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# Econometric Analysis of Public Infrastructure, Urbanization, and Unemployment Nexus in Nigeria

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**Abstract**
This study examined the relationship between public infrastructure, urban population growth, and unemployment in Nigeria by utilising annual time series data from the Debt Management Office (DMO), World Bank, World Development Indicators (WDI), and Central Bank of Nigeria (CBN) Statistical Bulletin. The number of paved roads (PRD), water supply infrastructure (WSI), electric power supply (EPS), and telecommunication infrastructure (TCI) served as proxies for infrastructure, while the rate of unemployment served as the dependent variable. The variables were subjected to a stationarity test using Augmented Dickey-Fuller (ADF) while the autoregressive technique was used as its main estimation technique. The long-run cointegration relationship was found, and its significance was assessed by calculating the bound cointegration. The study found that, despite the erratic effects of interest rates, paved road kilometres had a negative impact on unemployment, whereas infrastructure related to the provision of electricity had a favourable impact. To reduce unemployment in Nigeria, the study advises that concerted efforts be made by the government, the private sector, investors, corporate entities, and stakeholders to enhance the availability of electric power supply, the calibre of road infrastructure, and telecommunications facilities.

**Keywords:** Public Infrastructure, Urbanization, Unemployment, Urban Population, Growth

## Introduction

Scholars in both rich and developing nations have recognised the function of public infrastructure as a stabilising tool as the population of cities grows. Developing nations, especially those in Africa, are cognizant of their infrastructure needs because infrastructure is a major factor in economic growth and development. Furthermore, Africa has a very low penetration rate for broadband services and a telecommunications penetration rate of only 6%, compared to an average of 40% for the other developing areas. Additionally, although the other developing regions have a road access rate of 50%, Africa only has a rate of 34%. Compared to the global average of 5.5% in 2007, freight expenses in Africa accounted for 10–25% of the entire value of imports in 2007 (ADB, 2009). There is evidence that the effectiveness and efficiency of economic operations that promote prosperity, job creation, and the general growth of the country are frequently hampered by the lack of a strong infrastructure and an increase in urbanisation. Insufficient infrastructure stock was identified by the African Development Bank (2018) as the crucial component lacking in their chase for Sustainable Development Goals (SDGs) in Africa to which Nigeria is a critical component.

Urbanisation is the term used to describe the process of cities expanding, usually due to the steady movement of humans from one location to the other. According to the UN DESA (2011) it is determined by the number of persons living in an area. Rural-urban migration, naturally occurring population expansion in urban regions, and the urbanisation of periurban and rural settlements are the main drivers of urban population growth. Urbanisation is oriented towards the needs of people from a demographic standpoint (McGranahan & Satterthwaite, 2014). The process of urbanisation modifies how individuals relate to the economy, environment, and space in fundamental ways (Granoff et al., 2014). According to Henderson (2003), urbanisation happens when labour shifts from less productive to more productive sectors and the economy's sectoral composition shifts from agriculture to industry and/or services. The process of structural economic transformation and development occurs simultaneously with urbanisation in many countries across the world (Haryanto et al., 2021). It may also arise from a natural increase (too many births relative


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to deaths), particularly in areas with advanced technology and ongoing development initiatives. The standards used to designate a town as an urban centre vary by nation based on population indices. For example, a city centre in Sweden has as little as 200 residents, whereas in Denmark it has 250. By 2050, there will be a 64% increase in the urbanisation rate in the Asian area. Undoubtedly, global population growth has presented more challenges, particularly in Asia, but there is also a belief that the reason for people moving from rural to urban areas is their pursuit of better employment possibilities. Because of this, people engage in economic activity, which promotes economic growth. The population of Nigeria has dramatically increased in metropolitan areas. 2017 data on the increase of the urban population. This is a decrease from the 4.370 percent recorded in the 2016 fiscal year. According to World Bank data, the CEIC's urban population growth statistics peaked in 1960 at 6.815% and fell to a record low of 3.466% in 1961.

With an estimated population of over 223 million people currently growing at a rate of 2.4%, infrastructure investment and capital spending in Nigeria have remained appalling for the past three decades, with unaffordable repairs costing more than #915 trillion compared to the current macroeconomic indicators. Of these, 56.9% live in urban cities, with a youth unemployment rate of 58.1% in 2017, and 53.4% in 2020. However, with a housing shortage of over 17 million people and a lack of technical human competency, Nigeria's urban population growth rate stood at 50.34% in 2018, 51.16% in 2019, 51.96% in 2020, 52.75% in 2021, 53.52% in 2022, and 56.9% in 2023, respectively (Aaron, 2024). This suggests that, despite a 2.4% increase in the overall population, the growth stood at a rate of 6% faster than the general population. Severe, inadequate, and dilapidated infrastructure in major cities like Lagos, Kaduna, Kano, and Port Harcourt may have prevented Nigeria from topping the list. In 2018, Nigeria's infrastructure was rated 132 out of 137 nations in the GDP competitive index. Manufacturing enterprises identified infrastructure as their main business restriction, according to the survey. Nigeria's infrastructure was also ranked third to last out of 102 countries evaluated in the global competitiveness assessment. resulting in low economic complexity, large public debt of $100.07 billion, double-digit inflation of 18.6%, high unemployment of 33.3%, and low rankings on all major human development indexes. The anticipated physical infrastructure deficit in Nigeria is expected to reach $3 trillion over the next 30 years; at the current rate of allocation, which is 4% of GDP annually, it will take Nigeria 300 years to close the gap. The Debt Management Office (DMO) released figures showing that the nation's debt increased by $30.72 trillion.

The quantitative evaluation of the PGII and BRI indicates that Nigeria should focus more of its efforts on China for the development of its infrastructure; given the current state of affairs, the worry about falling into a debt trap is unavoidable. The country's limited resources, which are recognised as the root cause of the region's uneven development, make it economically viable but not competitive. Compared to the N2.9 trillion budgeted amount, capital expenditures in 2018 totalled N820.6 billion, or a performance ratio of just 28.6% (Fatima (2022). However, cities in emerging countries—especially Nigeria—face problems with rapid population growth and sustained economic growth when the unemployment rate climbs higher than expected (Rakodi & Lukaševičius, 20074). Nigerian cities are often characterized by the following crises: a dearth of economic dynamism, inadequate governance, serious infrastructural and service deficiencies, inadequate land administration, poverty, and social breakdown, which has led to terrible unemployment among the nation's high school dropout rate. Scholars have empirically studied a wide range of literature on the effect of population growth and urban infrastructure on unemployment, with varying conclusions. A few instances include Chen et al. (2014), Shabu (2010), Sarker et al. (2016), Fatima and Nazeer (2022), and Haryanto et al. (2021) with varying degrees of effects on urbanisation on growth. Furthermore, studies have shown that policies supporting urbanisation in conjunction with fast economic growth are more prevalent in emerging nations (Pugh, 1995).

A variety of measures and policy actions have been taken by industry stakeholders to address the infrastructure need in Africa, of which Nigeria is a crucial component, to improve the quality of infrastructure desired to meet the demands of the continent's expanding human population. These initiatives include the Yokohama Plan of In 2017, Germany launched the G20 Compact with Africa, which, along with the Marshall Plan with Africa and the Reform Partnerships headed by BMZ, seeks to acknowledge strong governance and encourage private sector investments and job creation. Infrastructure development in Africa is part of the EU External Investment Plan, which focuses on attracting private investments and creating jobs. (EU, 2017), In 2019, the European Investment Bank pledged to provide 3 billion euros in fresh funding to African nations, with plans to allocate an additional 4 billion euros in 2020.

To better focus on Africa and address climate change, the EU is considering the possibility of combining all of its current development funding initiatives under a single organisation (EU, 2019). The USA founded the Millennium Challenge Corporation in 2001 to assist nations—many of which were in Africa—that satisfied specific governance requirements. To create a "Blue Dot" certification system for global infrastructure, the government passed the Better Utilisation of Investment Leading to Development Act (BUILD) in 2019. This act established a new US International Development Finance Corporation. The Power Africa programme was first introduced by the government in 2007. In light of these considerations, this study aims to experimentally explore, by the criticisms made by Seers (1989), the remote impact of infrastructure and urbanisation on economic development in Nigeria.

Prudhomme (2004) defined infrastructure as capital commodities that, although not immediately consumed, provide services in addition to labour and other inputs. Infrastructure is the term used to describe a group of interconnected structural components that serve as the foundation for a whole development structure. According to Snieska and Simkunaite (2009), there are two categories of infrastructure that economists and urban planners differentiate between economic infrastructure and social infrastructure. Infrastructure related to the economy includes items like roads, trains, airports, seaports, power, water supply, and sanitation. Infrastructure is defined by Snieska and Simkunaite (2009) as the basic physical framework that includes transport, energy, telecommunications, water supply and disposal, and other services. Bristow and Nellthorp (2000) identified three primary benefits of infrastructure. First off, it has a direct impact on welfare (more time and money saved, greater safety, and the creation of information networks) as well as the economy (jobs and economic growth). Snieska and Bruneckiene (2009) have suggested infrastructure as a metric for assessing regional competitiveness in the nation. The infrastructure that supports the population's health, education, and cultural norms—activities that have an impact on welfare directly and indirectly—is referred to as social infrastructure and includes places like playgrounds, parks, fountains, statues, schools, libraries, universities, clinics, hospitals, courts, museums, theatres, and playgrounds. As an indicator of regional competitiveness considerations, they point to physical infrastructure, which includes newly constructed estate, ITT, motor transportation infrastructure, and a region's external reach by land, air, and sea. Martinkus and Lukasevicius (2008) propose that the attractiveness of the local investment environment is influenced and enhanced by infrastructure services and physical infrastructure. Regarding this research project, infrastructure is defined as the fundamental physical framework of facilities that enable societies to access a wide range of services, including road construction and networks, telecommunication, power supply, education facilities, and water supply systems, or systems and structures related to the creation of public goods or the process of producing them, such as telecommunication, road networks, education facilities, water supply systems, and power/electricity supply systems.

Urbanisation is a benefit that is directly tied to urban areas and inextricably linked to the industrial sector, according to Edwards et al. (2007). Marshall's externalities are reflected in the benefits it offers, which include plentiful technology, access to specialised labour, and special resources. Many things contribute to it, such as commercialization, industrialization, the shift from rural to urban areas, changes in lifestyle, job opportunities, and social advantages. Urbanisation refers to the flow of people from rural to urban areas, the decrease in the number of people living in rural areas, and how these communities adapt to this change. Urbanisation in this study is defined as the increase in the overall population living in urban areas during a certain period, as assessed by urban population growth.

Unemployment is the incapacity of an employable individual to obtain employment. People are classified as unemployed if they are eager to work for the current price but cannot get a job (Gbosi, 1997). According to the International Labour Organisation, a portion of the working-age population is unemployed. Adeola and Evans (2020). claims that the benefits of possessing entrepreneurial skills and knowledge are directly correlated with the rate of unemployment. showing the disparity in entrepreneurship education. Nigeria has one of the highest rates of unemployment globally. 54% of Nigerian youth, particularly those with degrees, are unemployed, according to data from the National Bureau of Statistics (NBS, 2012). Given this, it wouldn't be incorrect to say that one of the biggest problems plaguing Nigeria right now is unemployment. For this study, unemployment is the condition of not having a job.

**The Wage-Goods Strategy**

Planning for an Expanding Economy, published in 1956 by Vakil and Brahmanand, introduced the idea of creating wage goods. "Extension of the Nurkesian idea of concealed saving potential in rurally disguised jobless" is how their


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method is described. six in the least developed countries. capital goods required for the manufacture of these wage goods should be prioritised in production, and the supply of wage goods plus capital goods required for their production must expand at a far faster pace than population growth to absorb the disguised jobless. According to Vakil and Brahmanand (1956), it would be possible to effectively utilise the "saving potential" if unemployed people were hired for project sites and given wage goods, which are described as "consumption requirements necessary for subsistence and execution of work." Putting this plan into practice means creating economic overheads in rural areas, funding them, providing wage products to workers, and utilising savings. This strategy aims to offer an analytical framework for tackling the three issues of inequality, poverty, and unemployment—even though it was created for India. It is similar to the ideas of community development and integrated rural development. We think that this strategy can be generalised in the following ways: To generate capital in the form of social and economic infrastructure in both urban and rural areas, development must employ excess manpower.

**Modernization Theory**

This idea gained popularity and significance between the 1950s and the 1970s. As to Smith's (1997) account, the theory posits that urbanisation results from the introduction of novel concepts and advancements into society through industry, technological application, information penetration, and cultural dissemination. The statement posits that human interaction boundaries are controlled by innovations, and traditional civilizations will undergo evolution through the adoption of modern methods. The advantage of modern states is that their citizens have more freedom to enjoy a higher standard of living and are wealthier and more powerful. They maintained that, in general, urbanisation has benefited emerging nations and that, in comparison to correspondingly backwards traditional rural communities, cities are superior places to foster constructive social and economic transformation. When modernization is applied to urbanisation, initial things are frequently observed. Secondly, given that urbanisation typically follows, it is evident how important technology is to the structure and development of society. It is impossible to divorce the current global state of urbanisation and growth from its pre-modern beginnings (Kasarda & Crenshaw, 1991). Most technical advances originate from technologically proficient societies that create wealth through inventions, increase economic potential, and use mechanical and electronic infrastructure to reduce labour force strain and boost productivity. In this particular context, it is thought that technology holds greater significance than the social structure of society. Therefore, it is believed that the primary motivating factor is the use of technology. Kasarda and Crenshaw (1991), as cited in Tombari (2019), assert that the modernization strategy encourages unequal development and the dispersion of culture and that industrialization, not capitalization, is the major factor influencing the change of third-world countries. This kind of urbanisation is assumed to have resulted from factors that have caused economic imbalance, concentrating social facilities and development initiatives in specific community areas. Due to rural push and urban pull, there must be a large-scale movement from rural to urban areas, with opportunities and investment concentrated in a small number of places (most likely cities). The concept is therefore very significant and relevant to this research. These theories rely on the observation that Nigeria has historically been below par and has a capital spending and infrastructure deficit. Despite government efforts and significant financial outlays for public goods and services, these theories suggest that capital spending and infrastructure investment have not achieved their intended goals. Thus, the theories are current and pertinent.

Using data on the urbanisation and economic growth of South Asian countries between 1990 and 2020, Fatima (2022) investigated the relationship between economic development and urbanisation trends. The correlation analysis, multicollinearity test, unit root test, and causality test are performed using a panel regression approach before the final estimation. The findings of the panel regression support the hypothesis that there is a positive correlation between urbanization—represented by indicators such as population density, the share of the population aged 15 to 64, and urban population share—and economic development, as indicated by GDP (per capita). Urban population square hurts economic growth, demonstrating a positive but waning association. All of the estimating methodologies—fixed-effect (static), random effect (dynamic), and ordinary least squares approach (pooled)—show statistically significant effects on the population of ages 15–64. In a similar vein, the pooled model indicates that the urban population has little effect, whereas the fixed and random effect models indicate that it has a significant influence.

In 2021, Haryanto et al. looked at the relationship between GDP per capita, urbanisation, and education. The data, which spanned the years 1990–2018, was provided by the UNDP and the World Bank. The estimation findings show that the strongest causality in VECM is between economic growth and education. They are therefore draw elements that are highly influential both today and in the future. The following recommendations about the implications of

policy were made: creating area-based urbanisation, which involves the integration of cities within a single area to measure the effects of an agglomeration economy. In order to prevent urbanisation from concentrating population density in one location, the government must also expedite the distribution of public facilities and infrastructure throughout various regions. Additionally, it must prioritise more equitable and simpler access to education across all regions. Conversely, once education is dispersed equally throughout all locations, the government must focus on infrastructure and transportation access. Sarker et al. (2016) used panel regression to establish a causal association between economic growth and urbanisation. For six years, they used national statistics on GDP and urban population from 1980 to 2014. To verify that the panel data was stationary, they employed ADF and the Philips Parron test. Additionally, the Pedroni cointegration test is employed to examine the relationship between economic growth and the urbanisation phenomenon. They concluded that in the South Asian region, the structure of urbanisation and economic growth were causally related. Chen et al. (2014) examined the relationship between urbanisation and economic growth using cross-sectional, panel estimate, and geographic information systems (GIS) approaches. The data shows how dramatically the levels of urbanisation have changed in the last thirty years. Empirical results from cross-sectional and panel data provide credence to the general notion that there is a high association between GDP per capita and levels of urbanisation. Moreover, there was compelling evidence of a global correlation between the rate of economic expansion and the rate of urbanisation. They therefore conclude that rapid urbanisation, particularly when it comes to government-led urbanisation, cannot bring about the anticipated economic gains for a given nation. Shabu (2010) investigated the connection between economic progress and urbanisation in emerging nations. Urbanisation and economic development have two-sided links, as the study employed a panel data approach to demonstrate. It both encourages and hinders economic development, which is why it is a barrier to most countries' economic progress. This study demonstrates that urbanisation correlates with economic development indices and that there is a limited association between urban growth and economic development in developing countries.

**Methods and Materials**

The study examined the relationship between Nigerian unemployment and infrastructure and urbanisation using time series data spanning from 1991 to 2022. There were three phases of the time series investigation. Pre-testing, estimating, and a post-estimation test comprise the three-step approach in these situations. An enhanced Dickey-Fuller (ADF) architecture was employed by the researcher to examine the time series data's stationarity condition. It was determined that the series were integrated of mix order 1(0), 1(1) after the unit root test. This explains why the Auto Regressive Distributive Lagged (ARDL) framework was chosen to test the effect of the explanatory variables on the explained variable. Using the Bounds cointegration, it was possible to determine the importance of a longterm association among the variables in the model. To conduct this inquiry, the study used Ex-post facto, or after the fact, research design is a type of study where the inquiry starts independently of the researcher after the fact has been established. This study examines the effects of two or more independent factors on the dependent variable. The method helps the researcher identify these effects as well as any interactions between the independent variables and the dependent variable. The Solow growth model and Hirschman's imbalanced growth model served as the foundation for this study's methodological methodology. The Solow model, which emphasises the importance of labour, capital, and technological improvement in boosting economic production and development, is the theoretical basis for economic growth theory.

**Model Specifications**

The Aik model will be used to further modify and deviate from the work of Ebuh et al. (2019) in the analysis framework of this study on infrastructure, urbanisation, and economic development in Nigeria. Using quarterly data from 1997Q1 to 2017Q4, Ebuh et al. (2019) examined the effects of infrastructure nexus growth in Nigeria. Based on the time series, they used VECM to perform the Granger causality test. The model was defined as:

$$Y=f(IINFL,HC,ISTK,FINI,IINV).$$

Where:

Y = growth in output or income as measured by GDP per capita

IINV stands for infrastructure investment, which is measured by the total amount of money spent by the government on power, water, sanitation, transportation, and education. ISTK = proxy for infrastructure stock FINI =proxy for financial infrastructure.

IINFL=Infrastructure inflation.

HC = proxy for human infrastructure.

Nonetheless, the current research departs from previous researchers by examining the impact of urbanisation and infrastructure on unemployment rates in Nigeria.

The functional form of the model will be represented. UMP= F(TCI, WSI,PRDI,PSI,UPG,)

The structural equation is expressed mathematically as follows:

$UMP= \alpha_0+\alpha_{1Ln}TCI_t+\alpha_{2Ln}WSI_t+\alpha LnPRDI_t+\alpha_{4Ln}PSI_t+\alpha_5UPG_t$

The econometric form of the above equation was expressed thus;

$UMP = ao+a1LnTCLt+a2LnWSIt+a3LnPRDIt+a4LnPSIt+a5UPGt+\mu_t$

DEPENEDNT VARIABLE

Unemployment: The percentage of the labour force, which is made up of both employed and jobless individuals, that is unemployed is known as the unemployment rate. The formula for calculating the unemployment rate is (unemployed labour force) x 100.

Independent Variables

Road Infrastructure: Larger road projects involve constructing new roads and maintaining the ones that already exist. Driveable areas include highways, roads, and streets. Reconstruction and resurfacing of streets and highways. Infrastructure for Water Supply: The quantity of clean water consumed by the entire population is referred to as the water supply. One of the most basic needs of humanity is water. It is crucial to maintain infrastructure if people are to have access to clean, filtered water on a continuous basis throughout a nation. In addition, a lot of companies depend on water for their manufacturing processes. Infrastructure related to electrical power: One of the things that is thought to affect productivity is electricity. Moreover, power is a critical component of most economic activities. The study uses the quantity of power generated and distributed (KWh) as a stand-in for the services that the electricity infrastructure provides. Any one of the dependent variables in the three structural equations of economic development is meant to benefit from it. Telecoms Communication infrastructure is the framework of methods, procedures, and concepts that enable successful information exchange between individuals. The necessity for telecommunications infrastructure initiatives, such as upgrading from 4G to 5G mobile networks, is continual due to the constant expansion of technology.

Urban Population; Urban population increase is the proportion of the total population, at a certain moment in time, usually in the middle of the year, living in areas classified as urban in a nation, territory, or geographic area. Cities, towns, and other heavily inhabited areas are the main categories that make up urban areas. There is an urban population rise among those who reside in urban areas as designated by national statistical authorities.

## Results

**Table 1: Descriptive Statistics**

| | UNP | UPG | CWSI | EPS | PRDI | TCI |
|---|---|---|---|---|---|---|
| Mean | 6.240909 | 39.35061 | 4.924498 | 47.41799 | 21.45089 | 18.72394 |
| Median | 6.700000 | 39.07000 | 5.317285 | 48.00000 | 19.44706 | 18.51000 |
| Maximum | 7.990000 | 49.50000 | 5.743439 | 59.30000 | 30.90000 | 90.03000 |
| Minimum | 3.500000 | 28.84000 | 3.020501 | 27.30000 | 15.00000 | 0.240000 |
| Std. Dev. | 1.163057 | 6.791065 | 0.866097 | 7.869398 | 5.251630 | 19.46694 |
| Skewness | -0.568694 | 0.035896 | -0.877883 | -0.548170 | 0.837081 | 1.901854 |
| Kurtosis | 2.314562 | 1.562890 | 2.373235 | 2.503315 | 2.258189 | 7.370865 |
| Jarque-Bera | 2.424782 | 2.846853 | 4.778875 | 1.991908 | 4.610511 | 46.16240 |
| Probability | 0.297485 | 0.240887 | 0.091681 | 0.369371 | 0.099733 | 0.000000 |
| Sum | 205.9500 | 1298.570 | 162.5084 | 1564.794 | 707.8794 | 617.8900 |
| Sum Sq. Dev. | 43.28647 | 1475.794 | 24.00396 | 1981.678 | 882.5477 | 12126.77 |
| Observations | 33 | 33 | 33 | 33 | 33 | 33 |

During the study period, the UNP, UPG INFL, EPS, PRDI, and TCI series in Nigeria had average values of


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6.240909, 39.35061, 4.924498, 47.41799, 21.45089, and 18.72394; the median values were 6.700000, 39.07000, 5.317285, 48.00000, 19.44706, and 18.51000. The fact that the mean value of the variables in question is very near to the median value indicates that they did not deviate from the mean. It is hence capable of withstanding outside attack. 7.990000, 49.50000, 5.743439, 59.30000, 30.90000, 90.03000, and 3.500000, 28.84000, 3.020501, 27.30000, 15.00000, and 0.240000 are the maximum and minimum numbers, respectively. The skewness values of 0.035896, 0.837081, and 1.901854 demonstrate that UPG, PRDI, and TCI have long right tails, while UNP, INFL, and EPS have long left tails, as indicated by the values of -0.568694, -0.877883, and -0.548170. As can be seen from the kurtosis values of 2.932560, 2.373235, 2.503315, and 2.258189, the distributions of INFL, EPS, and PRDI are mesokurtic (normal). In comparison to a normal distribution, the UPG value of 1.562890 is plytokurtic while the TCI value of 7.370865 is leptokurtic. All variables in the study had a normal distribution, except TCI, which had a substantial probability value.

**Table 2: Stationarity Test**

| S/N | Variables | | | | | Order |
|---|---|---|---|---|---|---|
| | | T.stat | Crt.Val | T.Stat | Crt.Val | |
| 1 | LOG(EPS) | -5.896708 | 3.557759 | ----- | ---- | I(0) |
| 2 | CWSI | -2.150729 | -2.960411 | -3.920864 | -2.960411 | I(1) |
| 5 | LOG(PRDI) | -2.680158 | -3.562882 | -9.545970 | -3.622033 | I(1) |
| 6 | TCI | -3.514333 | -3.562882 | -3.562882 | -3.562882 | I(1) |
| 7 | UNP | -2.753829 | -3.568379 | -9.190279 | -3.562882 | I(1) |
| 8 | UPG | -3.092666 | -3.568379 | -5.128358 | -3.580623 | I(1) |

*Source: Author compilation from EViews 10.05.*

The enhanced dickey fuller (ADF) instrument test results reveal that, except for the electric power supply infrastructure (EPS), nearly all of the time series data used for the investigation were stationary after being subjected to initial differences. This suggests that the infrastructure supporting the electric power supply either returned to its initial state or became level and stationary. A time series does not have a unit root problem when it is level and stationary. Data of this kind is stationary and detrended. However, unless they undergo a process that will stabilise the data, non-stationary time series data have unit root issues and cannot be used for any kind of meaningful estimation. The enhanced dickey fuller (ADF) instrument test results reveal that, except for the electric power supply infrastructure (EPS), nearly all of the time series data used for the investigation were stationary after being subjected to initial differences. This suggests that the infrastructure supporting the electric power supply either returned to its initial state or became level and stationary.

**Table 3: Bounds Test for Cointegration**

| Test Statistic | Value | k | Significance | I0 Bound | I1 Bound |
|---|---|---|---|---|---|
| F-statistic | 19.24483 | 5 | | | |
| | | | 10% | 2.26 | 3.35 |
| | | | 5% | 2.62 | 3.79 |
| | | | 2.5% | 2.96 | 4.18 |
| | | | 1% | 3.41 | 4.68 |

In the above table, the bounds cointegration test illustrates the calculation of the impact of infrastructure and urbanisation on unemployment in Nigeria. The data show that there is a long-term cointegrating relationship between the model's variables. It is possible to reach this conclusion since the F-statistic value of 19.24483 is more than the critical value of 3.79 at 5%. According to the information given above, we confirm that the variables used in the estimation have a long-term cointegrating connection. Considering that there is a long-term link, the calculation of the short- and long-term production comes next.

**Table 4: Error Correction Regression**

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| D(UNP(-1)) | 0.721206 | 0.127971 | 5.635712 | 0.0005 |
| D(UPG) | 0.047613 | 0.155182 | 0.306822 | 0.7668 |
| D(UPG(-1)) | -2.131133 | 0.293388 | -7.263859 | 0.0001 |
| DLOG(EPS) | 11.499178 | 2.031461 | 5.660546 | 0.0005 |
| DLOG(EPS(-1)) | -4.833742 | 1.699439 | -2.844316 | 0.0217 |
| DLOG(TCI) | -0.092859 | 0.131767 | -0.704724 | 0.5010 |
| DLOG(TCI(-1)) | 0.095166 | 0.133288 | 0.713987 | 0.4955 |
| DLOG(PRDI) | -4.129338 | 0.931283 | 4.434032 | 0.0022 |
| DLOG(PRDI(-1)) | -4.014520 | 1.024294 | -3.919302 | 0.0044 |
| D(INFR) | 0.005381 | 0.010818 | 0.497406 | 0.6323 |
| D(INFR(-1)) | -0.043015 | 0.010103 | -4.257480 | 0.0028 |
| CointEq(-1) | -0.865388 | 0.111004 | -7.796040 | 0.0001 |

| | |
|---|---|
| R-squared | 0.875036 |
| Adjusted R-squared | 0.809506 |
| Akaike info criterion | 0.674107 |
| Durbin-Watson stat | 2.409287 |
| F-statistic | 14.87922 |
| Prob(F-statistic) | 0.000272 |

The R-square adjusted value is 0.809506, while the statistical R-square value is 0.875036. This indicates that the variance in unemployment in Nigeria is predicted by a coefficient of determination of 80%, with the remaining 20% being captured by the error term. First-order autoregulation is absent, as indicated by the Durbin Western statistic of 2.409287. The error correction term appeared with a normal sign (-), and it is statistically significant, even if the T statistic value of 14.87922 and its probability value of 0.00272 indicate that the entire model has a good fit. Thus, the current disequilibrium will signal the arrival of a long-term equilibrium at a rate of 86% every year. The significant disposition of the dependent variable's lagged value (UNP(-1)) is the basis for the estimate's validity and dependability. The series' noteworthy conclusion demonstrates that, in the short term, unemployment feeds back on itself. In other words, a rise in the unemployment rate will cause a further 0.721206 increase in unemployment. Therefore, we claim that unemployment influences current unemployment in a feedback loop. Although the shortterm impact of urban population growth (upg) on the dependent variable is positive, it is not statistically significant at 590. The lagged value of the urban population growth rate has a considerable and negative impact on the dependent variable during the first period. Accordingly, an increase in the urban population will, under any circumstances, result in a 2.131133 reduction in unemployment. Conversely, the dependent variable is positively and statistically significantly impacted by the second-period lagged value of the urban population growth rate. When the variable's second-year lagged value increases by one unit, all other factors remain constant and the unemployment rate rises by 0.978119.

In the short term, the dependent variable is significantly impacted by the entrepreneurial variables and the electric power supply coefficient. First, the primary variable has a positive short-term effect on unemployment; its first- and second-year lagged values, on the other hand, released 4.833742 and 4.120723 of the changes in the dependent variable (unemployment rate). indicating that unemployment has been negatively impacted by past realisations of the electric power supply. Inferentially, higher investment leads to higher productivity in the short term since the lagged

values of the electric power supply (EPS(-1) and EPS(-2)) increase. Since infrastructure for the provision of electricity is a hallmark of investment and since rising investment would result in falling unemployment, the parameter's sign is consistent with economic theory. The dependent variable is not significantly impacted by the telecommunication infrastructure coefficient or its interpretation lag values in the short term. indicating that there is no connection between the condition of the telecommunications infrastructure and the rising unemployment rate in Nigeria. All other things being equal, growth in Nigeria's network of paved roads will result in a 4.129338 unit decline over time as additional roads are built. Road construction uses both human and material resources, therefore this explanation is in line with the appriori expectation. In summary, the effect of inflation on unemployment was determined to be negligible and positive. That being said, the dependent variable was significantly negatively impacted by its first-year lagged value, or INFR(-1). This suggests that the unemployment rate will drop by 0.043025 units for every unit increase in inflation of one year. It follows that when overall prices rise, so does the jobless rate. This stance defies theoretical predictions since rising production costs will result in lower investment as the economy grows. A decline in investment will lead to job losses and an increase in unemployment.

**Table 5: Long-Run Coefficients**

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| UPG | -0.779294 | 0.119132 | -6.541410 | 0.0002 |
| LOG(EPS) | 35.437590 | 6.571287 | 5.392793 | 0.0007 |
| LOG(TCI) | 0.460672 | 0.219130 | 2.102272 | 0.0687 |
| LOG(PRDI) | -1.914391 | 0.823964 | -2.323391 | 0.0487 |
| INFR | 0.098178 | 0.015214 | 6.453006 | 0.0002 |
| C | -96.654739 | 21.119260 | -4.576616 | 0.0018 |

In the long run, the dependent variable (the unemployment rate) is significantly and negatively impacted by the coefficient of urban population growth (UPG), which serves as a stand-in for urbanisation. Thus, if everything else remains the same, an increase in urbanisation will ultimately result in a 0.779294 unit drop in unemployment. Such a link implies that urbanisation is the engine driving Nigeria's unemployment reduction mechanism. The expected sign is not supported by this expositive. In this study, we anticipate that the increasing number of people residing in urban areas, or urbanisation, will put pressure on socioeconomic attributes. It would thereby raise the unemployment rate.

On the other hand, the dependent variable is positively and statistically significantly impacted by the infrastructure's coefficient of electric power supply (EPS). In light of this, an increase in the electric power supply (EPS) will ultimately result in a 35.43790 unit rise in the unemployment rate, all other things being equal. Economic theory supports providing electric power supply assets to promote productivity and lower the unemployment rate, hence this attitude deviates from theoretical expectations. One explanation for the aforesaid scenario would be that the extra electricity supply is being used for conspicuous consumption like playing video games and attending seminars rather than for productive uses. This is only feasible in nations where the ratio of consumption to production is higher. Although the coefficient of communications infrastructure (TCI) is statistically not significant enough to affect changes in unemployment, it does have a favourable long-term effect on the dependent variable. All other variables being equal, a change in the total number of paved roads (PRNI) will result in a long-term decrease in unemployment of 1.914391 units; nonetheless, It follows that in the long run, paved roads increase jobless prospects in the nation. This aligns with the extended methodology.

Lastly, as predicted, inflation (INFN) has a considerable and favourable impact on unemployment. Under all circumstances, a rise in inflation (INFN) will ultimately result in a 0.098178 unit increase in unemployment.


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**Post Estimation Test.**

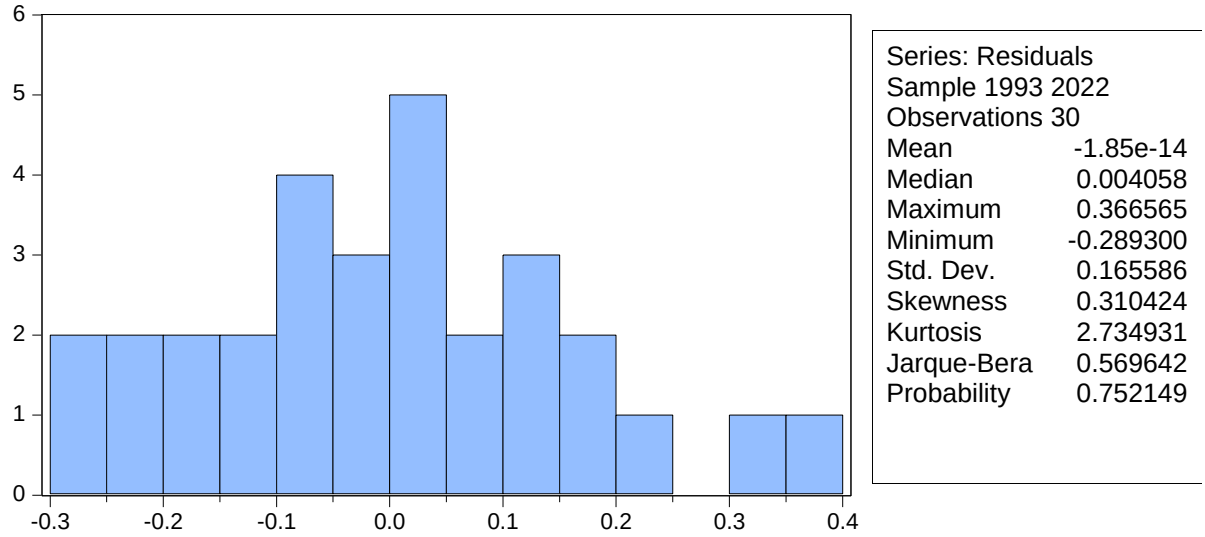


**Figure 1: Normality of the residual Test**

Researchers examine the normality of the regression residual to assess the validity of the regression. The researcher will be able to determine whether the estimated equation is consistent with the fundamental tenet of the ordinary least square by using this precise post-estimation test. We claim that the residual is normally distributed given the Jarque-Bera statistic value of 0.569642 and its probability value of 0.752149.

**Table 6: Post Estimation Test**

| **Serial Correlation** | | | | **Heteroskedasticity** | | | |
|---|---|---|---|---|---|---|---|
| F-statistic | 9.046923 | Prob. F(2,6) | 0.4154 | F-statistic | 1.729928 | Prob. F(21,8) | 0.2156 |
| Obs*R-squared | 22.52921 | Prob.Chi-Square(2) | 0.1234 | Obs*R-squared | 24.58588 | Prob. Chi-Square(21) | 0.2655 |
| | | | | Scaled explained SS | 1.516615 | Prob. Chi-Square(21) | 0.4758 |

We used the Breusch-Godfrey Serial Correlation LM Test to determine whether the error term was serially independent. With probability values of 0.4154 and 0.1234, the observed R-square value of 22.52921 and the F-statistic value of 9.046923 are statistically insignificant. We declare that the study's residual shows no evidence of serial correlation, and we conclude that the calculated equation is BLUE. Using the Breusch-PaganGodfrey heteroskedasticity test, we were able to verify if the residual variance was equal, as needed by the fundamental classical least squares assumption. This test can be used to determine whether the classical least squares assumptions are accurate. It is the opposite of the homoskedasticity test. We determine that there is evidence of homoskedasticity in the residual and that the estimated equation is BLUE given the F statistic value of 1.729928, Obs*R-squared value of 24.58588, Scaled explained SS value of 1.516615, and their probability values of and 1.0000, 0.2655, and 0.4758.

**Discussion**

Nigerian Urbanisation and Unemployment

An increase in urban population growth will have a significant negative impact in the long run, according to the long-run ARDL, while prior values (UPG(-1)) have a negative influence in the short term. This indicates that unemployment is permanently impacted negatively by urbanisation, which is advantageous for economic growth in the most populous nation in Africa. Therefore, by Lewis's opinion, the alternative hypothesis is accepted, and the null hypothesis—which claims that there is a statistically significant link between urbanisation and unemployment—is rejected (1998).

Nigeria's Infrastructure for Electric Power Supply and Unemployment According to data from the ARDL, infrastructure related to the provision of electricity has a net positive influence on employment over the long term, but its first-year lag value has a negative short-term impact on unemployment. indicating that Nigeria's unemployment rate is unstable when the amount of electric power supplied increases. The alternative hypothesis is accepted and the null hypothesis, which claims that there is no statistically significant correlation between the availability of electric power and the rising unemployment rate in Nigeria, is now rejected in light of the information presented above.

Nigeria's paved road network and unemployment
There is a negative association between the paved road infrastructure, its second-year lag value, and unemployment in the short run, despite the short-run estimation showing that the paved road network and its second-year lag value have a positive and significant impact on unemployment. Inferentially, the number of kilometres of paved roads in Nigeria has an erratic effect on the rate of unemployment. Based on the aforementioned, the alternative hypothesis is accepted and the null hypothesis, which claims that there is no statistically significant correlation between the total number of paved road kilometres in Nigeria and unemployment, is rejected. This bolsters the research of academics such as Herranz-Loncán (2007).

Nigeria's Telecommunication Infrastructure and Joblessness
Evidence from the third ARDL output indicates that a rise in telecommunications infrastructure has no appreciable long-term or short-term effects on unemployment. Therefore, the expansion of telecommunications infrastructure is not the reason behind Nigeria's rising unemployment rate. The null hypothesis, based on the aforementioned, asserts that there is no statistically significant correlation between Nigeria's unemployment rate and its telecommunications infrastructure. The results of researchers like Saidi et al. (2018) are corroborated by this study.

Nigerian Unemployment and Inflation
Evidence derived from the third estimation's ARDL output indicates that while inflation's one-year lagged value will have a negative short-term effect on unemployment, an increase in inflation will have a long-term beneficial effect. indicating that unemployment in Nigeria is unpredictably influenced by inflation. Therefore, the reason for the volatility observed in the trend of the unemployment rate in Nigeria is an increase in inflation during the research period. The alternative hypothesis is accepted and the null hypothesis is rejected in light of the information presented above. The findings of this study corroborate those of researchers Kodongo and Ojah (2016).

Concerns about the nation's current infrastructure deficit at a time when key economic indices like unemployment, poverty, and income inequality are rising were the focus of the infrastructure, urbanisation, and economic development study. One major problem that has affected Nigeria's degree of economic development, aside from the country's lack of infrastructure, is the population's steady increase in cities. As suggested by Pesaran et al. (2001), the autoregressive distributed lag (ARDL) was used in the investigation. The time series data's stationarity, which indicated the presence of mixed order integration I(1) and I(0), provides the basis for the choice of ARDL as the estimate process. According to the test result, (i) Growing urbanisation has a detrimental effect on unemployment over the long and short terms.
The short-term impact of rising inflation on unemployment is erratic.

1. A rise in the availability of electric power has a favourable impact on unemployment over the long and short terms.
2. Both short- and long-term growth in the infrastructure of paved roads has a detrimental effect on unemployment.
3. The effect of rising inflation on unemployment is erratic.

**Conclusion**

The study concludes that Nigeria's economic progress is significantly influenced by urbanisation and infrastructure. In particular, urbanization—the process of more people living in urban areas—reduced economic development by having a positive impact on poverty and income inequality and increased it by having a negative impact on unemployment. On the other hand, infrastructure related to the supply of electricity and fully paved roads positively affects both unemployment and income inequality; in Nigeria, however, the primary cause of income inequality is the lack of telecommunications infrastructure. According to these studies, Nigeria's public infrastructure is insufficient to propel the country's economy towards the level that is wanted.


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**Recommendations**

(i) Nigeria should work to increase its electric power supply to promote economic growth and the anticipated decrease in poverty.

(ii) A concerted effort should be made to raise the standard of road infrastructure delivery to lower production costs and increase accessibility for corporate investment.

(iii) Given that poor telecommunications infrastructure in Nigeria has a long-term detrimental influence on wealth disparity, efforts should be taken to improve it.

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