

## **Investment in Infrastructural and Economic Growth in Nigeria from 1990 - 2022**

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### **ABSTRACT**

This research investigates the impacts of infrastructural investment on Nigeria's economic growth from 1990 to 2022, utilizing time series data sourced from the CBN Statistical Bulletin and the World Development Indicators. The specific objectives of this study are to investigate the impact of investment in road and construction on Nigeria's GDP growth; assess the effect of investment in transport and communication on GDP growth; evaluate the influence of telecommunication developments on GDP growth; and to examine the impact of access to electricity on GDP growth in Nigeria. The dependent variable in the study is the GDP growth rate (annual %), while the independent variables include investment in roads and construction, access to electricity (% of population), investment in transport and communication, and fixed telephone subscriptions (per 100 people). The data analysis techniques utilized include the ADF unit root test, bounds cointegration, the autoregressive distributed lag (ARDL) estimation method and the residual diagnostic tests. The Augmented Dickey-Fuller (ADF) unit root tests revealed a mix of I(1) and I(0) series, indicating that the variables differ in their levels of integration. Evidence of cointegration was established, suggesting a long-term equilibrium relationship among the variables. The ARDL results revealed that investment in roads and construction exhibits a negative relationship with economic growth, which is not statistically significant; access to electricity has a positive relationship but is not statistically significant with economic growth; investment in transport and communication has a positive and statistically significant impact on Nigeria's economic growth; and fixed telephone subscriptions have a positive but not statistically significant impact on economic growth in Nigeria. Based on these findings, the study recommends, among other things, that the Nigerian government should conduct a thorough review of the current strategies and allocations in road construction. This review should aim to identify inefficiencies and misallocations of resources.

**Keywords:** ARDL, ADF and Infrastructure investment

### **1. Introduction**

Infrastructure investment is widely recognized as a critical driver of economic growth, particularly in developing countries like Nigeria. The nexus between infrastructure development and economic growth has been extensively studied, revealing that efficient infrastructure promotes economic activities, enhances productivity, and improves the quality of life (Foster et al., 2023; Syadullah and Setyawan, 2021).

Nigeria, Africa's largest economy, has experienced fluctuating economic growth rates over the past decades. Despite rich natural resources, the country's economic performance has been hindered by inadequate infrastructure (World Bank, 2019). The Nigerian government, recognizing this, has increased its focus on improving infrastructure to bolster economic growth. According to



the data from Central Bank of Nigeria, Statistical Bulletin in 2022, infrastructure spending in Nigeria has seen a significant increase in recent years, yet the tangible impacts on economic growth remain a subject of extensive debate among policymakers and scholars.

Infrastructure in Nigeria has historically been underfunded and poorly maintained, leading to significant economic inefficiencies. The World Economic Forum (2018) ranks Nigeria 132nd globally in terms of infrastructure quality. Statistically, it is estimated that power outages and poor road conditions cost Nigeria approximately 2% of its Gross Domestic Product (GDP) annually (World Bank, 2019). This study aim is to quantitatively examine the relationship between infrastructure investment and economic growth in Nigeria. Specifically, the objectives of this study are to investigate the impact of investment in road and construction on Nigeria's GDP growth; assess the effect of investment in transport and communication on GDP growth; evaluate the influence of telecommunication developments on GDP growth; and to examine the impact of access to electricity on GDP growth in Nigeria.

## **2. Literature Review**

### **Theoretical Literature**

#### **Solow-Swan Growth Model**

Endogenous Growth Theory, developed in the 1980s and 1990s, marks a significant shift in understanding economic growth by focusing on internal factors within an economy, unlike exogenous models like the Solow-Swan model that view technological progress as external (Romer, 1986; Lucas, 1988). This theory posits that economic growth is driven by investments in human capital, innovation, and knowledge, which are seen as key internal growth engines.

Unlike traditional models that assume diminishing returns, Endogenous Growth Theory often suggests constant or increasing returns due to knowledge spillovers and the non-rival nature of knowledge (Romer, 1990). Knowledge is considered a crucial input that can perpetuate growth without external stimuli. The theory differentiates between proprietary specific knowledge and general knowledge that benefits the entire economy, emphasizing that knowledge accumulation boosts productivity and spurs further innovation (Aghion and Howitt, 1992).

Endogenous Growth Theory also highlights the significant role of government policy in fostering growth through support for research and development, education, and infrastructure, which enhance economic capacity (Grossman and Helpman, 1991). Additionally, it underscores the importance of institutions and policies that create favorable market conditions, such as protecting intellectual property rights and maintaining competitive markets (North, 1990). Despite its insights, the theory faces criticism for possibly overstating the role of knowledge and technology in growth and questioning the practicality of policy interventions across different institutional contexts (Parente and Prescott, 1994).



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## **New Economic Geography Theory**

Paul Krugman's New Economic Geography, introduced in his 1991 paper, offers a framework for understanding the role of infrastructure in economic clustering. According to Krugman, businesses tend to cluster in specific regions to benefit from reduced transportation costs and better market access (Krugman, 1991). This clustering is strategic, aimed at minimizing costs and maximizing efficiency.

Infrastructure investments, especially in transportation, are crucial in this context. They improve transportation efficiency, allowing businesses to cluster more effectively, reducing shipping costs and enhancing the exchange of labor and ideas, which in turn fosters innovation and efficiency (Krugman, 1991). Krugman suggests that this creates a self-reinforcing cycle where initial regional advantages attract more businesses, enhancing the region's economic density and attractiveness. This geographical concentration of industries, spurred by infrastructure, can significantly impact regional and overall economic growth. Better infrastructure in a region can attract more industries, leading to greater local economic activity and potentially higher overall economic output. This concentration can also increase specialization and economies of scale, boosting productivity and growth (Krugman, 1991).

In summary, Krugman's theory highlights the critical role of strategic infrastructure investments in promoting economic agglomeration and growth, emphasizing their long-term impact on regional and national economic development (Krugman, 1991).

## **Network Externality Theory**

Network externalities, or network effects, describe how the value of a product or service increases with the number of its users. This concept is crucial in sectors like telecommunications and electricity. For example, in telecommunications, the utility of fixed telephone services grows as more people subscribe, because each new user expands the network's reach and potential for communication. This increase in value can create a positive feedback loop, attracting even more subscribers. Katz and Shapiro (1985) discussed this in detail, noting the strong network externalities present in telecommunications. Similarly, in the electricity sector, as more people connect to the power grid, the broader economic and social benefits increase. This is because electricity supports essential services and industries, enhancing overall productivity and economic activity as the network expands.

The presence of network externalities suggests that early substantial investments in these networks can be beneficial. Achieving a critical mass of users can initiate a self-sustaining cycle of growth and value enhancement, which is an important consideration for policy and investment decisions. Overall, network externalities are key to understanding the increasing value and impact of expanding infrastructure networks in telecommunications and electricity.



## **Empirical Review**

Irshad and Ghafoor (2023) analyzed the contribution of infrastructure in economic growth across 18 lower-middle income countries for the period of 1995–2017 by applying fully modified ordinary least squares (FMOLS) and dynamic ordinary least squares (DOLS). The study finds that investment in telecommunication, electricity power consumption, and transportation contributes to economic growth in lower-middle-income countries. Thus, continuous investment is needed in transportation, electricity power, and communication sectors to achieve the target of high economic growth.

Zhang and Cheng (2023) investigated the relationship between transport infrastructure development and economic growth in the UK from different time spans. The study utilized principal component analysis (PCA) to construct a comprehensive measure of transport infrastructure development. The study then applies Vector Error Correction Model (VECM) to investigate both long-run and short-run relationships between transport infrastructure development and economic growth from 1970 to 2017 in the UK. Empirical results suggested that transportation infrastructure has a long-run promotive effect on economic development. However, in the short run, the effect turns out to be significantly negative.

Haldar et al. (2023) investigated the effects of ICT, innovation, electricity-consumption and renewable power generation, on the economic growth of the emerging economies. Using Instrumental-Variable GMM and fixed-effects regression with Driscoll-Kraay standard-errors, the study found that, ICT not only increases economic growth monotonically, but also increases the effectiveness of financial development on growth. However, ICT were also found to accentuate the negative effects of trade on economic growth. In order to account for the heterogeneities among these economies, both conditional and unconditional panel quantile estimators were used for an income-level analysis. The result showed that internet-use increases growth significantly in the lower and middle-income quantiles; innovation were also found to have significant negative effects on growth, except for the highest income-quantile, while the positive growth-effects of electricity-consumption are confirmed across all quantiles. These findings suggested that the emerging economies should increase internet-connectivity to induce network-effect and to improve their capital markets, while also augmenting renewable electricity generation for environmentally-sustainable economic growth.

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Okonkwo et al. (2023) scientifically examined the effects of government capital expenditure in its disaggregated form (administration, social and community service, economic services, transfers, and government deficit) on Nigeria's economic growth rate from 1981 to 2021 in addition to evaluating how well government expenditure performed in the years following the pandemic in 2021. Secondary data sourced from the CBN statistical bulletin, 2021, were used in the analysis. Because the variables have a mixed order of integration, the study used the autoregressive distributed lag model. The bounds test showed a longrun association between the studied variables. The error correction model showed a strong and positive association between administrative and economic services and the rate of economic growth in Nigeria.

Using Hirschman's approach, Okoli et al. (2023) investigated the impact of government spending on economic growth in Nigeria, analyzing annual data from 1970 to 2020. The study utilized data from the CBN Statistical Bulletin to examine government's spending in the transport, communication, health, education, and utilities sectors. An autoregressive distributed lag model was employed, and the results indicate a positive but non-significant short-term effect of communication and utility sector spending on Nigeria's economic growth. However, there was a negative but non-significant short-term effect of transportation, health, and education sector spending on Nigeria's economic growth. Thus, their study recommended that the government increase expenditure on the highlighted sectors, as well as the agricultural and petroleum sectors, which are areas where Nigeria is highly endowed. This approach will enable the country to achieve infrastructural development and positively impacting economic growth.

Abdullahi and Sieng (2023) examined the effect of infrastructure development on economic growth in ten sub-Saharan Africa. This study uses balanced panel data of ten African countries, particularly sub-Saharan Africa over the period of 2010–2020 by analyzing a set of independent variables with relation to the dependent, which is GDP per capita. Their study found that water supply and sanitation index and electricity index have positive and significant relationship with economic growth, while transport index and Information & Communications (ICT) have negative relationship with economic growth in these countries.

using ARDL models, Nenaveth (2023), investigated the relationship between transport infrastructure and economic growth in India for the period 1990 – 2020. The results showed that infrastructure has a positive impact on economic growth in India for the long run. Moreover, Granger causality test demonstrates a unidirectional relationship between transport infrastructure to economic development. Stimulatingly, the research highlighted the effect of air infrastructure statistically insignificant on economic growth in the long and short-run period.

Owunna and Adediwura (2023) examined the impact of information communication technology, using the internet usage and telephone subscription as a proxy on economic growth in Nigeria between 1996 and 2020. Auto Regressive Distribution lag (ARDL) method of estimation was used to achieve the objective of their study. Empirical findings established that, there exists a relationship between internet usage and telephone subscription on economic growth in Nigeria.



Hence, the result showed that mobile telephone subscription has a positive and significant effect on economic growth both in short run and long run, while Internet Usage revealed a negative and insignificant relationship with the economic growth in Nigeria.

Chandana et al. (2024) investigated the impact of Nigerian government expenditure (disaggregated into capital and recurrent) on economic growth using time series data for the period 1970-2019. The paper employs Autoregressive Distributed Lag (ARDL) model. To ensure robustness of results, the study accounts for structural breaks in the unit root test and the co-integration analysis. The key findings of the study are that capital expenditure has positive and significant impact on economic growth both in the short run and long run while recurrent expenditure does not have significant impact on economic growth both in the short run and long run. The study recommends that government should increase the share of the capital expenditure especially on meaningful projects that have direct bearing on the citizen's welfare. Government should also improve the spending patterns of recurrent expenditure through careful reallocation of resources toward productive activities that would enhance human development in the country.

Eldowma et al. (2023) investigated the nexus between electricity consumption, carbon dioxide emissions, total population, and economic growth from 1971 to 2019. Their study incorporated Autoregressive Distributed Lag (ARDL) bound testing approach with various econometric techniques to address methodological limitations in Sudan and introduces appealing methodological innovation to control the structural breaks in the dataset. The study empirical findings demonstrated that despite the high potential of energy resources, Sudan has failed to provide adequate electricity to promote economic development and meet population electricity demand. The ARDL results show strong associations between total population, environmental degradation and economic growth. The Granger causality results show evidence that the country's growing population improves economic growth, increases electricity demand, and damages the environment.

Mhaka et al. (2020) used time series data for the period 1992-2018 and Dynamic Ordinary Least Squares (DOLS) to assess electricity access on economic growth. The results revealed that electricity access to urban population and electricity access to population (EAP) have positive significant impact on economic growth. However, electricity access to rural population was found to be statistically insignificant reflecting that electricity is not always available when it is needed in the rural areas.



### 3. Methodology

#### Research Design

This study adopted the ex-post research design.

#### Data Collection Method and Sources

The data utilized in this study is obtained from secondary data, mainly time-series data from reputable organizations such as the CBN Statistical Bulletin and World Development Indicators 1990-2022.

#### Model Specification

To achieve the objective of this study, the Autoregressive Distributed-Lag model was adopted to quantitatively estimate the relationship between investment in road and construction, transport and communication, telecommunication developments and access to electricity on GDP growth in Nigeria. The Solow-Swan growth model developed by Robert Solow in 1956 is valuable for modeling infrastructure investment and economic growth as it highlights the critical role of infrastructure in economic progression, provides a long-term perspective on the impacts of infrastructural investments, and aids in strategic policy formulation.

#### The Functional forms of the models are thus:

$$GDPG = f(ROCO, TCOM, ACCE, FTES) \quad 1$$

#### Stated in linear form gives:

$$GDPG_t = \beta_0 + \beta_1 ROCO_t + \beta_2 TCOM_t + \beta_3 ACCE_t + \beta_4 FTES_t + \varepsilon_t \quad 2$$

Where;

GDPG= GDP annual growth; ROCO = Road and construction; TCOM = Transport and communication; ACCE = Access to electricity; FTES = Fixed telephone subscriptions

$\beta_0$  = constant parameter or the intercept;  $\beta_1 - \beta_4$  = are coefficients;  $\mu_1$  is the error term; t = represent time.

#### Formulating the Autoregressive Distributed Lag (ARDL) short and long-run model gives:

$$\Delta GDPG_t = \alpha_0 + \sum_{i=1}^p \Delta_1 ROCO_{t-1} + \sum_{i=1}^k \Delta_2 TCOM_{t-1} + \sum_{i=1}^k \Delta_3 ACCE_{t-1} + \sum_{i=1}^k \Delta_4 FTES_{t-1} + \Delta_5 \pi ect_{t-1} + \lambda_1 GDPG_{t-1} + \lambda_2 ROCO_{t-1} + \lambda_3 TCOM_{t-1} + \lambda_4 ACCE_{t-1} + \lambda_5 FTES_{t-1} + \varepsilon_{1t}$$

**Where:**  $\alpha_0$  = constant parameter to be estimated;  $\alpha_1 - \alpha_5$  = short run parameters;  $\lambda_1 - \lambda_5$  = long-run multipliers; p = optimal lag for the dependent variables; k = optimal lag of the independent variables;  $\Delta$  = first difference operator;  $\varepsilon_{1t}$  = error term

#### Justifications for the variables used

The inclusion of these specific variables: ROCO (Road and Construction), TCOM (Transport and Communication), ACCE (Access to Electricity), and FTES (Fixed Telephone Subscriptions) provides a comprehensive picture of Nigeria's infrastructural development and its relationship with

economic growth. Each variable targets a distinct and essential component of infrastructure that, collectively, supports economic activity. Roads, transport, and communication infrastructure lower transaction costs and enhance connectivity; access to electricity enables industrial and technological advancement; and fixed telecommunication tracks the development of communication infrastructure, an important element for business operations, even as mobile technologies emerge. Given Nigeria's significant infrastructural deficits, understanding the impact of investment in these areas can help identify the most effective pathways to accelerating economic growth.

In sum, using ROCO, TCOM, ACCE, and FTES to measure economic growth in Nigeria is justified by their direct impact on productivity, business efficiency, and access to markets and services. This approach aligns with empirical evidence showing that infrastructure investments are powerful drivers of growth, especially in developing economies like Nigeria (Calderón and Servén, 2010; Aker and Mbiti, 2010; Muhammad et al., 2021).

### Expectation

Based on economic theory, it is anticipated that the coefficients  $\beta_1$ - $\beta_4$  will be positive. Therefore,  $\beta_1 > 0$ ,  $\beta_2 > 0$ ,  $\beta_3 > 0$  and  $\beta_4 > 0$ .

## 4. Results and Discussion

**Table 1: ADF Unit Root Test**

| Variables | ADF at Level | Critical value 5% | ADF at 1 <sup>st</sup> Diff. | Critical value 5% | Order of Integration |
|-----------|--------------|-------------------|------------------------------|-------------------|----------------------|
| GDPG      | -3.683614    | -2.957110         | NA                           | NA                | 1(0)                 |
| ROCO      | 0.978516     | -2.963972         | -6.591146                    | -2.963972         | 1(1)                 |
| TCOM      | -2.703519    | -2.960411         | -4.558924                    | -2.960411         | 1(1)                 |
| ACCE      | -2.116845    | -2.971853         | -5.434433                    | -2.971853         | 1(1)                 |
| FTES      | -2.382784    | -2.967767         | -3.785773                    | -2.960411         | 1(1)                 |

Source: Authors 2024 computations from Eviews 12

The results of the Augmented Dickey Fuller (ADF) unit root test presented in Table 1 indicate that only the GDP growth rate (GDPG) exhibits stationarity at the level, as its ADF value surpasses the critical values at the 5% significance level. Conversely, the other variables in the analysis were found to be stationary in their first difference forms, as their ADF values exceed the critical values at the 5% significance level. Therefore, the series analyzed in the study consist of a combination of variables that are integrated of order 1 (I(1)) and integrated of order 0 (I(0)), as indicated in the table (Aninwagu, 2022)



### Cointegration Test Results

Given the evidence of mixed integration in the variables, the ARDL bounce test method is applied.

**Table 2: Bounds Cointegration Test**

|      | F-STATISTICS | K | Critical value |                |
|------|--------------|---|----------------|----------------|
|      |              |   | Lower bound 5% | Upper bound 5% |
| GDPR | 4.381647     | 4 | 2.56           | 3.49           |

Source: Authors 2024 computations from Eviews 12

**Note: K denotes number of explanatory variables**

In light of the admixture of I(1) and I(0) series observed in the ADF unit root test, the study employed the ARDL bound cointegration test to examine the existence of a long-run relationship in the model. The results reveal that the F-statistic of 4.381647 exceeds both the lower and upper bound critical values at a 5% significance level. This indicates a strong indication of a long-run relationship between the dependent variable and the independent variables in the model (Aninwagu, 2022).

### Model Estimation

The Autoregressive Distributed Lag (ARDL) model findings of our analysis are summarized in table below

**Table 3: ARDL short and long run results for**

| Variable     | Coefficient | Std. Error | t-Statistic | Prob.  |
|--------------|-------------|------------|-------------|--------|
| D(GDPG(-1))  | 1.396024    | 0.221688   | 6.297248    | 0.0032 |
| D(GDPG(-2))  | 1.452787    | 0.244229   | 5.948458    | 0.0040 |
| D(GDPG(-3))  | 0.687573    | 0.148428   | 4.632358    | 0.0098 |
| D(ROCO)      | -0.095435   | 0.020790   | -4.590402   | 0.0101 |
| D(ROCO(-1))  | -0.040068   | 0.016623   | -2.410410   | 0.0735 |
| D(ROCO(-2))  | -0.135516   | 0.021574   | -6.281579   | 0.0033 |
| D(ROCO(-3))  | -0.063429   | 0.016443   | -3.857431   | 0.0182 |
| D(ACCE)      | 0.383977    | 0.137670   | 2.789118    | 0.0494 |
| D(ACCE(-1))  | 0.152533    | 0.137929   | 1.105877    | 0.3308 |
| D(ACCE(-2))  | 0.392370    | 0.138902   | 2.824802    | 0.0476 |
| D(ACCE(-3))  | 0.310085    | 0.128510   | 2.412918    | 0.0733 |
| D(TCOM)      | 0.192175    | 0.040860   | 4.703240    | 0.0093 |
| D(TCOM(-1))  | -0.364946   | 0.067591   | -5.399319   | 0.0057 |
| D(TCOM(-2))  | -0.341904   | 0.043633   | -7.835930   | 0.0014 |
| D(TCOM(-3))  | -0.237785   | 0.055434   | -4.289535   | 0.0128 |
| D(FTES)      | 20.03245    | 4.547400   | 4.405252    | 0.0116 |
| D(FTES(-1))  | 4.890073    | 3.268868   | 1.495953    | 0.2090 |
| D(FTES(-2))  | 17.98169    | 5.027098   | 3.576952    | 0.0232 |
| D(FTES(-3))  | -21.41148   | 5.902838   | -3.627320   | 0.0222 |
| CointEq(-1)* | -3.142343   | 0.408571   | -7.691049   | 0.0015 |




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**Long run**


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| Variable | Coefficient | Std. Error | t-Statistic | Prob.  |
|----------|-------------|------------|-------------|--------|
| ROCO     | -0.035022   | 0.013551   | -2.584398   | 0.0610 |
| ACCE     | 0.149954    | 0.101153   | 1.482449    | 0.2124 |
| TCOM     | 0.223950    | 0.071286   | 3.141556    | 0.0348 |
| FTES     | 3.939702    | 2.310334   | 1.705252    | 0.1633 |
| C        | -6.588239   | 4.391428   | -1.500250   | 0.2079 |

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 $R^2 = 0.935585;$        $Adj.R^2 = 0.799597$ 


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Source: Authors 2024 computations from Eviews 12

The ARDL short and long run econometric analysis presented in the table above indicates that investment in road and construction during the current period and lags 1-3 has a negative and statistically significant impact on economic growth in Nigeria, except at lag 1. Conversely, the long-run econometric analysis reveals that investment in road and construction has a negative relationship with economic growth in Nigeria, which is not statistically significant. These findings are inconsistent with the empirical results from (Ali et al., 2023; Muhammad et al., 2021), which suggested that infrastructure investments, such as those in roads, bridges enhance economic growth.

Furthermore, the short-run analysis shows that access to electricity during the current period and at lag 2 has a positive relationship and is statistically significant with respect to economic growth in Nigeria. However, at lags 1 and 3, access to electricity shows a positive relationship but is not statistically significant. In the long run, the econometric analysis indicates that access to electricity has a positive relationship with economic growth in Nigeria, though it is not statistically significant. This finding aligns with the empirical research by Mhaka et al. (2020) and supports the Network Externalities theory, which posits that as more people gain access to electric services, the overall productivity and economic activities in the area can increase significantly.

Additionally, in the short run, the econometric analysis demonstrates that investment in transport and communication during the current period has a positive and statistically significant impact on economic growth in Nigeria. However, from lags 1 to 3, it shows negative relationships that are statistically significant. In contrast, the long-run econometric analysis reveals that investment in transport and communication has a positive and statistically significant impact on economic growth in Nigeria. These findings are consistent with the empirical results from Calderón and Servén (2004) and Estache and Goicoechea (2005), and they support the new economic geography theory introduced by Paul Krugman's in his 1991 seminal paper.

Moreover, the short-run econometric results indicate that fixed telephone subscriptions during the current period, lags 1 and 2, have positive relationships, but are only statistically significant at the current period and lag 2. At lag 3, fixed telephone subscriptions show a negative relationship and are statistically significant with respect to economic growth in Nigeria. In the long run, the econometric analysis shows that fixed telephone subscriptions have a positive but not statistically



significant impact on economic growth in Nigeria. This finding supports the results from Alao-Owunna and Adediwura (2023).

The negative and statistically significant coefficient of the error correction term (ECM02(-1)) value of -3.142343 suggests that the system corrects deviations from the long-run equilibrium in the short term at an approximately 314.23%.

The overall model fit is exceptionally high, with an R-squared of 0.935585 and an adjusted R-squared of 0.799597. This indicates that 93.5% of the variation in GDP growth is explained by the model, after accounting for the number of predictors. The high R-squared values suggest a robust and well-specified model that captures the dynamics of the relationship between infrastructural investment and economic growth effectively.

### Post-estimation Tests

Residual diagnostic analysis is presented in Table 4

#### Breusch-Godfrey Serial Correlation LM Test

**Table 4: Breusch-Godfrey Serial Correlation LM Test:**

|               |          |                     |        |
|---------------|----------|---------------------|--------|
| F-statistic   | 1.706119 | Prob. F(2,2)        | 0.3695 |
| Obs*R-squared | 18.28355 | Prob. Chi-Square(2) | 0.0001 |

Source: Authors 2024 computations from Eviews 12

The results of the Breusch-Godfrey Serial Correlation LM Test for the study "Infrastructural Investment and Economic Growth in Nigeria" are summarized as follows. The F-statistic is 1.706119, with a corresponding p-value of 0.3695. The p-value of the F-statistic (0.3695) is above the conventional significance level of 0.05, suggesting that we fail to reject the null hypothesis of no serial correlation based on the F-statistic. This implies that, considering the F-statistic, there is no significant evidence of serial correlation in the residuals. This finding is in tandem with the results of Aninwagu (2022).

#### Heteroskedasticity test

Findings reveal uniform variance in the model, with F-statistics and the probability exceeding the 5% significance level. This suggests the validity of the constant variance assumption across in the model analyzed (Aninwagu, 2022).



**Table 5: Breusch-Godfrey-Pagan Heteroskedasticity Test**

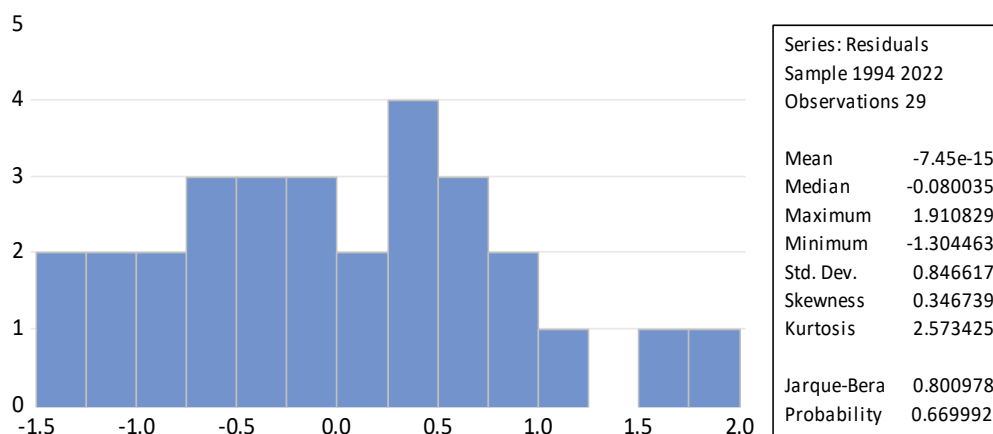
|                     |          |                      |        |
|---------------------|----------|----------------------|--------|
| F-statistic         | 0.660556 | Prob. F(24,4)        | 0.7703 |
| Obs*R-squared       | 23.15716 | Prob. Chi-Square(24) | 0.5105 |
| Scaled explained SS | 0.346597 | Prob. Chi-Square(24) | 1.0000 |

Source: Authors 2024 computations from Eviews 12

### Normality Test

The test reports a Jarque-Bera statistic of 0.800978 with a probability value of 0.669992. Since the p-value is greater than 0.05, we fail to reject the null hypothesis that the residuals are normally distributed. The skewness (0.346739) and kurtosis (2.573425) values are also within acceptable ranges, supporting the conclusion of normality.

**Figure 4.1: Jarque Bera Test**



Source: Authors 2024 computations from Eviews 12

### Conclusion and Recommendation

Based on the ARDL long-run econometric analysis, the empirical findings suggest a nuanced relationship between various types of infrastructure investments and economic growth in Nigeria. This study concludes that investment in road construction does not contribute significantly to the Nigeria’s economy. This indicates that, over the long term, road construction investments do not necessarily correlate with enhanced economic performance in Nigeria. It is also advisable for Nigerian government to conduct a thorough review of the current strategies and allocations in road construction. This review should aim to identify inefficiencies and reallocate resources towards more productive infrastructure investments.



## References

- Abdullahi, A., & Sieng, L. W. (2023). The effect of infrastructure development on economic growth: The case of sub-Saharan Africa. *Journal of Infrastructure, Policy and Development*, 7(2), 1994.
- Aghion, P., & Howitt, P. (1992). A model of growth through creative destruction. *Econometrica*, 60(2), 323-351.
- Aker, J. C., & Mbiti, I. M. (2010). Mobile phones and economic development in Africa. *Journal of Economic Perspectives*, 24(3), 207-232.
- Alao-Owunna, I., & Adediwura, O. M. (2023). Information communication technology and its impact on the economic growth of Nigeria. *Asian Journal of Economics, Business and Accounting*, 23(8), 52-63.
- Aninwagu, V. O. (2014). *Fiscal deficits and macroeconomic performance* [Unpublished master's thesis]. Rivers State University.
- Calderón, C., & Servén, L. (2004). The effects of infrastructure development on growth and income distribution. *World Bank Policy Research Working Paper*, No. 3400.
- CBN (2022). *Annual statistical bulletin*. Retrieved from <https://www.cbn.gov.ng/documents/statbulletin.asp>
- Chandana, A., Adamu, J., & Musa, A. (2024). Impact of government expenditure on economic growth in Nigeria, 1970-2019. *CBN Journal of Applied Statistics (JAS)*, 11(2), 6.
- Donaldson, D. (2018). Railroads of the Raj: Estimating the impact of transportation infrastructure. *American Economic Review*, 108(4-5), 899-934.
- Duranton, G., & Turner, M. A. (2012). Urban growth and transportation. *Review of Economic Studies*, 79(4), 1407-1440.
- Eldowma, I. A., Zhang, G., & Su, B. (2023). The nexus between electricity consumption, carbon dioxide emissions, and economic growth in Sudan (1971–2019). *Energy Policy*, 176, 113510.
- Fedderke, J. W., & Bogetic, Z. (2009). Infrastructure and growth in South Africa: Direct and indirect productivity impacts of 19 infrastructure measures. *World Development*, 37(9), 1522-1539.
- Fernald, J. G. (1999). Roads to prosperity? Assessing the Link between Public Capital and Productivity. *American Economic Review*, 89(3), 619-638.
- Foster, V., Gorgulu, N., Straub, S., & Vagliasindi, M. (2023). *The impact of infrastructure on development outcomes*. Washington, DC: World Bank.
- Grossman, G. M., & Helpman, E. (1991). *Innovation and growth in the global economy*. MIT Press.
- Haldar, A., Sucharita, S., Dash, D. P., Sethi, N., & Padhan, P. C. (2023). The effects of ICT, electricity consumption, innovation and renewable power generation on economic growth:

- An income level analysis for the emerging economies. *Journal of Cleaner Production*, 384, 135-607.
- Irshad, R., & Ghafoor, N. (2023). Infrastructure and economic growth: Evidence from lower middle-income countries. *Journal of the Knowledge Economy*, 14(1), 161-179.
- Katz, M. L., & Shapiro, C. (1985). Network externalities, competition, and compatibility. *American Economic Review*, 75(3), 424-440.
- Krugman, P. (1991). Increasing returns and economic geography. *Journal of Political Economy*, 99(3), 483-499.
- Krugman, P. (1991). Increasing returns and economic geography. *Journal of Political Economy*, 99(3), 483-499.
- Liu, Y., Ali, A., Chen, Y., & She, X. (2023). The effect of transport infrastructure (road, rail, and air) investments on economic growth and environmental pollution and testing the validity of EKC in China, India, Japan, and Russia. *Environmental Science and Pollution Research*, 30(12), 32585-32599.
- Lucas, R. E. (1988). On the mechanics of economic development. *Journal of Monetary Economics*, 22(1), 3-42.
- Lucas, R. E. (1988). On the mechanics of economic development. *Journal of Monetary Economics*, 22(1), 3-42.
- Mhaka, S., Runganga, R., Nyagweta, D. T., Kaseke, N., & Mishi, S. (2020). . Impact of rural and urban electricity access on economic growth in Zimbabwe. *International Journal of Energy Economics and Policy*, 10(6), 427-434
- Muhammad, A., Rabia, R., Rashid, A., Furrukh, B. (2021). Infrastructural investments and economic growth: Evidence from Pakistan. *Journal of Business and Social Review in Emerging Economies*, 7(3). <https://doi.org/10.26710/jbsee.v7i3.1845>
- Nenavath, S. (2023). Does transportation infrastructure impact economic growth in India?. *Journal of facilities management*, 21(1), 1-15.
- North, D. C. (1990). *Institutions, institutional change and economic performance*. Cambridge University Press.
- Okoli, U. V., Nwokoye, E. S., & Ezedebego, I. R. (2023). Government infrastructural spending and economic growth in Nigeria. *International Journal of Research and Innovation in Social Sciences*, 7(5), 457-469.
- Okonkwo, O. N., Ojima, D. A. V. I. S., Ogwuru, H. O. R., Echeta, D. O., Duru, E. E., Akamike, O. J., & Manasseh, C. O. (2023). Impact of government capital expenditure on the economic growth rate of Nigeria. *Journal of Economics and Allied research*, 8(1), 335-348.
- Parente, S. L., & Prescott, E. C. (1994). Barriers to technology adoption and development. *Journal of Political Economy*, 102(2), 298-321.
- Romer, P. M. (1986). Increasing returns and long-run growth. *Journal of Political Economy*, 94(5), 1002-1037.



- Romer, P. M. (1990). Endogenous technological change. *Journal of Political Economy*, 98(5), S71-S102.
- Solow, R. M. (1956). A contribution to the theory of economic growth. *Quarterly Journal of Economics*, 70(1), 65-94.
- Solow, R. M. (1957). Technical change and the aggregate production function. *Review of Economics and Statistics*, 39(3), 312-320.
- Syadullah, M., & Setyawan, D. (2021). The impact of infrastructure spending on economic growth: A case study of Indonesia. <https://doi:10.26552/com.C.2021.3.A184-A192>
- World Bank (2022). *The World Bank in Africa*. Retrieved from <https://www.worldbank.org/en/region/afr/overview>
- World Economic Forum (2018). *The global competitiveness report 2018*. <https://www3.weforum.org/docs/GCR2018/05FullReport/TheGlobalCompetitivenessReport2018.pdf>
- Zhang, Y., & Cheng, L. (2023). The role of transport infrastructure in economic growth: Empirical evidence in the UK. *Transport Policy*, 133, 223-233.