March 2021, the federal government's debt soared by over 658%. Both external and domestic debt profiles have displayed alarming upward trends, surpassing pre-relief levels significantly. As of June 30, 2022, Nigeria's total public debt stood at 42.84 trillion Naira ($103.31 billion USD). By September 30th, 2023, public debt reported by the Debt Management Office (DMO) had risen to 87.91 trillion Naira ($114.35 billion USD), with a substantial portion attributed to both domestic and foreign borrowing. This mounting debt burden has led to fluctuations in Nigeria's economic performance, with notable shifts in key macroeconomic indicators such as inflation, unemployment, and national output. Despite experiencing a gradual recovery from the 2016 recession between 2016 and 2019, primarily driven by gains in the oil sector, Nigeria continues to grapple with persistently high unemployment rates, reaching 33.3% in the fourth quarter of 2020 according to the National Bureau of Statistics (NBS). While internal debt can be more manageable and less risky, external debt often brings additional risks such as exchange rate fluctuations, high interest rate and dependency on foreign creditors. Addressing the gap requires an approach to debt management, investment strategies and ensuring that borrowed funds are effectively utilized to foster sustainable economic growth. The objective is to provide a comprehensive analysis of the effect of external debt (EXD), internal debt (IND), and infrastructure (INFI) on economic growth (RGDP).

In achieving this objective, the research has been carefully organized and divided into five sections. Chapter one considers the introduction, chapter two reviews relevant literatures, chapter three is the research methodology, chapter four present the data, analysis and interpretation. Finally, chapter five concludes the paper and provided policy recommendations.

2.0 Conceptual Review

2.1 Public Debt

Public debt, as elucidated by various scholars, encompasses the financial obligations incurred by a government through borrowing to finance its expenditures. According to Égert (2015), public debt represents the cumulative result of past fiscal deficits, indicating the government's indebtedness to creditors, both domestic and foreign. This definition resonates with Salmon's (2021) characterization of public debt as the aggregate amount borrowed by the government through various financial instruments beyond its tax revenues. Similarly, Saungweme and Odhiambo (2018) underscore the dual nature of public debt, comprising both external and internal debt, reflecting the government's commitments to repay borrowed funds. By synthesizing these perspectives, a coherent understanding emerges, defining public debt as the financial liability assumed by the government to fund its operations, infrastructure projects, or stimulate economic growth, thereby influencing fiscal sustainability and economic stability (Gomez-Puig et al., 2022).

2.1.1 Types of Public Debt

Public debt manifests in two primary forms: external debt and internal debt. External debt, as illuminated by Alagba Ochuko and Idowu (2019), refers to the funds borrowed by a government from foreign entities or

international financial institutions, denominated in foreign currencies. This type of debt exposes the government to exchange rate risks and potential economic vulnerabilities arising from fluctuations in currency values (Amune & Ogunjimi, 2019). Conversely, internal debt, delineated by Owusu-Nantwi and Erickson (2016), encompasses the funds borrowed domestically by the government from its citizens, financial institutions, or the central bank, typically denominated in the local currency. Internal debt offers greater control over interest rates and repayment terms, yet excessive reliance on domestic borrowing can lead to crowding out private investment and inflationary pressures (Rafindadi & Musa, 2019).

External debt, characterized by its reliance on foreign creditors, often serves as a source of capital inflow for developing countries, facilitating investment in infrastructure projects and stimulating economic development (Ajayi & Edewusi, 2020). However, high levels of external debt can pose significant risks, constraining fiscal policy flexibility and potentially precipitating debt crises, as evidenced by past episodes in various economies (Yusuf & Mohd, 2021). In contrast, internal debt, being sourced domestically, allows governments to mitigate external risks associated with currency fluctuations and sovereign default, thereby fostering financial stability and reducing vulnerability to external shocks (Elom-Obed et al., 2017). Nevertheless, indiscriminate accumulation of internal debt can strain financial markets, crowd out private investment, and undermine long-term economic growth prospects (Adams et al., 2022).

2.2 Infrastructure

Infrastructure refers to the fundamental physical and organizational structures and facilities necessary for the operation of a society or enterprise, including transportation systems, utilities, communication networks, and public institutions (Chakamera & Alagidede, 2018). It constitutes the backbone of economic activity and plays a crucial role in facilitating trade, fostering innovation, and enhancing productivity (Bennee et al., 2021). Furthermore, infrastructure encompasses both tangible assets, such as roads, bridges, and power plants, and intangible elements, such as regulatory frameworks and institutional arrangements that support economic development (Ng et al., 2019).

2.2.1 Components of Infrastructure Index

The components of an infrastructure index encompass various dimensions crucial for societal development and economic progress. Firstly, physical infrastructure includes tangible assets such as roads, bridges, railways, airports, and ports, which form the backbone of transportation networks essential for trade, commerce, and mobility (Chakamera & Alagidede, 2018). Adequate investment in physical infrastructure enhances connectivity, reduces transportation costs, and fosters regional integration, thereby stimulating economic growth and facilitating social inclusion (Ng et al., 2019). Secondly, social infrastructure comprises essential services such as education and healthcare facilities, which are vital for human capital development and well-being (Bennee et al., 2021). Investments in social infrastructure contribute to improving literacy rates, enhancing skills training, and promoting public health, thereby fostering long-term productivity and social cohesion (Babatunde, 2018). Lastly, digital infrastructure encompasses telecommunications networks, internet access, and information technology systems, which are increasingly recognized as critical enablers of economic competitiveness and innovation (David, 2019). Robust digital infrastructure supports the digitalization of economies, facilitates access to information and services, and fosters entrepreneurship and job creation, thus driving economic diversification and resilience (Chakamera & Alagidede, 2018).

2.3 Economic Growth

Economic growth, a central concept in economics, is defined and conceptualized by various scholars in different ways. Adams, Zubair, and Olatunde-Aiyedun (2022) conceptualize economic growth as the sustained increase in the real gross domestic product (GDP) of a country over time, indicating the expansion of the economy's output and productive capacity. Ajayi and Edewusi (2020) extend this definition to emphasize the role of economic growth in improving living standards and reducing poverty through increased employment opportunities and income levels. They view economic growth as a fundamental driver of socio-economic development, encompassing improvements in various indicators of human welfare. Akhanolu et al. (2018) further highlight the multidimensional nature of economic growth by emphasizing its role in promoting technological progress, innovation, and structural transformation within an economy. They argue that sustained economic growth fosters dynamic structural changes, leading to diversification, industrialization, and increased competitiveness in global markets. These conceptualizations collectively underscore economic growth as a multifaceted process involving quantitative expansion, qualitative improvements, and socio-economic development, encapsulating both macroeconomic and microeconomic dimensions of progress within an economy.

2.3.1 Measurement of Economic Growth

The measurement of economic growth encompasses various indicators that capture the quantitative and qualitative dimensions of an economy's performance. Real Gross Domestic Product (GDP) growth rate serves as a primary measure, reflecting the annual percentage change in the inflation-adjusted value of goods and services produced within a country's borders. This metric, utilized extensively in economic analysis, provides insights into the pace of economic expansion over time (Adams, Zubair, & Olatunde-Aiyedun, 2022). Additionally, nominal GDP, which represents the total value of goods and services produced without adjusting for inflation, offers another perspective on economic output. Per capita income, calculated by dividing the total GDP by the population, measures the average income level of individuals within an economy and serves as an indicator of living standards and economic welfare (Ajayi & Edewusi, 2020). Other indicators such as employment levels, investment levels, industrial production, and trade balances offer supplementary information on the drivers and sustainability of economic growth. For this study, the real GDP growth rate is chosen as the primary measure of economic growth due to its comprehensive reflection of economic performance, encompassing both output expansion and price level changes, thereby providing a more accurate assessment of the economy's overall progress (Rafindadi & Musa, 2019). By focusing on real GDP growth rate, the study aims to capture the underlying trends in economic activity while accounting for the effects of inflation, thus facilitating a more robust analysis of the relationship between public debt, infrastructure and economic growth in Nigeria.

2.4 Theoretical Review

2.4.1 Keynesian Theory of Public Debt

The Keynesian Theory of Public Debt, developed by John Maynard Keynes in the early 20th century, offers insights into the role of government borrowing in stimulating economic activity and promoting infrastructure development. Keynes argued that during periods of economic downturns, characterized by deficient aggregate demand and high unemployment, government intervention through deficit spending could effectively stimulate economic growth and employment (Salmon, 2021). Keynesian economists, including Samuelson (1940) and Tobin (1975), further refined Keynes's theories, emphasizing the importance of fiscal policy in stabilizing the economy and achieving full employment. The theory's foundational assumption is that government borrowing to finance public investment projects, such as infrastructure development, can have multiplier effects on aggregate demand, leading to increased output and employment (Rafindadi & Musa, 2019).

Keynesian perspectives on public debt underscore the notion that government borrowing, particularly for productive purposes like infrastructure investment, can play a vital role in economic growth and development. According to Keynesian theory, infrastructure projects financed through public debt can generate positive externalities, such as improved transportation networks, enhanced productivity, and increased private sector investment (Amune & Ogunjimi, 2019). Moreover, by creating employment opportunities and boosting consumer spending, government expenditure on infrastructure can stimulate aggregate demand, thereby fostering economic growth (Babatunde, 2018). Keynesian economists argue that during periods of economic slack, when private sector investment is insufficient to drive growth, government borrowing can fill the investment gap and spur economic activity (Chakamera & Alagidede, 2018). The Keynesian Theory of Public Debt holds significant implications for the study of the interrelationship between public debt, infrastructure, and economic growth. By highlighting the potential role of government borrowing in stimulating economic activity and infrastructure development, the theory informs policymakers about the importance of strategic debt-financed investments in promoting long-term economic growth (Yusuf & Mohd, 2021). Additionally, Keynesian perspectives challenge the notion that public debt is inherently detrimental to economic performance, suggesting that judicious use of deficit spending can lead to positive outcomes, particularly in times of economic crisis or underutilization of resources (Gomez-Puig et al., 2022).

2.4.2 The Ricardo's Theory of Debt

The Ricardo Theory of Public Debt was propounded by David Ricardo in 1819. In his Principles, Ricardo developed the theory of public debts by stating that the ordinary and extraordinary spending of government were mainly payments made to sustain unproductive laborers. Therefore, any saving from the government expenses would be included in the income if not to the capital of the contributors. Ricardo in a letter written to McCulloch in 1816 believed that public expenditure was wasteful venture undertaken by the state. Ricardo's theory of public debts was then, based on the fact that the primary burden to the community was derived from the wasteful nature of public expenditure itself rather than from the methods adopted to finance such expenditure (Precious, 2015). The theory postulated that financing public expenditure should be focused on drawing the funds from the liquid resources of the community. This is because to focus on the economy, does not make any significant difference

whether the funds were raised by loans or taxes. Accordingly, Ricardo argument about payments of interest on public debt deals with a transfer of wealth from one pocket to another within the society. Thus, when countries borrow, it is uncertain whether the loan would be used productively or unproductively. If the loan is used productively, it leads to growth, but it is used unproductively, it deters economic growth in the economy (Okoye, Modebe & Evbuomwan, 2013). In conclusion, this theory is relevant to this study as it would help to determine whether actually, the government expenditures in Nigeria have over time been used productively or unproductively according to the theory.

2.4.3 Debt Overhang Theory

This theory is credited to Krugman (1988). The theory is premised on a situation where a debt burden is so large an entity cannot take on additional debt to finance future projects. Debt overhang can lead to underinvestment, which stunts growth, making recovery even more difficult. It can also apply to sovereign state like Nigeria. In these case, the term refers to a situation in which the debt of nation exceeds its future capacity to repay it. This can occur from an output gap or economic underemployment, repeatedly plugged by the creation of additional credit. To this extent part of the returns got from investment made by either domestic or new foreign investor in the domestic economy are heavily taxed. (Lawal et al, 2016). Therefore, the new foreign investor may be discouraged from making further investment in the domestic economy. It has been argued that debt overhang can lead to stagnant growth and a degradation of living standard from reduced funds to spending in critical areas such as healthcare, education and infrastructure. The theory on debt overhang is based on assumption that if the level of debt a country owes goes beyond the ability of that country to payback, then it is not healthy situation and that can plung the economy into unwanted economic uncertainty. The concept of debt overhang is wider in scope because its impact is not limited to investment in physical capital but also to any activity that may incur cost in the nearest future (Elbadawi, 1997).

2.4.4 The Classical Theory

The classical economists, Adam Smith, Thomas Robert Malthus, David Ricardo, John Stuart Mill, and others, were very much concerned with economic growth. They thought that economic growth would eventually cease. The economy would enter a stationary state. In that state, population growth would be zero, and investment would be for replacement only. Real wages would be constant and at a low level. Classical theory was based in part on the theory of population associated with Thomas Robert Malthus. In a simplest terms, Malthus assumed that population increases geometrically: 1, 2, 4, 8, 16, ... Food production, on the other hand, is capable of increasing only arithmetically: 1, 2, 3, 4, 5, ... Consequently, difficulties will arise in the long run as population outstrips the food supply. At that point, mortality rates increase owing to starvation and malnutrition. In the short run, the classical economists assumed that economic growth would occur. Profits would be high and capital accumulation would occur. As the capital stock increased, it was assumed that real wages would rise above the minimum subsistence level, thereby inducing population growth.The classical economists stressed land as a factor of production and emphasized the law of diminishing returns. They argued that land was essentially a nonaugmentable factor of production; therefore as population increased and capital accumulated, diminishing returns would prevail. Consequently, real wages and profits would fall until only investment for replacement would be profitable. To be sure, the classical economists conceded that technological progress might postpone the inflationary state, but not indefinitely. The prognosis of the classical economists was, therefore gloomy.

2.5 Empirical Review

This section briefly examines the relationships between public debt, infrastructure, and economic growth across various studies, employing diverse methodologies to uncover the insights. Adams et al (2022) examined the impact of social infrastructure on Nigeria's economic growth using data from the Central Bank of Nigeria and an autoregressive distributed lag (ARDL) model. They found that investments in education positively and significantly affect economic growth, while power investments have a positive but insignificant impact, and investments in transportation and communication technology have negative long-term impacts. Ajayi and Edewusi (2020) analyzed the effect of public debt on Nigeria's economic growth using a vector error correction model and found that external debt negatively impacts growth, while domestic debt has a positive effect. Similarly, Akhanolu et al. (2018) found using two-stage least square regression that external debt negatively impacts Nigeria's economy, while internal debt positively impacts it. Ochuko and Idowu (2019) also found domestic debt positively impacts economic growth, but external debt does not, using data from 1981-2018. Amune and Ogunjimi (2019) focused on infrastructure's role in attracting FDI, using ARDL and found that while none of the infrastructure variables were significant in the short run, electricity production influenced FDI in the long run. Bennee et al. (2021) identified a significant positive relationship between infrastructure

development expenditure and Nigeria's economic growth using longitudinal research design and E-Views 10.0. Chakamera and Alagidede (2018) used principal components analysis and Generalized Method of Moments (GMM) to examine infrastructure's impact on economic growth in Sub-Saharan Africa. They found that infrastructure stock positively affects growth more than quality. Elom-Obed et al. (2017) utilized Vector Error Correction Model (VECM) and found both external and domestic debts negatively impact economic growth in Nigeria due to corruption and mismanagement. Kim, Ha, and Kim (2017) used pooled OLS and GMM models and highlighted that corruption affects the relationship between public debt and economic growth, with public debt enhancing growth in transparent countries but having a negative impact in corrupt ones. Matthew and Mordecai (2016) used co-integration and ECM, revealing that domestic debt positively impacts economic development, while external debt has a negative relationship. Ndoricimpa (2020) applied panel smooth transition regression and identified a debt threshold effect in Africa, showing that low debt is growth neutral or enhancing, while high debt is detrimental. Rafindadi and Musa (2019) found that debt management strategies like refinancing and debt forgiveness positively impact Nigeria's debt profile using ARDL.

3.0 Methodology

3.1 Data

Data for the study was sourced from the Central Bank of Nigeria (CBN) statistical bulletin, Debt Management Office and World Bank. The independent variables under examination include External Debt (EXD), Internal Debt (IND) and Infrastructure Index (INFI) while control variables such as Debt Servicing (DES), Exchange Rate (EXR) and Real Interest Rates (RITR) are included to mitigate potential confounding effects. The dependent variable is Real GDP Growth Rate (RGDP), serving as a proxy for economic growth.

3.2 Method of Data Analysis

The collected data were measured econometrically. Specifically, the data was first subjected to Descriptive statistics to summarize the characteristics of the data, providing a preliminary understanding of key variables' distributions and relationships, followed by Unit-Root test, Co-integration test, given the existence of non-stationarity among the variables. The co-integration test enables the study ascertain the existence of long-run relationship.

3.3 Model Specification

The econometric model used for data analysis is specified as;

$$RGDP = \beta_0 + \beta_1 EXD + \beta_2 IND + \beta_3 INFI + \beta_4 DES + \beta_5 EXR + \beta_6 RITR + \mu_t$$

$Where$:

$RGDP = Economic\ Growth\ rate$
$EXD = External\ debt$
$IND = Internal\ Debt$
$DES = Debt\ Servicing$
$EXR = Exchange\ Rate$
$RITR = Real\ Interest\ Rate$
$\beta_i = Intercept$
$\mu_t = Stochastic\ error\ term$

4.0 Empirical Results and discussion

4.1 Empirical Results

The section presents the data analysis and interpretation of the result of the endogenous and exogenous variables. The collected data are analyzed and presented in the following tables. Tables 1, 2, 3, 4 and 5 (descriptive statistics, correlation matrix, unit root test, cointegration results and regression and T-test result).

Table 1: Descriptive Statistics of the Variables

	RGDP	EXD	IND	INFI	DES	EXR	RITR
Mean	385.8974	2702.229	4038.054	7.3539	0.306253	115.7412	13.08333
Std. Dev.	208.5423	4281.546	5852.148	9.3230	0.547132	119.1408	3.947702
Skewness	0.527287	2.353025	1.592670	0.6858	1.735614	1.021357	0.675538
Kurtosis	1.639848	8.076075	4.541303	1.7962	4.569246	3.221275	4.435984
Obs.	42	42	42	42	42	42	42

Source: Authors computation with E-views 10.

The descriptive statistics presented in Table 1 offer insights into the distribution and characteristics of the variables under examination. The mean values provide an indication of the central tendency of each variable, with Real GDP Growth Rate (RGDP) averaging 385.89, External Debt (EXD) at 2702.22, Internal Debt (IND) at 4038.05, Infrastructure Index (INFI) at 7.3539, Debt Servicing (DES) at 0.306, Exchange Rate (EXR) at 115.74, and Real Interest Rates (RITR) at 13.08. Standard deviations measure the dispersion of data points around the mean, with higher values indicating greater variability. In this case, variables such as EXD, IND, and INFI exhibit relatively high standard deviations, indicating significant variability in the levels of external debt, internal debt, and infrastructure index across the observation period. Skewness measures the asymmetry of the distribution, with positive values indicating a right-skewed distribution. Kurtosis measures the peakedness of the distribution, with higher values indicating heavier tails. Interpreting the skewness and kurtosis values reveals that several variables, including EXD, IND, INFI, DES, EXR and RITR, exhibit right-skewed distributions with positive skewness and higher kurtosis, suggesting non-normal distributions with heavier tails. These findings imply potential challenges in modeling these variables using parametric techniques that assume normality.

Table 2: Correlation Matrix

	RGDP	EXD	IND	INFI	DES	EXR	RITR
RGDP	1						
EXD	0.6426	1					
IND	0.8933	0.8736	1				
INFI	0.9793	0.6442	0.9165	1			
DES	0.8249	0.8598	0.9619	0.8622	1		
EXR	0.9187	0.8683	0.9508	0.9031	0.9080	1	
RITR	-0.1371	0.1468	-0.0299	-0.1849	-0.0376	-0.0154	1

Source: Authors computation with E-views 10.

The correlation matrix in Table 2 illustrates the relationships between the variables under investigation. RGDP shows strong positive correlations with External Debt (EXD), Internal Debt (IND), Infrastructure Index (INFI), Debt Servicing (DES), and Exchange Rate (EXR) with correlation coefficients of 0.6426, 0.8933, 0.9793, 0.8249, and 0.9198 respectively. These findings suggest that as RGDP increases, so do the levels of external and internal debt, infrastructure index, debt servicing, and exchange rate. However, Real Interest Rates (RITR) show weak negative correlations of -0.1371 with all other variables, indicating a potential inverse relationship with economic growth and other economic indicators. These correlations have important implications for understanding the dynamics between public debt, infrastructure, and economic growth. The strong positive correlations between RGDP and EXD, IND, INFI, DES, EXR suggest that higher levels of debt and infrastructure investments are associated with higher economic growth. Conversely, the weak negative correlations between RGDP and RITR indicate that higher real interest rates may have a dampening effect on economic growth.

Table 3: Unit Root Test of Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) Test

Variables		at levels	at first difference	at second difference	Equation Specification	Order of Integration
RGDP	ADF	0.60303 (0.9881)	-3.33121 (0.0199)	-	None	I(1)
	PP	1.12599 (0.9971)	-3.19733 (0.0275)	-	None	I(1)
EXD	ADF	1.17493 (0.9975)	-1.95637 (0.3042)	-	None	I(1)
	PP	3.40574 (1.0000)	-1.95251 (0.3059)	-	None	I(1)
IND	ADF	4.06373 (1.0000)	3.17214 (1.0000)	-	None	I(1)
	PP	27.1407 (1.0000)	-0.26073 (0.9218)	-	None	I(1)
INFI	ADF	0.89550 (0.9945)	-6.13281 (0.0000)	-	None	I(1)
	PP	0.93247 (0.9950)	-6.13688 (0.0000)	-	None	I(1)
DES	ADF	3.72164 (1.0000)	4.51452 (1.0000)	-	None	I(1)
	PP	0.99639 (0.9958)	-8.33817 (0.0000)	-	None	I(1)
EXR	ADF	2.86410 (1.0000)	-4.21165 (0.0019)	-	None	I(1)
	PP	3.18644 (1.0000)	-4.12966 (0.0024)	-	None	I(1)
RITR	ADF	-3.38683 (0.0172)	-8.62799 (0.0000)	-	None	I(1)
	PP	-3.33526 (0.0196)	-8.73535 (0.0000)	-	None	I(1)

P-values at 5% statistical significance

Source: Authors computation with E-views 10.

The unit root tests (ADF and PP) results presented in Table 3 indicate the stationarity properties of the variables: RGDP, EXD, IND, INFI, DES, EXR, and RITR. At their levels, all variables have p-values greater than 0.05, implying the presence of unit roots and hence non-stationarity. However, at the first difference, the p-values for all variables fall below the 0.05 significance level, suggesting that the null hypothesis of a unit root can be rejected, and the variables become stationary. This means that each variable is integrated of order one, I(1). The implication of these findings is that to avoid spurious regression results and to ensure valid econometric analysis, the variables must be differenced once to achieve stationarity. This step is crucial in time-series analysis to properly capture the long-run equilibrium relationships and dynamic interactions among the variables under study.

Table 4: Cointegration Test

Trend assumption: Quadratic deterministic trend Lags interval (in first differences): 1 to 2				
Unrestricted Cointegration Rank Test (Trace)				
Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.858251	272.3870	139.2753	0.0000
At most 1 *	0.835648	196.1928	107.3466	0.0000
At most 2 *	0.734117	125.7687	79.34145	0.0000
At most 3 *	0.601382	74.10540	55.24578	0.0005
At most 4 *	0.489598	38.23508	35.01090	0.0218
At most 5	0.239228	12.00537	18.39771	0.3087
At most 6	0.033823	1.341926	3.841466	0.2467
Unrestricted Cointegration Rank Test (Maximum Eigenvalue)				
Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.858251	76.19424	49.58633	0.0000
At most 1 *	0.835648	70.42405	43.41977	0.0000
At most 2 *	0.734117	51.66332	37.16359	0.0006
At most 3 *	0.601382	35.87032	30.81507	0.0111
At most 4 *	0.489598	26.22972	24.25202	0.0270
At most 5	0.239228	10.66344	17.14769	0.3389
At most 6	0.033823	1.341926	3.841466	0.2467

Source: Authors computation with E-views 10.

The cointegration test results in Table 4, based on the Johansen method with a quadratic deterministic trend, indicate that there are multiple cointegrating relationships among the variables RGDP, EXD, IND, INFI, DES, EXR, and RITR. The Trace test identifies five cointegrating equations at the 0.05 significance level, while the Maximum Eigenvalue test identifies five as well. Specifically, the eigenvalue statistics for "None" through "At most 4" exceed the critical values, with p-values indicating statistical significance ($p < 0.05$), suggesting long-term equilibrium relationships among these variables. The presence of these cointegrating relationships implies that despite short-term fluctuations, the variables tend to move together in the long run, maintaining a stable equilibrium. This finding is essential for policymakers and economists as it suggests that public debt, infrastructure, and economic growth are interconnected in the long term, providing a robust basis for formulating policies aimed at sustainable economic development.

Table 5: Regression and T-test Result

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	177.6672	19.76377	8.989541	0.0000
EXD	-0.013636	0.006542	-2.084491	0.0445
IND	0.005709	0.007220	0.790688	0.4345
INFI	13.66542	3.764636	3.629944	0.0009
DES	-65.77475	33.64928	-1.954715	0.0586
EXR	1.076121	0.229608	4.686770	0.0000
RITR	1.308617	1.386303	0.943961	0.3517

Source: Authors computation with E-views 10.

The hypothesis regarding the impact of external debt (EXD), internal debt (IND), and the infrastructure index (INFI) on real GDP growth rate (RGDP) are tested using the regression results presented in Table 5. The results indicate that EXD has a negative and significant impact on RGDP, with a coefficient of -0.013636 and a p-value of 0.0445, leading to the rejection of the null hypothesis (H0: EXD has no significant impact on RGDP). In contrast, IND has a coefficient of 0.005709 and a p-value of 0.4345, which is greater than the 0.05 significance level, resulting in the acceptance of the null hypothesis (H0: IND has no significant impact on RGDP). The infrastructure index (INFI) shows a positive and significant impact on RGDP with a coefficient of 13.66542 and a p-value of 0.0009, leading to the rejection of the null hypothesis (H0: INFI has no significant impact on RGDP).

4.2 Discussion of Findings

The analysis and hypothesis testing yielded critical insights into the relationships between public debt, infrastructure, and economic growth. The first hypothesis tested whether external debt (EXD) significantly impacts the real GDP growth rate (RGDP). The regression analysis revealed a negative coefficient for EXD (-0.013636) with a p-value of 0.0445, indicating that external debt has a statistically significant adverse effect on economic growth at the 5% significance level. The second hypothesis examined the impact of internal debt (IND) on RGDP. The coefficient for IND was found to be 0.005709, with a p-value of 0.4345, suggesting that internal debt does not have a statistically significant effect on economic growth. The third hypothesis investigated the effect of the infrastructure index (INFI) on RGDP. The results showed a positive and significant coefficient for INFI (13.66542) with a p-value of 0.0009, indicating that infrastructure development significantly promotes economic growth.

5.0 Conclusion and Policy Recommendations

5.1 Conclusion

These study findings have profound significance and implications for economic policy and growth strategies, particularly in the context of developing economies like Nigeria. The findings underscore the importance of prudent external debt management, the stability offered by internal debt, and the growth-enhancing effects of investing in infrastructure. These insights are crucial for policymakers aiming to foster sustainable economic growth. Balancing debt levels while investing in strategic infrastructure is a critical driver for economic growth. This study contributes to the broader discourse on public finance and economic policy, offering evidence-based recommendations for managing debt and promoting growth. The integration of these findings with existing literature, such as that of Ajayi and Edewusi (2020), Akhanolu et al. (2018), and Chakamera and Alagidede (2018), enriches the understanding of the dynamics between public debt, infrastructure and economic growth, providing a comprehensive framework for future research and policy formulation. The emphasis on strategic infrastructure investments and effective debt management strategies can guide policymakers in developing countries toward achieving sustainable economic growth and development.

5.2 Policy Recommendations

Based on the major findings from this study, several recommendations emerge to foster sustainable economic growth. Firstly, the negative impact of external debt on economic growth suggests the need for prudent external debt management. Policymakers should prioritize borrowing from concessional sources with lower interest rates and longer repayment periods to minimize the debt burden, implement stringent debt management policies, debt buybacks and place embargo on new loans. Secondly, the study showed that internal debt does not significantly impact economic growth indicates the potential benefits of developing a robust domestic debt market. Enhancing the capacity of domestic financial institutions to absorb government securities can provide a stable funding source for development projects. Thirdly, the significant positive impact of infrastructure on economic growth underscores the need for more strategic and sustained investment in critical infrastructure. The government should engage in Public Private Partnerships in key infrastructural sectors such as agriculture, transportation, energy, telecommunication and manufacturing to address bottlenecks, encourage foreign direct investments and drive economic growth.

To achieve these recommendations, policymakers should adopt a multi-faceted approach that includes comprehensive planning, stakeholder engagement, effective regulation, transparency and accountability, continuous monitoring and evaluation. Establishing inter-ministerial committees to oversee debt management and infrastructure development can enhance coordination and ensure that policies are implemented effectively. Engaging with international financial institutions and development partners can provide technical assistance and funding support for capacity-building initiatives. Regularly reviewing and updating policy frameworks based on empirical evidence and best practices can ensure that strategies remain relevant and effective. Finally, fostering transparency and accountability in public finance management can build public trust and support for government initiatives, thereby facilitating the successful implementation of recommended policies.

6.0 References

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