

Public Infrastructure Spending and Economic Growth in Nigeria: Evidence from a Disaggregated Expenditure

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Abstract

This study examines the effect of disaggregated public infrastructure expenditures on economic growth in Nigeria 1990 to 2024, using gross domestic product per capita (GDPPC) as the measure of economic performance. Specifically, the study investigates the effects of road and construction, education, health, communication, and security infrastructure expenditures on Gross domestic product per capita. Data were sourced mainly from World Development Indicators of the World Bank, and the Central Bank of Nigeria (CBN) statistical bulletin. The Autoregressive Distributed Lag (ARDL) model was employed to estimate the short-run and long-run relationships among the variables. The findings reveal that road and construction infrastructure has a positive and statistically significant effect on GDPPC in both the short and long run. Education, health, and communication infrastructure also exhibit positive and statistically significant effects, highlighting their importance to economic development. In contrast, security infrastructure has a positive but statistically insignificant relationship with GDPPC in both periods. The study concludes that greater investment in productive infrastructure, particularly road and construction, education, health, and communication infrastructure, is essential for improving economic performance in Nigeria. The study therefore recommends efficient and sustained public investment in these infrastructure components to promote higher GDP per capita and sustainable economic development.

Keywords: Public Infrastructure Expenditure, Economic Growth, Education Expenditure, Health Expenditure, ARDL, Nigeria,

1. Introduction

Public infrastructure constitutes a fundamental component of the productive capacity of an economy because it lowers transaction costs, facilitates the mobility of goods, people, information, and capital, and raises the productivity of private factors of production. The theoretical and empirical literature has consequently treated infrastructure as an important determinant of long-run economic performance. Aschauer (1989), for example, established an influential link between public capital and aggregate productivity, emphasizing the particularly important role of core infrastructure such as roads, highways, airports, and related public facilities. Subsequent cross-country evidence has similarly shown that both the quantity and quality of infrastructure are positively associated with economic growth, while improvements in infrastructure can also contribute to reductions in income inequality (Calderón & Servén, 2004; Straub, 2011). More recent evidence reinforces the importance of infrastructure across

energy, transport, and digital sectors, while emphasizing that its effects can vary substantially across infrastructure types and development outcomes (Vagliasindi & others, 2025).

These considerations are particularly pertinent to Nigeria, Africa's most populous economy and one characterized by a substantial infrastructure deficit. Although the Nigerian economy generated approximately US\$252.3 billion in GDP in 2024 and recorded real GDP growth of 4.1 percent, its GDP per capita was only about US\$1,084, illustrating the continuing challenge of translating the country's considerable economic scale into broad-based productivity and living-standard improvements. Infrastructure constraints remain an important part of this challenge. World Bank evidence indicates that only 61.2 percent of Nigeria's population had access to electricity in 2023, while only 41 percent of the population used the Internet in 2024. Earlier assessments further documented that Nigeria's approximately 200,000-kilometre road network had only about 30 percent paved, while deficiencies in power and transport infrastructure imposed significant costs on firms and households. Indeed, estimates in the World Bank's Nigeria Country Private Sector Diagnostic suggest that infrastructure deficiencies may reduce Nigeria's annual GDP growth by approximately 4 percentage points. The infrastructure problem, however, is neither homogeneous nor necessarily uniform in its implications for economic activity. Electricity provides the energy required for production and is therefore directly connected to firms' operating costs and productivity; roads and railways determine physical connectivity and access to domestic and international markets; air transport facilitates the movement of passengers, high-value goods, and business activity across geographically distant locations; while telecommunications reduce information and communication costs and increasingly constitute an essential input into modern production. The complementarity among these infrastructures is also important: for example, electricity can stimulate production, but inadequate transport can prevent producers from accessing markets, while improved roads may generate limited productivity gains where reliable electricity and modern production technologies are unavailable. Nigeria's historical experience provides further evidence of heterogeneous infrastructure effects. For instance, Jedwab and Moradi (2016) demonstrate that colonial railways generated persistent economic effects in Nigeria, with particularly pronounced benefits in areas that initially had limited access to export ports. Despite this theoretical rationale, empirical evidence for Nigeria remains fragmented and yields important reasons for further investigation. Existing studies have variously examined aggregate infrastructure indices or selected individual sectors. Enimola (2010), using Nigerian data for 1980–2006, identified a long-run relationship between infrastructure investment and economic growth, while Balogun (2022) reported heterogeneous effects for electricity, roads, and telecommunications over 1990–2020. More closely aligned with the present inquiry, Olayiwola (2022) examined electricity production, road and rail infrastructure, air transport, and telecommunications over 1986–2020 and found evidence of a short-run relationship between physical infrastructure and economic growth. Nevertheless, the persistence of infrastructure deficiencies, the expansion of Nigeria's digital and transport networks, and changes in the structure of the Nigerian economy warrant renewed empirical attention.

The central problem, therefore, is not simply whether infrastructure matters for Nigerian economic growth, but which dimensions of public infrastructure matter, and to what extent. Treating infrastructure as a single aggregate stock can obscure potentially important differences in the productivity, scale, timing, and economic transmission mechanisms of electricity, road and rail systems, air transport, and telecommunications. Such aggregation may consequently provide limited guidance for public investment prioritization in a resource-constrained economy. This study addresses this problem by empirically examining the effects of these disaggregated components of public infrastructure on GDP in Nigeria. By separating electricity, road and rail infrastructure, air transport, and telecommunications, the study seeks

to provide more precise evidence on the infrastructure-growth nexus and, in turn, contribute to the policy debate concerning which infrastructure investments are most consequential for Nigeria's economic expansion.

2. Literature Review

Theoretical Review

2.1 Endogenous Growth Theory

Endogenous Growth Theory is principally associated with Paul Romer (1986), building on earlier contributions by Kenneth Arrow (1962) and subsequently developed by Robert Lucas (1988). Romer's (1986) model marked an important departure from the neoclassical growth framework by treating technological progress and knowledge accumulation as endogenous rather than as an unexplained external factor. Romer assumes that knowledge is a productive input capable of generating increasing returns, while investment and learning can create knowledge spillovers that enhance economy-wide productivity.

The theory assumes, broadly, that economic agents make purposeful investments in factors that generate productivity-enhancing knowledge, that knowledge can spill over among producers, and that these spillovers can prevent the diminishing returns that would otherwise constrain long-run growth. Consequently, policies and investments that improve the productive environment can influence the economy's long-run growth trajectory. In the context of this study, public infrastructure can facilitate these mechanisms by improving the environment in which firms accumulate capital, adopt technology, exchange information, and undertake productive activities. Reliable electricity supports production and technology adoption; telecommunications facilitate information and knowledge diffusion; while road, rail, and air transport improve the movement of inputs, outputs, labour, and knowledge. Thus, Endogenous Growth Theory provides a theoretical basis for expecting infrastructure improvements to contribute to higher GDP through productivity-enhancing channels (Romer, 1986; Lucas, 1988).

2.2 Public Capital / Infrastructure-Led Growth Theory

The Public Capital approach to growth is most closely associated with David Aschauer (1989), whose influential contribution formally examined the productive role of public capital in the economy. Aschauer (1989) argued that public capital should be considered an input into production alongside private capital and labour. His empirical analysis found that non-military public capital, particularly core infrastructure such as streets, highways, airports, and mass transit, was strongly associated with private-sector productivity.

The central assumption of this approach is that appropriately provided public infrastructure can raise the productivity of private economic inputs and reduce production and transaction costs. Infrastructure therefore affects output not merely through government expenditure itself but through the stock and quality of productive public capital available to firms and households. However, the theory does not imply that every public investment necessarily increases output: poorly designed, inadequate, or inefficiently utilized infrastructure may generate limited benefits, while public investment can also interact with private investment through both crowding-in and crowding-out mechanisms (Aschauer, 1989).

This framework has a particularly direct application to the present study. Electricity constitutes an essential production input; roads and railways facilitate the movement of goods and factors of production; air transport improves interregional and international connectivity; and telecommunications reduce information and communication costs. Accordingly, the theory predicts that improvements in these infrastructure components can increase the productivity of private capital and labour and consequently raise GDP. It also provides a strong justification

for disaggregating infrastructure, since different forms of public capital may have different productive effects.

2.3 New Economic Geography Theory

New Economic Geography (NEG) is principally associated with Paul Krugman (1991), whose seminal model Increasing Returns and Economic Geography explains the spatial concentration of economic activity through the interaction of increasing returns, transportation costs, and market size. Krugman's framework assumes imperfect competition, economies of scale, and positive feedback between market size and firms' location decisions. In the model, lower transportation costs make it easier for firms to serve larger markets, while the resulting concentration of economic activity can further expand market demand and reinforce agglomeration. The central implication is that infrastructure and transportation costs influence where economic activity occurs and how effectively markets are integrated. Better transport infrastructure reduces the economic distance between producers, consumers, and markets, potentially encouraging specialization, trade, investment, and agglomeration. Conversely, inadequate transportation can isolate producers from markets and increase the cost of economic exchange. Krugman's model demonstrates that the interaction between transportation costs, economies of scale, and market size can produce persistent core-periphery patterns in economic activity (Krugman, 1991). This theory is particularly relevant to the road, rail, and air transport components of the present study. Improvements in these networks can reduce transportation costs and increase market accessibility, thereby supporting greater economic integration and productivity. The theory can also complement the analysis of telecommunications because improved communications reduce the effective costs of exchanging information across locations. Thus, New Economic Geography provides a spatial explanation for how infrastructure can influence GDP by facilitating connectivity, market integration, and the concentration and diffusion of economic activity.

Empirical Review

Aninwagu et al. (2024) investigated the impact of infrastructural investment on Nigeria's economic growth from 1990 to 2022 using time-series data obtained from the CBN Statistical Bulletin and World Development Indicators. The study employed the Augmented Dickey-Fuller (ADF) unit root test, bounds cointegration test, ARDL estimation, and residual diagnostic tests. The findings established cointegration among the variables. The ARDL results showed that road and construction investment had a negative but statistically insignificant effect on economic growth, while electricity access and fixed telephone subscriptions had positive but insignificant effects. However, investment in transport and communication had a positive and statistically significant effect on economic growth.

Abebe and Gbalam (2025) examined the effect of road infrastructure expenditure on Nigeria's economic development using fiscal data covering 2000–2023. Using an ex-post facto research design and secondary data obtained from the Central Bank of Nigeria and the National Bureau of Statistics, the study found that road construction expenditure had a positive and statistically significant effect on GDP. Conversely, transport and communication expenditure had a negative but statistically insignificant effect on economic growth. The model reported an R-squared of approximately 78%, while the diagnostic tests indicated model reliability and stability. Amadi and Odu (2022) examined the effect of government infrastructure spending on Nigeria's economic development using time-series data covering 1981–2019. Employing the ARDL technique, the study found that government economic infrastructure expenditure had a positive but statistically insignificant effect on economic growth, whereas social infrastructure expenditure had a positive and statistically significant effect. The findings suggested that social

infrastructure constituted an important component of government expenditure for promoting economic development. Enya and Ezeali (2021) examined public investment in infrastructure and economic development in Nigeria. Using time-series data, the study employed stationarity, cointegration, and error correction techniques. The results indicated the existence of a long-run relationship among the variables. Public investment in technology, educational infrastructure, and power had positive relationships with economic performance, whereas transport infrastructure had a negative relationship. The study concluded that public infrastructure investment played an important role in stimulating Nigeria's economic development.

Aninwagu et al. (2026) examined the determinants of Nigeria's economic growth from 1990 to 2023 using the ARDL bounds-testing approach. Real GDP per capita served as the dependent variable, while trade, foreign direct investment, gross fixed capital formation, and government education expenditure constituted the explanatory variables. The findings showed that trade and education expenditure had negative short-run effects, while FDI had a negative short-run but positive and significant long-run effect. Gross fixed capital formation had a positive and significant short-run effect but an insignificant long-run effect. The error correction term indicated approximately 62% annual adjustment toward long-run equilibrium.

Nedozi et al. (2019) evaluated the relationship between infrastructural development and economic development in Nigeria using simultaneous-equation analysis and ordinary least squares estimation. The findings established that infrastructure constituted an important component of Nigeria's economic growth and development. The study emphasized that inadequate attention to infrastructure could constrain the productive capacity of the real sector and consequently limit economic development.

3. Methodology

This study adopts an ex-post facto design. This is because it is deemed suitable, as the research depends on pre-existing macroeconomic and financial data that researchers cannot alter. The data for this study was sourced from the World Bank's World Development Indicators (WDI), and the Central Bank of Nigeria Statistical Bulletin from 1990 to 2024

The modelling of this study was theoretically anchored in the endogenous growth theory.

The study specifies the following models:

$$GDPPC = f(RCI, EDI, HTI, CCI, SCI) \quad 3.1$$

$$GDPPC = \beta_0 + \beta_1 \ln RCI + \beta_2 \ln EDI + \beta_3 \ln HTI + \beta_4 \ln CCI + \beta_5 \ln SCI + \mu_t \quad 3.2$$

Where:

GDPPC = Gross Domestic Product Per Capita

RCI = road & construction infrastructure expenditure

EDI = education infrastructure expenditure

HTI = health infrastructure expenditure

CCI = communication infrastructure

SCI = security infrastructure expenditure

β_0 = Regression intercept

$\beta_1 - \beta_5$ = Parameters

e_t = Time subscript

NOTE: The logarithmic transformation of explanatory variables was intended to normalize the data, reduce heteroskedasticity, and interpret coefficients in elasticity terms.

4. Data Analysis

Table 4.1: Summary of Descriptive Statistics for the Variables

	GDPPC	RCI	EDI	HTI	CCI	SCI
Mean	3792.943	120.4677	371.8654	227.8120	37.11543	125.6174
Median	3762.200	89.16000	214.1500	127.9200	32.13000	67.25000
Maximum	7182.220	402.3100	1260.550	814.0200	140.6100	679.4300
Minimum	2013.400	0.640000	0.450000	0.230000	0.370000	0.000000
Std. Dev.	1524.919	128.4622	391.0710	251.5545	34.67118	154.1037
Skewness	0.257941	0.748988	0.879804	0.921679	0.976891	1.587352
Kurtosis	1.830434	2.214071	2.496260	2.550243	3.615135	5.820139
Jarque-Bera	2.382945	4.173187	4.885382	5.250369	6.118666	26.29656
Probability	0.303774	0.124109	0.086927	0.072426	0.046919	0.000002
Sum	132753.0	4216.370	13015.29	7973.420	1299.040	4396.610
Sum Sq. Dev.	79062842	561086.6	5199842.	2151508.	40871.08	807430.6
Observations	35	35	35	35	35	35

Source: Researcher's computations using Eviews 12, (2026)

The summary statistics in Table 4.1 indicate that the mean values for the gross domestic product per capita (GDPPC) and road and construction infrastructure (RCI) recorded average values of 3792.943 and 120.47 during the study period, with GDPPC ranging from a minimum value of 2013.4 to 7182.2, while RCI ranged from a minimum value of 0.640 to a maximum value of 402.31.

Furthermore, the education infrastructure (EDI) and health infrastructure (HDI) recorded mean values of 371.87 and 227.81, with EDI ranging from 0.45 to 1260.55, while HDI moved from 0.23 to 814.02.

Additionally, the analysis shows that the communication infrastructure (CCI) and security infrastructure (SCI) recorded mean values of 37.12 and 125.62, respectively. While the CCI moved from a minimum value of 0.37 to a maximum of 140.61, the SCI ranged from a minimum value of 0.00 to a maximum value of 679.43.

The standard deviations indicate that the data for all variables are concentrated around their respective means except for RCI, EDI, HTI, and SCI. The outcomes of the Jarque-Bera test demonstrate that all variables exhibit normal distribution at the 5% significance threshold, as shown by JB and p-values exceeding 0.05 except for CCI and SCI.

Unit Root Test

Table 4.2: Augmented Dickey-Fuller (ADF) Test Results

Augmented Dickey-Fuller (ADF)						
Variables	Level	Critical Value 5%	1 st Difference @	Critical Value 5%	I(d) @	Stationary @
LOG(GDPPC)	0.454666	-2.954021	-7.277078	-2.954021	I(1)	1 st Difference
LOG(RCI)	-1.307660	-2.960411	-5.951357	-2.960411	I(1)	1 st Difference
LOG(EDI)	-6.247955	-2.957110	-	-	I(0)	Level
LOG(HTI)	-4.689011	-2.976263	-	-	I(0)	Level
LOG(CCI)	-2.079476	-2.954021	-7.870732	-2.954021	I(1)	1 st Difference
LOG(SCI)	-1.075432	-2.951125	-6.840760	-2.954021	I(1)	1 st Difference

Source: Researcher's computation using Eviews 12 (2026).

Note: *, **, and *** denote significance at 10%, 5% and 1%, respectively.

Table 4.2 presents the summary results of the ADF unit root tests carried out on all the variables in our model. The unit root test results showed that education infrastructure (EDI) and health infrastructure (HTI) attained stability at levels. This is because their test statistic values are greater than the Mackinnon critical value at 5% level of significance at levels. This further indicates that education infrastructure (EDI) and health infrastructure (HTI) were stationary at order zero [i.e., I(0)]. On the other hand, other variables attained stability after first differencing. This is because their test statistic values are greater than the Mackinnon critical value at 5% level of significance at first difference. This further indicates that the variables were integrated at order one [i.e., I(1)].

Table 4.3: Bounds cointegration test results for the models

Significant Level	Critical Value Bound		Hypothesis	F-Statistics
	I(0) Bound	I(1) Bound		
10%	2.08	3	H0: There is no cointegration/long run relationship	6.299451***
5%	2.39	3.38		
2.5%	2.7	3.73		
1%	3.06	4.15		
F _{GDP} PC(RCI, EDI, HTI, CCI, SCI)			K = 5	

Source: Researcher's computation using Eviews 12, (2026).

Note: Null hypothesis: No level relationship; K = number of regressors; *, ** and *** denote significance at 10%, 5% and 1% level, respectively.

The results presented in Table 4.3 demonstrate that the F-statistics for the model, 6.299451, exceed the critical values at both the lower and upper bounds at a 5% significance level. This indicates a strong relationship between the dependent and the independent variables.

Model Result and Discussion

Table 4.4: Estimated Long-Run and Short-Run Coefficients of ARDL GDPPC Model

Dependent Variable = GDPPC

Long-Run Results

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
LOG(RCI)	0.713050	0.108753	6.556595	0.0012
LOG(EDI)	0.026332	0.006623	3.975876	0.0106
LOG(HTI)	0.026494	0.004995	5.304603	0.0032
LOG(CCI)	0.088381	0.025414	3.477639	0.0177
LOG(SCI)	0.422301	0.313439	1.347313	0.2706
C	8.309942	1.437546	5.780643	0.0103
EC = GDPPC - (0.7131*LOG(RCI) + 0.0263*LOG(EDI) + 0.0265*LOG(HTI) + 0.0884*LOG(CCI) + 0.4223*LOG(SCI) + 8.3099)				

Short-Run Results

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
D(GDPPC(-1))	0.208696	0.120429	1.732944	0.1815
D(GDPPC(-2))	1.611903	0.173775	9.275790	0.0027
DLOG(GDPPC(-3))	0.885884	0.179872	4.925065	0.0160

DLOG(RCI)	0.054491	0.006542	8.329887	0.0036
DLOG(RCI(-1))	1.349074	0.631668	2.135733	0.1223
DLOG(EDI)	0.476389	0.062816	7.583925	0.0048
DLOG(EDI(-1))	-0.230009	0.237884	-0.966897	0.4049
DLOG(EDI(-2))	0.494623	0.058839	8.406359	0.0035
DLOG(EDI(-3))	0.179721	0.033216	5.410647	0.0124
DLOG(HTI)	0.286913	0.042674	6.723395	0.0067
DLOG(HTI(-1))	0.540933	0.068772	7.865570	0.0043
DLOG(HTI(-2))	-0.333751	0.337381	-0.989241	0.3955
DLOG(HTI(-3))	-0.095134	0.582726	-0.163257	0.8807
DLOG(CCI)	0.039512	0.006271	6.300848	0.0081
DLOG(CCI(-1))	0.080384	0.008445	9.518393	0.0025
DLOG(CCI(-2))	0.022614	0.008177	2.765396	0.0698
DLOG(CCI(-3))	0.012610	0.006268	2.011848	0.1004
DLOG(SCI)	0.144611	0.113829	1.270422	0.2598
DLOG(SCI(-1))	0.015432	0.006186	2.494523	0.0881
DLOG(SCI(-2))	0.001888	0.006443	0.293060	0.7886
DLOG(SCI(-3))	0.015442	0.006228	2.479292	0.0893
CointEq(-1)*	-0.242009	0.029074	-8.323969	0.0036
R ²	0.880437			
Adjusted R ²	0.834792			
Durbin-Watson stat	2.914944			

Source: Researcher's Computation (EViews 12), 2026.

Interpretation of Long-Run and Short-Run ARDL Model Estimation Results

The long-run and short-run estimates of the ARDL model are shown in Table 4.4. The long-run estimates of the ARDL model results revealed road & construction infrastructure has a positive and significant effect on gross domestic product per capita in Nigeria. This is evident by the positive coefficient value (0.713050) of road & construction infrastructure and its p-value (0.0012) which is less than 0.05. This implies that an increase in the road & construction infrastructure by one percent will lead to 71.3% significant increase in gross domestic product per capita in the long run. Also, the short-run estimates of the ARDL model results revealed that road & construction infrastructure has a positive and significant relationship with the gross domestic product per capita in Nigeria. This is evident by the positive coefficient value (0.054491) of road & construction infrastructure and its p-value (0.0036) which is less than 0.05. This implies that an increase in the road & construction infrastructure by one percent will lead to 5.4% significant increase in gross domestic product per capita in the short run.

Education Infrastructure (EDI) and Gross Domestic Product Per Capita (GDPPC)

Furthermore, the results of the long-run estimates of the ARDL model revealed that education infrastructure has a significant positive long-run effect on gross domestic product per capita in Nigeria. This is evident by the positive coefficient value (0.026332) of education infrastructure and its p-value (0.0106) which is less than 0.05. This implies that an increase in education infrastructure by one percent will lead to 2.6% significant increase in gross domestic product per capita in the long run. Also, the results of the short-run estimates of the ARDL model revealed that education infrastructure has a significant positive long-run effect on gross domestic product per capita in Nigeria. This is evident by the positive coefficient value (0.476389) of education infrastructure and its p-value (0.0048) which is less than 0.05. This

implies that an increase in the education infrastructure by one percent will lead to 47.6% insignificant increase in gross domestic product per capita in the short run.

Health Infrastructure expenditure (HTI) and Gross Domestic Product Per Capita (GDPPC)

Moreover, the results of the long-run estimates of the ARDL model revealed that health infrastructure has positive and significant effect on gross domestic product per capita in Nigeria in the long-run. This is evident by the positive coefficient value (0.026494) of health infrastructure and its p-value (0.0032) which is less than 0.05. This implies that one percent increase in health infrastructure will lead to 2.6% increase in gross domestic product per capita in the long run. Also, the results of the short-run estimates of the ARDL model revealed that health infrastructure has a significant positive short-run relationship with the gross domestic product per capita in Nigeria. This is evident by the positive coefficient value (0.286913) of health infrastructure and its p-value (0.0067) which is less than 0.05. This implies that one percent increase in health infrastructure will lead to 28.7% increase in gross domestic product per capita in the short run.

Communication Infrastructure expenditure (CCI) and Gross Domestic Product Per Capita (GDPPC)

Moreover, the results of the long-run estimates of the ARDL model revealed that communication infrastructure has significant positive long-run effect on gross domestic product per capita in Nigeria. This is evident by the positive coefficient value (0.088381) of communication infrastructure and its p-value (0.0177) which is less than 0.05. This implies that one percent increase in communication infrastructure will lead to 8.8% increase in gross domestic product per capita in the long run. Also, the results of the short-run estimates of the ARDL model revealed that communication infrastructure has a significant positive short-run effect on the gross domestic product per capita in Nigeria. This is evident by the positive coefficient value (0.039512) of communication infrastructure and its p-value (0.0081) which is less than 0.05. This implies that an increase in the communication infrastructure by a unit will lead to 4.0% increase in gross domestic product per capita in the short run.

Security Infrastructure expenditure (SCI) and Gross Domestic Product Per Capita (GDPPC)

Moreover, the results of the long-run estimates of the ARDL model revealed that security infrastructure has non-significant positive long-run relationship with the gross domestic product per capita in Nigeria. This is evident by the negative coefficient value (0.422301) of security infrastructure and its p-value (0.2706) which is greater than 0.05. This implies that an increase in the security infrastructure by one percent will lead to 42.2% significant increase in gross domestic product per capita in the long run. Also, the results of the short-run estimates of the ARDL model revealed that security infrastructure has a non-significant positive long-run relationship with the gross domestic product per capita in Nigeria. This is evident by the positive coefficient value (0.144611) of security infrastructure and its p-value (0.2598) which is greater than 0.05. This implies that an increase in the security infrastructure by one percent will lead to 14.5% non-significant increase in gross domestic product per capita in the short run.

Interpretation of CointEq(-1) Result

The results of the short-run dynamic coefficients associated with the long-run relationships obtained from the error correction model are given in Table 4.6. The signs of the short-run

dynamic interactions are consistent with that of the long-run relationship. The estimated error correction coefficient of -0.242009 (with p-value of 0.0036) is highly significant, has the correct sign, and imply a low speed of adjustment to equilibrium after a shock. This implies that approximately 24% of disequilibria from the previous year's shock converge back to the long run equilibrium in the current year.

Interpretation of Adjusted R-Squared (Adj. R²) Value

The Adjusted R-squared value of 0.834792 from the results of the short-run estimates of the ARDL model in Table 4.6 indicated that the estimated model is well fitted as the systematic changes in explanatory variables (road & construction infrastructure, education infrastructure, health infrastructure, communication infrastructure and security infrastructure) explained approximately 83 percent (R-squared) variation in gross domestic product per capita while the remaining 17 percent is explained by other variables of factors outside the model.

Interpretation of Durbin-Watson Statistic Value

Lastly, Durbin-Watson stat of 2.914944 which is greater than 2 indicates the absence of serial autocorrelation.

Table 4.5: Post-Estimation Tests Results

Test	Null Hypothesis	X ² Value	X ² Prob	Remark
Jarque-Bera	Normal distribution exists	0.304857	0.8586	Normal Residuals
Breusch-Godfrey LM	Serial correlation does not exist	0.894198	0.5989	Serial Independence
Breusch-Pagan-Godfrey	Homoscedasticity exists	1.747911	0.3618	Constant Variance
Ramsey RESET	Model is stable	0.573156	0.6244	Correctly Specified Model

Source: Researcher's Computation (EViews 12), 2026.

The Jarque Bera (Normality) test result in Table 4.5 shows that the probability value (0.8586) is greater than 0.05 level of significance which imply that the null hypothesis of Normal distribution cannot be rejected. Thus, this necessitates the acceptance of null hypothesis and therefore concludes that the model is normally distributed. The Breusch-Godfrey Serial Correlation LM test result in Table 4.6 shows that the probability values (0.5989) is greater than 0.05 level of significance which imply that the null hypothesis of no serial correlation cannot be rejected. Thus, this necessitates the acceptance of null hypothesis and therefore concludes that the model has no serial correlation problem.

Also, the Breusch-Pagan-Godfrey heteroskedasticity test result in Table 4.6 shows that the probability values (0.3618) is greater than 0.05 level of significance which imply that the null hypothesis of homoscedasticity cannot be rejected. Thus, this necessitates the acceptance of null hypothesis and therefore concludes that the model has homoscedasticity. This implies that relevant variables were not omitted. Lastly, the Ramsey RESET test result in Table 4.5 shows that the probability values (0.6244) is greater than 0.05 level of significance which imply that the null hypothesis of correctly specified cannot be rejected. Thus, this necessitates the acceptance of null hypothesis and therefore concludes that the model is correctly specified. This implies that the functional form of the model is correct.

5. Conclusion and Recommendations

Conclusion

This study examined the effects of disaggregated public infrastructure expenditure on GDP per capita in Nigeria using the ARDL approach. The findings indicate that road and construction, education, health, and communication infrastructure expenditures have positive and statistically significant effects on GDP per capita in the short and/or long run, highlighting their importance to Nigeria's economic development. In contrast, security infrastructure expenditure does not have a statistically significant effect on GDP per capita over either period. Overall, the findings suggest that greater emphasis should be placed on productive infrastructure, particularly roads and construction, alongside investments in education, health, and communication infrastructure. These investments can strengthen productivity, improve economic opportunities, and support sustained improvements in GDP per capita in Nigeria.

Recommendations

Based on the findings and conclusion drawn from this study, the following recommendations are made:

- i. The government should increase investment in the construction, rehabilitation, and maintenance of roads, given its positive and significant effect on GDP per capita in both the short run and long run.
- ii. Greater investment should be directed toward classrooms, laboratories, libraries, and digital learning facilities, as education infrastructure has a positive and significant effect on GDP per capita in both periods. This would strengthen human-capital development and productivity.
- iii. Government should improve healthcare facilities, medical equipment, and access to quality healthcare, particularly in underserved areas.
- iv. Investment in telecommunications, broadband, and digital connectivity should be expanded, especially in rural areas.
- v. government should emphasize the efficiency and effectiveness of existing security investments rather than simply increasing expenditure. Resources should be strategically allocated to security interventions that protect productive economic activities.

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