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Analysis of Effects of Some Selected Infrastructure on Real Gross Domestic Product in Nigeria

[1]Obeh, H. O., [2]Chris U. Kalu & [3]Uchenna, N. Anyanwu
[1,2&3]Department of Economics,
Nnamdi Azikiwe University, Awka

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Abstract

The study examined the effect of economic infrastructure on real gross domestic product in Nigeria, over the period, 1961 to 2020. The study employed the dynamic autoregressive distributed lag method (ARDL) on variables of gross domestic product (GDP) at constant 2010 prices, electricity consumption, railway lines, fixed and mobile phone lines, hospital beds, total government expenditure and credit to the private sector, sourced from World Bank website and National Bureau of Statistics Bulletin. The results showed that electricity consumption, fixed and mobile phones lines were both negative and positively related to economic growth while the estimated coefficients of hospital bed and total government expenditure are positively related to economic growth within the periods. Both the short and long run results showed mixed effects of infrastructure on economic growth implying that infrastructure has not significantly affected economic growth in Nigeria within the period under review. The policy implications of these findings were discussed. The recommendation among others is that the Nigerian government/policy makers should strengthen and sustain infrastructure investment as well as enabling the private sector to participate in infrastructure provision in the form of public private partnership (PPPs) so as to stimulate the real gross domestic product in.

Keywords: *Infrastructure, Real GDP, Electricity consumption, Mobile phone lines, Railway line, and Hospital beds, ARDL, Nigeria*

Corresponding Author: Obeh, H. O.

Background to the Study

Infrastructure has been applied in the context of general working condition, in the context of social overheads and also in the context of economic growth and development. According to Rosenteen-Rodan (1943), infrastructure is defined as a set of conditions necessary for servicing private capital circulation in the main economic sectors and creating favourable conditions for the economy's further development. Nurske (1953) compared infrastructure with the 'circulatory' and partly with the 'nervous system' of the economy while Row (1962) saw infrastructure as an instrument essential to efficiently meet the (social) needs of a growing population. These definitions points to the fact that infrastructure is a key driver of every economy. Public infrastructures are basic physical and organizational structure and facilities for example, building, roads, hospitals, power supply projects required to boost productivity that are owned by the government or are for public use. It is generally distinguishable from private or generic infrastructure in terms of policy, financing and purpose (Gramlich, 1994). Core infrastructure comprises highways, water, electricity, telecommunications, educational and health facilities. Public services provided by core infrastructure components may enter directly (intermediate inputs) into private-sector production or even into aggregate production function. This study will centre on expenditures made on these public infrastructures over the years as against their contributions to the economic growth of the Nigerian economy.

Economic growth on the other hand, refers to as a steady process by which the productive capacity of the economy is increased over time to bring about rising level of national output and income (Todaro and Smith, 2006). Jhingan (2006), viewed economic growth as an increase in output and adequate Provision of basic public infrastructure at full capacity has been seen as one of the driving forces of economic growth and development for countries wishing to move from a less developed economy to developed economy. Like most developing countries, the Nigerian rural sector is faced with the challenges of urbanisation. In addition, poverty is most prevalent and infrastructure is either inadequate or unavailable (Anam, Eteng and Ojong, 2017)

From the first national development plan, more than 70 per cent of the total capital expenditure of £676.8 million was devoted to those sectors which contributed directly to economic growth (primary production; trade and industry; electricity; transport system; communications; irrigation and industrial water supplies), but due to the civil war, the expected annual average investment of £112.8 million was really never achieved. The second national development plan contained policy framework and programmes for the reconstruction of the damaged areas of the country due to the civil war. It is observed from the third national development plan that the sectoral percentage distribution of the gross capital expenditure of ₦32.9 billion shows that the economic sector of agriculture, water supply, urban road development, sewage with 62.3 per cent of the total outlay had the largest allocation. Also in the fourth national development plan, out of a total of ₦1.2 billion budgeted for capital expenditure, National Basic Health Scheme had a financial allocation of ₦100 million, while the establishment of new hospitals gulped about ₦150 million.

In 1986, the government introduced the Structural Adjustment Program (SAP) with the establishment of Directorate of Food, Roads and Rural Infrastructure (DFRRI). .In that fiscal year, it received a budgetary allocation of ₦300 million, in 1987 it received ₦400 while ₦500 million was allocated to the agency in 1988 to develop rural infrastructure. By 1994, the

government established the Petroleum Special Trust Fund charged with the responsibility of using the gains from increase in the prices of petroleum products to complete all government-abandoned projects and rehabilitate decaying infrastructure in the country. A total of ₦120 million was used to drill boreholes in some selected states, ₦11, 953 million was allocated to construct roads between 1995 and 1997, while a total of ₦9,588 billion was expended on education specifically, university education. Vision 202020 placed emphasis on the capital expenditure in sectors like education, health, transport and communication. In line with this policy, the appropriated capital expenditure allocation to education stood at ₦74,923,247,201 in 2010 which was a huge increment from ₦40,005,096,429 in 2009. This figure increased steadily in nominal terms from 2010 to 2018. Same is true for the health sector, transport and communication sectors.

The road system in Nigeria are neglected, public transport and telecommunication systems are unreliable and therefore have been phased out; power supply frequently breaks down and this has led to the unbundling of Power Holding Company, the former Government provider of power in Nigeria. Presently, electricity tariff via the commercial providers are quite high. Over the years now, the capital vote in the fiscal budget is abysmally low compared to the recurrent vote. This situation has affected infrastructure provision in Nigeria. Geo-political consideration and political economy structure of infrastructure decision-making has also affected infrastructure provision in Nigeria. Corruption is also another great obstacle to infrastructure provision in Nigeria.

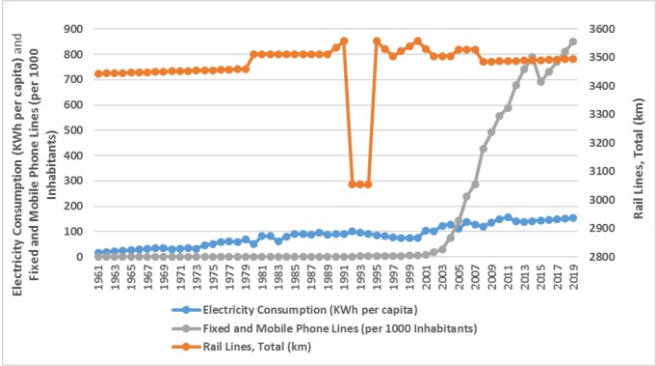
The problems as highlighted above have not only attracted policy measures but also literature attention. Existing empirical literature on the effects of public infrastructure on growth has mainly focused on cross-country evidence and a production function framework to estimate the average relation between public infrastructure and growth (Bougheas, Demetriades and Morgenroth, 1999; Kodongo and Ojah, 2016) but totally neglecting the key sectors that constitute public infrastructure. However, other empirical literatures on the effect of infrastructure on growth focus on one element of infrastructure for example, either telephone or roads (Ogunlana, Yaqub and Alhassan, 2015; Ehizuelen, 2016; Olorunfemi, 2008; Aigheyisi, and Oaikhenan, 2015), ignoring the multidimensional nature of public infrastructure. There is therefore, the need to study and investigate the effect of public infrastructure on economic growth in Nigeria focusing on more dimensions of infrastructure other than road or telephone. Most significantly, existing results on the effect of public infrastructure on economic growth showed mixed results; thereby affect a general conclusion of the relationship between both in Nigeria. This study bridges these seemingly gaps and extends the knowledge in infrastructure- economic growth relationship in Nig. The discussions of the paper are centred around the following questions: What are the effects of infrastructure on economic growth in Nigeria? What are the policy options for promoting the use of infrastructure for real GDP development? The main objective of the study is to examine the effect of infrastructure on economic growth in Nigeria. Specifically, the paper: investigates the effect of electricity consumption, fixed and mobile phone line, railway line and hospital beds on economic growth in Nigeria. The paper is significantly relevant in some dimensional form: theoretical, empirically /methodologically, policy-wise and to the research community.

These theories are relevant to economic discussion and for policy making on infrastructure provision for economic growth. Empirically/methodological: this paper employed the dynamic autoregressive distributed lag approach (ARDL), an addition to knowledge as most previous studies employed the Johanson and Jesulius approach to co-integration. Again, the inclusion of explanatory variables-hospital beds, fixed and mobile lines, railway line and electricity consumption and control variables; government expenditure and credit to the private sector are value- additions to the previous studies.

Some stylised Facts on Infrastructure and Real GDP

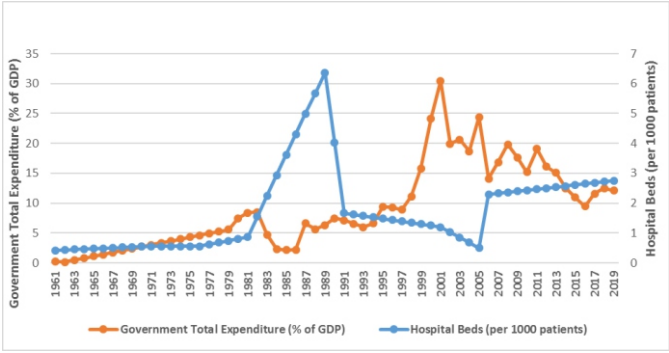
Figure 1 presents some stylized facts on infrastructure and real DGP over the period 1961to 2020. Figure shows electricity consumption, fixed and mobile lines in Nigeria between 1961 to 2020

Figure 1: Electricity Consumption, Fixed and Mobile Lines and Rail lines, 1961-2019



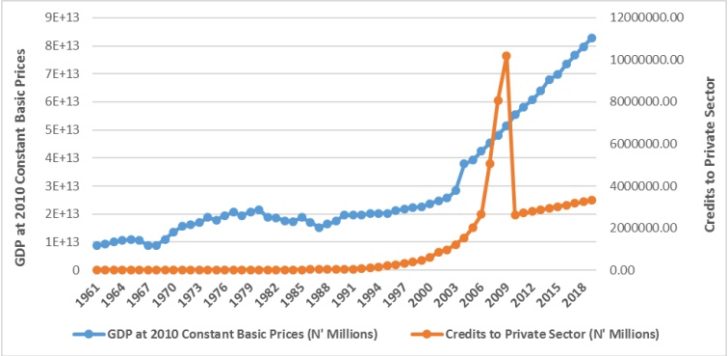
Source: WDI (2020)

Figure 2: Government Total Expenditure and Hospital Beds (per 1000 patients), 1961-2019



Source: WDI (2020)

Figure 3: GDP at 2010 Constant Basic Prices and Credits to the Private Sector, 1961-2019



Source: WDI (2020)

Table 1: Growth of Recurrent and Capital Budget Estimate on Infrastructures in Nigeria (per cent)

Year	1977-1986	1987-1996	1997-2006	2007-2019
Transport and Communication	-1.84	49.2	79.6	7.03
Education	8.78	48.4	33.1	13.3
Health	11.1	38.9	44.1	13.3
Construction	18.8	27.0	57.4	4.96
Water	38.0	33.3	73.2	4.96

Source: CBN (2020)

Table 2 further give credence to the fact that despite government's spending on the provision of infrastructures in Nigeria, the contribution of the existing ones is far from raising the quality of growth. Evidence from table 2 showed that education, transport, health, electricity and water contributed insignificantly to growth in Nigeria. Between 1970-1979, the contribution of education, transport, health, electricity and water stood at 1.49per cent, 3.01per cent, 0.52per cent, 0.43per cent and 0.07per cent respectively. This fell to 0.22per cent, 2.58per cent, 0.06per cent, 0.21per cent and 0.01per cent during the period 2000-2009. During period 2010-2014, the contribution of these infrastructures to growth was not sustained as it fell to 0.15per cent, 1.84per cent, 0.04per cent, 0.18per cent and 0.01per cent respectively. This indicates a gross deficit in infrastructure finance required to catalysed growth (Hamilton, 1994). During the same period, telecommunication infrastructure recorded massive improvement due to positive globalization externality.

Table 2: Contributions of Selected Infrastructures to Growth in Nigeria, 1970-2019 (per cent)

Year	1970-1979	1980-1989	1990-1999	2000-2009	2010-2019
Education	1.49	0.46	0.23	0.22	0.15
Transport	3.01	4.46	2.64	2.58	1.84
Health	0.52	0.14	0.06	0.06	0.04
Electricity	0.43	0.45	0.13	0.21	0.18
Water	0.07	0.27	0.07	0.01	0.01
Telecommunication	0.20	0.11	0.03	0.52	1.34

Source: CBN (2020)

Electricity and health have long been identified as major setbacks to growth in Nigeria (see tables 3 and 4). Electricity generation and consumption continues to be Nigeria's largest infrastructure challenge as it filtrates into other segments of the economy. The Nigerian power sector is characterized by low generating capacity relative to installed capacity. A large number of electricity consumers do not have access to uninterrupted supplies of electricity. Presently, electricity consumption has been increasing while the percentage of electricity generated fluctuated. Government policy towards addressing the question of electricity needs for the country could not be articulated in clearer terms. For example, the last major electric generation installation in Nigeria was in 1990 when the Shiroro power station was commissioned. Since then, no new units have come on stream and none of the existing ones have had a major overhaul over the past few years.

Table 3: Electricity Generation and Consumption in Nigeria, 1970-2019

Year	1970-1979	1980-1989	1990-1999	2000-2009	2010-2019
Installed Capacity (mw)	1097.8	3495.3	4654.8	8244.5	12112.2
Total Generation(mw/hr)	384.4	1117.2	1736.5	3850.9	6096.6
Capacity Utilized (per cent)	35.6	32.6	37.4	45.6	50.3
Total Consumption	312.5	712.3	1006.5	1997.6	4032.9
per cent of Generation Used	83.0	63.2	58.1	54.7	66.0

Source: CBN (2020)

As shown in table 3, there is a wide gap between the installed capacity and total electricity generated. The gap became widened during the periods: 1970-1979, 1980-1989; 1990-1999; 2000-2009 and 2010-2014. Consequently, power outages became so frequent and the sector operated below its estimated capacity. Low water levels at various power stations are frequently claimed to be responsible for the frequent power shortages (Babatunde and Shuaibu, 2011).

The health infrastructure in Nigeria is at worrisome stage during the period 1995-2014. As at 2005-2009, the value of public health expenditure as percentage of total health expenditure increased from 25.04per cent to 29.10per cent during the period 1995-1999 and 2000-2004. It reached its peak during 2005-2009 with 32.62per cent and fell to 29 per cent during 2010-2014. During the same period, private health expenditure as percentage of GDP stood at 2.32per cent during 1995-1999. It increased sharply to 2.76per cent during 2005-2009 and declined to 2.61per cent during 2010-2014. Similarly, public health expenditure as percentage of government expenditure increased significantly from 8.51per cent to 17.69per cent during 1995-1999 and 2005-2009. It declined to 16.70per cent during 2010-2014. However, public health expenditure as percentage of GDP stood at 0.78per cent during 1995-1999. It increased marginally to 0.98per cent in 2000-2004, peaked at 1.33per cent during 2005-2009, and later declined to 1.06per cent during 2010-2014 respectively. Similarly, the total health expenditure as percentage of GDP increased from 3.10per cent to 4.09per cent during 1995-1999 and 2005-2009. It reduced marginally to 3.66per cent in 2010-2014 (table 4).

Table 4: Health Expenditure in Nigeria, 1995-2019

Year	1995-1999	2000-2004	2005-2009	2010-2019
Public health exp. (per cent of Total)	25.04	29.10	32.62	29.00
Private health exp. (per cent of GDP)	2.32	2.40	2.76	2.61
Public health exp. (per cent of Govt.Exp)	8.51	11.30	17.69	16.70
Public health exp. (per cent of GDP)	0.78	0.98	1.33	1.06
Total health exp. (per cent of GDP)	3.10	3.38	4.09	3.66

Source: World Health Organization Global Health Expenditure Database (2020)

Empirical Literature

Aschauer (1988), investigated the relationship between aggregate productivity and stock as well as flow of government spending variables in the USA between 1945 and 1989. Contrary to economic theory which says that increase in government expenditure raises real interest rates and crowds-out private investment, Aschauer used a generalised Cobb Douglas function to show that movements in public investment induces similar movements in output from the private segment of the US economy. The dependent variable was output per capital in private business economy and the independent variables used were private sector labour input, private capital input, non-military public capital, private business total factor productivity and capacity utilisation rated in manufacturing. The overall findings indicate that core infrastructure which comprised of 55per cent of the cumulative non-military stock is highly significant with an elasticity of 0.24. He therefore concluded that core infrastructure bears the highest explanatory power of productivity of an economy. This work examined the impact of public infrastructure on selected sectors on economic growth in Nigeria and deviating by anchoring the unbalanced growth model. Ret, Niels, Daniel and Youdi (1994), examined the impact of infrastructure (roads, telecommunications, electricity) on industrial development in Central Java using Ordinary Least squares. The spatial distribution of manufacturing industry is analysed by means of both secondary and primary data on 274 firms in various parts of Central Java. In addition to demand side factors, infrastructure indeed plays an important role, but local government bureaucratic procedures for obtaining land and permits are also important. The paper concentrated attention on the Nigerian economy and extended the analysis to include the health and education sectors.

Bougheas, Demetriades and Morgenroth (1999), analysed the relationship between infrastructure stock and increased specialisation in European six countries over the period 1970 to 1990. The study used an augmented gravity model, an approach where the dependent variable is the logarithm of exports from one country to another while the independent variables are logarithms of gross domestic product (as a proxy of market sizes), logarithms of product of capital public capital and distances between the capital cities. In a separate equation, the length of motorway network is included as a distinct variable to measure transport infrastructure. The results indicate that the coefficients of infrastructure variables are positive and significant while those of GDP are smaller and positive. The improvement of R^2 values when additional infrastructure variables are introduced imply that volume of exports (and thus competitiveness of an economy) is highly determined by development on infrastructure. This work used time series analysis and based on the unbalanced growth

model, employed real gross domestic product as the dependent variable and transport, communication, health, education and utilities sectors as the independent variables. Ayogu (1999), in a study of annual data on core infrastructure disaggregated by regions 1985–95 in Nigeria, adopted Cobb–Douglas production function. The study employed physical stock of core infrastructure variables, kilometres of Federal highways; per cent of population with access to potable water, power consumed and access to main telephone mainlines as variables. Study found that there are no regional differences in productivity across infrastructure types but in general infrastructure is productive. Results are stronger in the aggregate that does not control for regional differences. The unbalanced growth model was adopted for this study with real gross domestic product as the dependent variable and transport, communication, health, education and utilities sectors as the independent variables.

Haughwout (2000), gives a review of literature on effects of public investment in the USA using descriptive analysis with data on federal, state and local authorities. Findings revealed that States that wish to use their public capital money as part of a strategic economic development effort will direct more resources to central cities and other localities that have high concentrations of jobs and avoid building new projects in the green fields on the edges of metro areas. This paper concentrated on the Nigerian economy for its analysis and using selected sectors studied the effect of infrastructure on economic growth. Moreno, Lo´pez-Bazo and Artıs (2002), presented a theoretical framework for determining the short- and long-run effects of public infrastructure on the performance of manufacturing industries in the Spanish regions using the iterative Zellner technique for seemingly unrelated regression equations imposing the equality restrictions among parameters across equations to fit the theoretical models. The study derived long-run elasticities by taking into account the adjustment of quasi-fixed inputs to their optimum levels. By considering the impact of infrastructure on private investment decisions, the study found that infrastructure exerts an indirect source of influence in the long-run through their effect on private capital, apart from the direct effect on costs in the short-run. This work tried to examine the impact of both the long and short run relationship between public infrastructure and economic growth that was established and their effect on the Nigerian economy as well as the direction of causality between them. Paul (2003), used annual data from Australia from 1968/69– 1995/96 examined the effects of public infrastructure on cost structure and productivity in the private sector. The study utilized trans log cost functions incorporating public capital infrastructure for both the private-sector and a group of seven broad industries. Public infrastructure is found to have a positive and significant impact on productivity in the private sector Also, public capital is found to be a substitute for private capital and labour Returns to public capital are significant and vary over the sample period. This study examined the impact of public infrastructure on economic growth of Nigeria as an entity using the unbalanced growth model and covering the period in-between 1981 to 2016. Akinbobola and Saibu (2004), used aggregate quarterly data, 1986–2000 to investigate the correlation between public expenditure, unemployment, human development and government capital spending in Nigeria. Real per capita income, government capital expenditure, unemployment rate and ranking on human development index were variables employed using VAR. Findings reveals that spending on infrastructure development led to more job opportunities, higher level of

income per capita and a reduction in poverty, this resulted to an improvement in the human development index. This study employed ARDL incorporating transport, communication, health, education and utilities sectors to study their impact on the Nigerian economy.

Herranz-Loncán (2007), investigated the impact of infrastructure investment on Spanish economic growth during the period 1850 to 1935 using new infrastructure data and VAR technique. The result shows a strong positive relationship between infrastructure and growth but infrastructure returns were not significant in the estimation. This work employed ARDL in its estimation from 1981 to 2016 to examine both the long run and short run impact of investment on public infrastructure using the transport, communication, health, education and utilities sectors on economic growth in Nigeria. Olorunfemi (2008), examined the direction and the strength of the relationship between infrastructural services and manufacturing output in Nigeria using time series data from 1981 to 2005. The study used Vector Autoregressive (VAR) model and Granger causality relating manufacturing output to telecommunication, electricity, education and transport infrastructural services. Results show that the present transport and electricity service in Nigeria did not cause growth to occur in the manufacturing sector. It was also revealed in the study that telecommunication and education had contributed to the growth in the manufacturing sector. The paper recommended that a centrally coordinated, internally consistent and a holistic approach that would encompass uniform standard, a maintenance culture and a linkage between the various sectors of the economy toward the development of infrastructure services is important to the development of manufacturing sector.

This study examined the direction of causality between public infrastructure and economic growth in Nigeria for the period 1981 to 2016 using the unbalanced growth model with real gross domestic product as the dependent variable and transport, communication, health, education and utilities sectors as the independent variables. Babatunde, Salius and Oseni (2012), attempted to investigate the impact of infrastructure on economic growth in Nigeria using a multivariate model of simultaneous equation during 1970 to 2010. The study utilized three-stage least squares technique to capture the transmission channels through which infrastructure impacted on growth. Variables considered include, market size, public investment and private sector investment. The paper submitted that infrastructure investment directly impacted on the overall output and indirectly stimulates growth of other sectors. This study employed ARDL to cover from 1981 to 2016 using the unbalanced growth model was being adopted for this study with real gross domestic product as the dependent variable and transport, communication, health, education and utilities sectors as the independent variables. Nedozi, Obasanmi and Ighata (2014), analysed infrastructure development and economic growth in Nigeria using simultaneous analysis. Two models were specified and analysed using the OLS method along with variables such as gross domestic product, exchange rate, labour force, inflation rate and contribution of infrastructure to GDP. Findings from the study show that infrastructure constitute a critical part of growth process in Nigeria. This study employed ARDL incorporating the unbalanced growth model with real gross domestic product as the dependent variable and transport, communication, health, education and utilities sectors as the independent variables. Also, the direction of causality between the dependent and independent variables was determined.

Ogunlana, Yaqub and Alhassan (2015), examined the effect of public and private investment on infrastructures and its impact on economic growth in Nigeria during the period 1970 to 2014 using the Engel-Granger (1987) co-integration and Error correction mechanism (ECM). Empirical results show that infrastructure components exert positive contribution on economic growth in Nigeria. Domestic investment on infrastructure and total labour force correlated with economic growth negatively. The study recommended that government need to design an economic policy that would raise the quality of infrastructures and at the same time make provisions for human capital development for sustained growth. This study not only examined if there exists both a long run and short run relationship between public infrastructure and economic growth in Nigeria but also their impact and the direction of causality between them.

Kodongo and Ojah (2018), in a study titled does infrastructure really explain economic growth in Sub-Saharan Africa used System GMM to estimate a model of economic growth augmented by an infrastructure variable, for a panel of 45 Sub-Saharan African countries, over the period 2000–2011. They found that it is the spending on infrastructure and increments in the access to infrastructure that influence economic growth and development in Sub-Saharan Africa. Interestingly, these significant associations, especially those of infrastructure spending, are more important for lesser developed economies of the region than for the relatively more developed economies, which uncommonly have better than near-zero access to infrastructure. In addition to these robust direct links between the target variables. The study further found that infrastructure access, and quality, also relate to economic growth indirectly via export diversification (trade competitiveness), and cross-border capital flows and trade competitiveness, respectively. They recommended reversing Africa's pervasive infrastructure deficit, in ways that enable economic growth and development, must be carefully nuanced. This study employed time series analysis using ARDL for the periods of 1981 to 2016 to study the impact of public infrastructure on economic growth using the unbalanced growth model with real gross domestic product as the dependent variable and transport, communication, health, education and utilities sectors as the independent variables.

Ehizuelen (2019), examined the dynamic linkages between infrastructure and economic growth in Nigeria. Economic development in Nigeria can be facilitated and accelerated by the presence of infrastructure. The study employed Ordinary Least Squares along with variables such gross domestic product, exchange rate, inflation rate, labour force and contribution of infrastructure. Results show that infrastructure is an integral part of Nigeria economic growth. Undermining it (infrastructure) is undermining the growth and development of Nigerian economy. The study has showed that infrastructure is an intermediate goods and service for the real sector and a finished goods and service for consumers. So, if the real sector which is the engine of growth is to propel Nigerian growth and development, infrastructure should be given qualitative and adequate attention. This study employed ARDL incorporating real gross domestic product as the dependent variable and transport, communication, health, education and utilities sectors as the independent variables.

Ehizuelen (2016), Olorunfemi (2008), Bougheas, Demetriades and Morgenroth (1999), and Aschauer (1988), studied the relationship between public infrastructure and economic growth of Nigeria, USA and some European countries, using mostly road and telephone lines infrastructure. The current goes beyond these variables to include: railway lines, GSM subscription and hospital bed to extend the infrastructure variables. In summary, the study is justified in the following ways:

(i) It extends the existing knowledge by using additional infrastructure variables unlike the reviewed empirical studies in Nigeria,

(ii) Unlike Ehizuelen (2016), Olorunfemi (2008), that used single regression, the current study used the autoregressive dynamics. A suitable approach for effect examination,

(iii) Unlike previous studies, the current provides some stylized facts on infrastructure and economic growth in Nigeria. Thereby providing a well-informed study on the subject matter,

(iv) Unlike previous studies, the current study used a well-defined theoretical framework that anchors the theoretical model construct of the study thereby supporting the reliability of the study

(v) The paper departed from previous studies on the use of the GDP 2010 constant prices. The Nigerian re-based GDP value. A more pragmatic approach to the study of infrastructure-economic growth relationship in Nigeria. First of its kind in the literature.

Research Methods

The purpose of this chapter is to provide adequate and appropriate methods for this study. However, the basic objective of the methods employed in this study is to answer the research questions stated and hypotheses postulated. This chapter covers theoretical framework, model specification, estimation technique and procedure as well as nature and source of data used.

Theoretical Framework, Methodology and Data

The theoretical framework of the paper is anchored on the endogenous growth theoretical framework The paper followed the model building and specification of Omojimite (2011), whose paper is similar in structure to the current paper. Omojimite's model is specified thus:

$$PINV = f(GDP, CEXT, CEXM, ELEC) \quad 1$$

Where PINV = Private investment, CEXT = Capital (public) investment on transport and communication, CEXM = Capital (public) investment on manufacturing, ELEC = Output of Electricity. Therefore, the empirical model of the current study is specified as follows:

$$RGDP = f(ELEC, RWL, HSB, GEP, CPS) \quad 2$$

The mathematical and econometric (log linear) forms of equation 3.2 can be expressed thus:

$$LnGDP_t = f(b_0 + b_{1Ln}\,ELEC + b_2 Ln\,RWL + b3LnHSB + b4LnGEP + b5LnCPS \quad 3$$

Where GDPC= economic growth at 2010 constant price
ELE = Electricity consumption, RWL = Rail lines, HSB = Hospital beds, GEP = Government total expenditure, and CPS = Credit to the private

Similarly, equation 3 can further be expressed as:

$$RGDP_t = f(b_0 + b_1 Ln\,ELEC + b_2 Ln\,RWL + b3LnHSB + b4LnGEP + b5LnCPS + e_i)$$

Where ei is the stochastic error term under the ordinary least square assumption of linearity, homoscedasticity and other related assumptions. The model of the paper differed from that of Omojimite (2011), by the use of rail lines, fixed and mobile lines, hospital bed. Other included variables are total government expenditure and credit to the private sector.

Electricity Consumption and Economic Growth: Previous studies in Nigeria have studied the relationship between electricity consumption and economic growth. Ogundipe and Apata (2013), used GDP at constant price (at 2000) and electricity consumption. The present study uses 2010 constant basic price. The study is therefore justified. It is expected that there will be a positive relationship between electricity consumption and economic growth. As such, b>0. Ahmed, Hamed and Inqman (2012), for Pakistan, Kouakou (2010), for Cote d' Ivoire; Quadraogo (2012), and Yang (2000) for Sir Lanka have all examined the relationship. In a previous study, Tolulope and Taiwo examined the link between railway transport and economic growth in Nigeria. Others include Herranz-Loncan (2011), for Uruguay, Attack et al (2009) for the American Midwest, Haines and Margo (2006) for the USA and Ramirez (2001), for Colombia, although with different findings. The inclusion of railway line is therefore justified. A priori, it is expected that railway line will affect positively on economic growth such as $b_2 > 0$. Ghosh and Dinda (2017), examined health infrastructure and economic development in India, although hospital bed was not part of the health infrastructure using the server approach. No other similar study was found especially in Nigeria. It is expected that $b_3 > 0$, positively related to economic growth. Previous studies have examined the relationship between government expenditure and economic growth. Ghani and Din (2006) for Pakistan, Badawi (2013) for Sudan, Nurudean and Usman (2010), and Akpan (2005) showing mixed results. Government expenditure is included in the study as a control variable and not as an explanatory variable. It is expected that government expenditure will affect economic growth positively, so that; $b_4 > 0$. Therefore, its inclusion is justified. Credit to the private sector has been used as an explanatory variable in previous studies. Olowofeso *et al* (2015). In the present study, it is a control variable and therefore, its inclusion in the study model is justified. It is expected that it will positively relate to economic growth in Nigeria within the reviewing period, b5 > 0.

Following Pesaran et al (2001), the error correction model (ECM) of the unrestricted autoregressive distributed lag (ARDL) equation based on equation 3.4 is specified as follows:

$$\Delta GDP_{t=}a_0 + aii\sum_t^i = 0\Delta ELEC_{t-1} + a_{2i}\sum_t^i = O\Delta RWL_{t-1} + a_{3i}\sum_t^i = O\Delta HSB_{t-1} + a_{4i}\sum_t^i 0 = \Delta GEP_{t-1} + a_{5i}\sum_t^i 0 = \Delta CPS_{t-1} + a6\ ECM\ (-1) + ui$$

Where EC, is the error correction term (lagged residual of static regression and Δ stands for the first difference. Table 5 show the data and sources.

Table 5: Shows the nature and sources of data for the variables

Variables	Type	Proxy	Period covered	Unit of Measurement	Source
Economic Growth	Endogenous	Economy GDP	1961-2019	2010 constant basic prices	WDI (2018)
Electricity consumption	Exogenous	Infrastructure	1961-2019	% of population	WDI (2018)
Hospital bed	Exogenous	Infrastructure	1961-2019	Year	WDI (2018)
Credit to the private sector	Control variable	Private sector credit allocation	1961-2019	% of population	AfDB (2018)
Fixed and mobile phone lines	Explanatory	Infrastructure	1961-2019	% of population	NBS 2019
Government total expenditure	Control	Public sector finance	1961-2019	Percentage (%)	WDI (2018)
Rail line	Explanatory	Infrastructure	1961-2019	% of population	WDI (2018)

Result Presentation, Analysis and Discussion of Findings

Descriptive Statistics

Table 6 provides the summary of descriptive statistics

Table 6: Summary of Description Statistics Result

	GDP	ELEC	RWL	FML	HSB	GEP	CPS
Mean	3.2401	35.0041	9.2	4.53	23.7211	20.5	106.325
Median	67.50000	7.00000	12.21701	191.08615	46.34529	1.818902	15.48604
Maximum	87.6444	28.10000	72.83550	55.8544	53.08307	30.34408	140.9656
Minimum	21.5000	1.900000	5.382224	50.70674	45.85241	-15.45826	0.136443
Std. Dev.	22.42337	8.016812	17.93583	27.72970	2.399310	7.590613	45.23893
Skewness	0.62351	1.626154	-0.256894	1.01252	1.23421	-1.52864	1.6129
Kurtosis	2.46825	4.3251	7.6284	1.3252	6.4211	1.4356	5.2411
Jarque-bera	3.2463	2.9721	18.17112	10.2413	7.2430	3.7824	2.9738
Probability	0.17917	0.154579	0.00013	0.328555	0.039486	0.0000	0.044516
Observation	58	58	58	58	58	58	58

Note: GDP = Economic growth; ELEC = Electricity Consumption; RWL = Rail way lines; FML = Fixed and Mobile phone lines (per 1000 inhabitants); HSB= = Hospital beds; GEP = Total Government Expenditure; and CPS = Credit to the Private Sector.
Source: Researchers' Computation using E-VIEW 10.0.

The starting points of the empirical analysis are by examining the characteristics of the variables of the model. The descriptive statistics of gross domestic product (GDP) at 2010 constant basis prices, electricity consumption, railway lines, fixed and mobile lines (per 1000 inhabitants), hospital beds, total government expenditure and credit to the private sector are reported in table the statistic indicate the existence of wide variations in the variables. For

instance, the average of electricity consumption was 35.7 percent compared to 23.7 and 3.2 percent for hospital beds and economic growth in the period 1961-2019.Similarly, the average of credit to the private sector was 106.3 percent compared to 45.3% and 20.5% respectively for fixed and mobile phone lines and total government expenditure on infrastructure within the same period. While the average for railway line was quite minimal at 9.2%. The skewness statistics show that the total government expenditure on infrastructure as a percentage of GDP and the total spending on railway lines and negatively skewed, others showed positive skewness. The Kurtosis statistics show that total government expenditure (% of GDP) and railway lines are Platy-Kurtic, suggesting that its distributions are flat relative to normal distribution, why the other variables are Leptokurtic, so you think that the distributions are peaked elective two normal distributions. Finally, on the report of descriptive statistics, the Jarque-Bera statistics value rejected the null hypothesis of normal distribution for railway lines, fixed and mobile phone lines and hospital beds, at the 5% critical value while the null hypothesis of normal distribution for other variables-GDPR 2010 constant basis price (proxy for growth), electricity consumption, credit to the private sector and government total expenditure are accepted at the same 5% critical value.

Correlation Matrix

Table 7 presents the correlation matrix results

Table 7: Correlation Matrix Result

	GDP	**ELEC**	**RWL**	**FML**	**HSB**	**GEP**	**CPS**
GDP	1.00000	0.769917	0.7243	0.6245	0.8724	0.7241	0.5324
ELEC	0.76317	1.00000	0.3246	0.744726	0.400506	0.34216	-0.6241
RWL	-0.312579	0.3700	1.00000	0.4273	-0.3824	0.8632	0.6324
FML	0.8423	0.3246	0.7623	1.0000	-0.7436	0.7285	0.7321
HSB	0.4241	0.5738	0.6241	0.3200	1.0000	0.3246	0.4288
GEP	0.71100	0.43281	0.5261	0.4682	0.62834	1.0000	0.5628
CPS	0.8432	0.6481	0.5324	0.5624	0.6863	-0.7000	1.000

Sources: Researchers' Computation using E-VIEW 10.0.

The correlation matrix gives empirical support to the descriptive results outcome. It aims at ensuring that there is no inherent estimation problem with the data characteristics. The rule of the thumb is that any variable at the exact 0.95 or 95% is linearly correlated. Such variable should be removed from the estimation process. The result is presented in table 7. From the correlation matrix results presented in table 7, the results are free from the problem of multi-collinearity as none of the variable is equal or above the 95% standard. The examination of the data distributed and the non-identification of any data problem leads to the examination of the stationarity properties of the variables. This result is presented in the unit root/stationarity results as presented in table 7.

Unit Root Test

Table 8 presents the unit root test results using both the Augmented Dickey Fuller (ADF) and the Phillip-Perron tests for complementary purposes.

Table 8: ADF and PP Unit Root Results at Levels and First Differences

	ADF Test			Philip-Pearson (PP) Test		
Variables	**Levels**	**First difference**	**P-Value**	**Levels**	**First Diff.**	**P. Statistics**
LN GDP	0.43234	-3.548208*	0.982714	0.43101	-3.6240	0.92 I(1)
LN ELC	-1.874148	-3.555023*	0.341831	-1.7252	-3.5291	0.421 I(1)
LN RWL	-3.554109	-3.560019*	0.0102	-3.532	-3.6218	0.0112 I(0)
LN FML	-0.003419	-3.552666*	0.9540	-0.0124	-3.6259	0.961 I(1)
LN HSB	-1.550719	-3.548208*	0.5011	-1.6284	-3.7862	0.632 I(1)
LN GEP	-3.695666	-3.658208*	0.0066	-3.7246	-3.8636	0.1243 I(0)
LN CPS	-1.457377	-3.548208*	0.5479	-1.4625	-3.9428	0.624 I(1)

Note: * Significance at the 5% critical values.
Source: Researchers' Computation using E-View 10.0.

This is a test for the stationarity properties of the variables. As stated in chapter three, co-integration analysis based on the autoregressive distributed lag (ARDL) testing implies that a unit root is not stationary. However, it is necessary to carry out these tests to ensure that none of the chosen variables is of other two, i.e, I (2). The results show that within the framework of ADF and PP unit root test, railway line and total government expenditure that was stationary at levels, the other variables- GDP, ELC, FML, HSB, and CPS we are stationary after the difference. This indicates clearly that there is enough evidence to reject the null hypothesis of unit root for the variables under examination.

Co-Integration Test Result

Table 9 presents the long-run/co integration test

Table 9: ARDL Bound Testing Results (with Intercept and Trend)

F-Statistics	**5% Critical Value**		**1% Critical Value**	
	Lower Bound 1(0)	Upper Bound I (1)	Lower Bound	Upper Bound
4.675173			I(0)	I(1)
	-2.86	-4.38	-3.43	-4.99

Having ascertained that all our chosen variables are either I(0) or I(1) and that none is I(2), the long run relationship (co-integration) among these variables is determined using the ARDL co-integration approach. This procedure consists of estimating and Unconstrained Error Correction Model (ECM) as specified in preceding chapter. The first step to ARDL bound test is to determine the optimal lag learnt for the first difference of the chosen variables. The ARDL bank test results and the critical values obtained from Pesaran *et al* (2001:3000) are presented in table 9. The result in table 9 shows the ARDL bound testing for co-integration. The ARDL bound tests results indicate evidence of co integration among the variables of interest. The value of the f-statistics for the joint significance of the lagged level variables is greater than the upper bound of the 1% critical values. Therefore, from the results of the ARDL long run form and bounds test of co-integration. We conclude that long run relationship exists between the proxy variables of infrastructure and GDP (economic) growth in Nigeria within the reviewing periods.

Estimated Long-Run Coefficients Results

Table 10 presents the long-run result

Table 10: Dependent variables: D (LNGDP)

Variables	Coefficient	STD. Error	E-Statistics	Prob.
C	2.573974	5.107705	0.503940	0.6182
LN GDP (-1)*	-0.160690	0.061532	-.611479	0.0143
LN ELC (-1)	-0.185580	0.103548	-1.792216	0.0839
LN RWL (-1)	0.417888	0.625198	0.668409	0.5093
LN FML**	0.098966	0.019677	5.029559	0.0000
LN HSB (-1)	0.148417	0.045171	3.285672	0.0027
LN GDP (-1)	0.223318	0.054408	4.104483	0.0003
LN CPS (-1)	-0.080965	0.020788	0-3.894726	0.0006
LN GDP (-1)	0.094244	0.173020	0.544699	0.5903
LN GDP (-2)	-0.602186	0.196244	-3.068553	0.0047
LN GDP (-3)	0.067434	0.168985	0.399055	0.6929
LN GDP (-4)	-0.422807	0.180810	-2.338406	0.0267
LN ELC	-0.074527	0.094886	-0.785441	0.4388
LN RWL	-0.056557	0.534375	-0.105838	0.9165
LN RWL (-1)	0.361246	0.399563	0.904101	0.3737
LN HSB (-1)	-0.147544	0.055682	-2.649749	0.0131
LN HSB (-2)	-0.088179	0.057538	-1.532547	0.1366
LN HSB (-3)	-.064794	0.046667	-1.388437	0.1760
LN GEP	0.089090	0.052162	1.707939	0.0987
LN GEP (-1)	-0.142738	0.052578	-2.714792	0.0112
LN GEP (-2)	-0.143124	0.049383	-2.898225	0.0072
LN CPS	0.048296	0.047602	1.014574	-0.3190
LN CPS (-1)	0.111320	0.048522	2.294214	0.0295
LN CPS (-2)	0.080561	0.046812	1.720965	0.0963
LN CPS (-3)	0.086267	0.046415	1.858597	0.0736

*p-value incompatible with t-bounds distribution

** variable interpreted as Z = Z (-1) + D)Z)

EC = LNGDP-(-
1.1549*LNELC+2.6006*LNRWL+0.6159*LNFML+0.9236*LNHSB+1.3897*LNGEP-
0.5039*LNCPS

Source: Researchers' Computation using E-View 10.0

After conducting the unit Root test, the estimates of parameters of the long-run relationship between economic growth and the variables of infrastructure obtain and reported in table the long run coefficient derive through the long-run coefficients are derived through the ordinary least square (OLS) estimation, which is still the workhorse of economic metric empirical technique (Iyoha, 2004). From the results, the coefficients of flag of economic growth are negative, at variance with the theoretic postulation. From the results, and on average, a 1% increase in investment in critical infrastructures we reduced economic growth by 0.16 or this result is a real contrast to the Rosenstein-Rodan of "the big push theory and Rostow theory of the stages of economic development, that build social overhead capital as one of the key sources of economic growth. The estimated coefficient of electricity consumption is negative, which is also expected in the case of Nigeria. There is for electricity consumption in Nigeria.

From the results also, the estimate all fixed and mobile phone lines is positive and as expected from the theoretic postulation, such that 1% increase in fixed and mobile phone lines investment, there is a corresponding 1% increase in economic. This is a confirmation of the huge investment in telecommunications in the Nigerian economy over the years. Clearly, improvement in telecommunication will drive economic growth. The estimated coefficients of hospital beds and the total of government expenditure (%of GDP) are positively related to economic growth as expected. Results that support the infrastructure growth hypothesis. The estimate coefficients of credit to the private sector showed mixed results. The first lags showed positive and negative relationship with economic growth. However, the second and third lags are all positively related to economic growth. Table 11 presents the ARDL error correction result.

Table 11: ARDL Error Correction Regression

Variables	Coefficient	STD. Error	E-Statistics	Prob.
C	2.573974	0.042461	.395581	0.0000
LN GDP (-1)	0.094244	0.143529	0.656620	0.5168
LN GDP (-2)	-0.602186	0.162566	-3.704253	0.0009
LN GDP (-3)	0.067434	0.146336	0.460819	0.6485
LN GDP (-4)	-0.422807	0.138383	-3.055328	0.0049
LN ELC	-0.074527	0.072391	-1.029511	0.3121
LN RWL	-0.056557	0.325184	-0.173924	0.8623
LN RWL (-1)	0.361246	0.313435	1.152536	0.2588
LN HSB	0.085811	0.038375	2.236121	0.0335
LN HSB (-1)	-0.147544	0.042464	-3.474563	0.0017
LN HSB (-2)	-0.088179	0.041507	-2.124463	0.0426
LN HSB (-3)	-0.064794	0.033822	-1.915754	0.0657
LN GEP	0.089090	0.041939	2.124283	0.426
LN GEP (-1)	-0.142738	0.043328	-3.294565	0.0027
LN GEP (-2)	-0.143124	0.039350	-3.637213	0.0011
LN CPS	0.048296	0.035530	1.350305	0.1849
LN CPS (-1)	0.111320	0.039824	2.795255	0.0093
LN CPS (-2)	0.080561	0.038036	2.118037	0.0432
LN CPS (-3)	0.086267	0.036609	2.356416	0.0257
Coint Eg (-1)*	-0.160690	0.025491	-6.303885	0.0000

R-Squared	0.624904	Mean dependent var.	0.037404
Adjusted R-square	0.415292	S.D. dependent var.	0.079148
S.E of regression	0.060521	Akaike Infor. criterion	-2.493523
Log. Likelihood	87.32512	Schwarz Criterion	-1.756862
F-Statistics	2.981237	Hannan –Quinn criterion	-2.209422
Prob (F- Statistics)	0.002683	Durbin –Watson Stat	2.220308

*P-value incompatible with t-Bounds distribution

From table 11, it was also shown that the estimate coefficient of economic growth and second and fourth lags we are negative, while the year 1 and year 3 lags are positive, such that 1% increase in infrastructure will contribute 0.6% of increase in economic growth. From the results, GDP has mixed results, implying that infrastructure could either contribute positively or negatively to economic growth. This result is consistent with the position of Romand de

Brian (2005), who concluded that the desire for growth does not necessarily mean higher or increased need for infrastructure and more infrastructures does not necessarily guarantee more economic growth. Electricity consumption is negatively related to economic growth such that 1% increase in electricity consumption expressed in kilowatts reduces economic growth by this result is not a tandem with the findings of Ogundipe and Apata (2013), that found out that electricity consumption impacted significantly on economic growth although the dimensions of the significance is not known. This result is variation with the theoretic assumptions. Railway line has negative effects, although in the long run or lag 1, the relationship between railway lines and economic growth is positive, such that 1% increase in railway lines usage of transport goods and human beings will result to 36% increase in economic growth, a result that is significant for policy enhancement and further consideration. This result is consistent with Tolulope and Taiwo (2013), for Nigeria and Herranz-Loncan (2011), for Uruguay that found out also that there is inverse relationship between railway lines and economic growth. In the first lag period, railway lines impacted positively on economic growth, a result that support the findings of Attack et al (2009). The negative and positive impact of railway lines on economic from the estimation results of the study for the corroborate the general findings on the inclusive argument of rail infrastructure and economic growth in the literature.

From the ARDL error correction regression results the effects of hospital bed infrastructure appeared mixed negative and positive. Hospital bed is negative in all the lag period, why positive at its ordinary levels. At its levels, a percentage change in hospital bed infrastructure contributes 0.0 or 1 percentage points to economic growth. This result is in line with the findings of Ogunjimi (2008). Total government expenditure as a percentage of the ratio of GDP is positive at the levels, but negative in the first and second lag periods. In the second lag, the percentage increase in total government expenditure leads to a decrease of 14.3 percentage points in economic growth. The expenditure pattern doesn't support economic growth. This result is consistent with the findings of AI- Yousuf (2000) for Saudi Arabia and Floater and Henrekson (2000), for which countries. Significantly, credit to the private is positively related to economic growth in Nigeria during the reviewing periods but at levels and in its lag periods. This result is in line with the findings of Amos et al (2017). The coefficient of determination (R2) is about 0.62, which implies that about 60 to a percentage of the total variation in economic growth we are accounted by variation in the explanatory variables. The f statistics value of 2.981237 weeds it's P-value of 0.0026 83 shows that the overall model is statistically significant at 5% level. Although not all the variables are individually significant, they are jointly explaining the variation in the dependent variable (GDP).

Furthermore, the value of the Durbin Watson, D.W (2.22) and that was the Breusch- Godfrey serial correlation LM test of 1.818002. 1.1824 shows that the model is free from autocorrelation problem of any order. The results from the diagnostic test shoes that ARCH test (autoregressive conditional heteroscedasticity statistic satisfied homoscedasticity assumption of OLS- Ordinary Least Square with a statistic value of 0.16 (P-value 0.8905). The Randy RESET test for linearity/model specification with statistics (2.951279), the statistics (1.309272) have mobility value of and 0.2658, which is greater than the conventional P-value

of 0.10 in line with the assumption of linearity, implying that the model with the variables is appropriately specified. The normality result of 0.48 with probability value of 0.78 implies that the model is normally distributed. The model stability test using the cumulative sum (CUSUM) and the cumulative sum of square (CUMSQ) is it that the parsimonious model is dynamically stable since they fitted CUSUM and CUSUMSQ shown by the trick line falls within the two dotted critical value lines at 5% level.

Discussion of Findings

The results from the study showed mixed outcomes. It shows positive and negative outcomes. By their nature, infrastructures are lumpy, indivisible and require huge initial investment with long gestation periods. The potential role of economic infrastructure as a major driver of economic growth has long been recognised in the development literature. Bogetic and Fedderke (2005), know that there are least channels through which infrastructure promote economic growth namely; first, infrastructure investment facilitates private investments by lowering production cost and opening new markets, thereby creating new production, trade and profit opportunities. For example, it is much cheaper for a producer or manufacturer or entrepreneur in Nigeria to pay for public power supply than to provide power by itself using its own generating plants. Such cost saving confers competitive advantage on producers and accelerate capital accumulation.

From the results, the coefficients of GDP is mixed. Some negative and positive. In other words, the infrastructure growth Nexus does not hold in Nigeria. What explanation have been adduced, electricity consumption is high with high tariff in Nigeria. Producers generate their own power, thereby affecting saving and capital accumulation, this has pakoda effect on economic growth. In Nigeria, the government has privatized power to the generating companies (GENCOS) and distributing companies (DISCOS) that have profit making as an objective function. When electricity tariffs are increased as the situation now in Nigeria, it affects negatively on electricity consumption and other products through the multiplier effect, this no doubt effect economic growth. Infrastructure also influences economic growth via the availability of good health facilities that enhancing living conditions and productivity of workers. From the results, the hospital beds, proxy for health infrastructure has mixed results, positive at one point a negative and the other points. This implies that health infrastructure affects economic growth negatively or positively. Inadequate infrastructure has been associated with weak firms' competitiveness, high level of poverty and poor health as link to the infrastructure challenges of the Nigerian health sector poses some challenges to economic growth (Omojimite, 2009).

Generally, the levels of infrastructural investment are below levels required for dynamic growth. Eustache (2005) found out that if Africa including Nigeria had invested in infrastructure as much as Korea republic, it would have been able to raise it annual growth the capital by about 1% points. Infrastructure investment in less-developed countries has fallen short of required levels because as public goods they are consumed by all. This makes the private sector unable to supply them in adequate quantity in certain situations. As noted also by Bogetic and Fedderke (2005), political stability and undeveloped democratic process and patterns crowds-out private investment in developing countries like Nigeria.

In addition, fiscal adjustment following fall in commodity prices as in the case of Nigeria has resulted in drastic cuts in public investment with longer period effects, as revealed by the first and second lag of the total government expenditure (Easterly and Serve, 2002). In such a case infrastructure bottleneck may develop, thus becoming binding constraints on economic growth. In Nigeria, the trend in aggregate public expenditure review inherent stability. It has followed the trend in the Economic fortunes of the country. The deterioration a fiscal condition since the 1980s to date has forced a complete fiscal adjustment that took the form of a contraction in public investment and infrastructure. The coefficients of the railway lines are both negative and positive this outcome is not surprising because Nigeria has not constructed new rail lines or even adequately maintain existing ones in the past decades. Only approval for construction has been by the government in recent years. Nigerian civil line density in terms of land (rail-km/1000sqkm) lags behind. It's also lags behind all other comparator groups and regions. As we throw density, Nigerian lags behind low-income group African countries in terms of mainline tele density. Nigerian with 7 per 1000 main line subscribers lags behind sub-Saharan Africa (31 per 1000), Middle East and North Africa (129 per 1000), Latin America and Caribbean (192 per 1000) countries (Omojimite, 2009). However, cellular density has recorded impressive growth following the introduction of cellular phones in Nigeria in the early 2000s.In summing up, the overall performance of the model is weak at 62% which tends to suggest that Nigerian infrastructure investments have not impacted significantly on private investment and economic growth.

Policy Implication of Findings

The major findings of the study are as follows:

1. From the long run estimated coefficient, the lag of economic growth is negative, at variance with the theoretic postulation. A percentage point increase in investment on infrastructure reduced economic growth. This implies that investment that will promote growth in needed in Nigeria, not just speculative investment.
2. The coefficients of electricity consumption and fixed and mobile phone lines, components of economic infrastructure a negative and positive respectively. In the case of electricity consumption, the implication is that the unbundling of the former power provider via the privatization process has not yielded the desired results.
3. The estimated coefficients of hospital beds and the total government expenditure are positively related to economic growth in long-run. Therefore, access to help via increase in government expenditure is needed to stimulate growth
4. Railway lines, a components of infrastructure have a negative and weak relationship with economic growth in the short-run. However, it has a positive relationship with economic growth in the long-run. This implies that the provision and efficiency railway lines is growth inducing
5. The coefficient of credit to the private sector is positive but in previous levels and in the lag periods negative. This implies that adequate provision of credit to the private sector users will promote growth of the economy

Conclusions and Policy Recommendation

Conclusion

The paper is an examination of the effect of infrastructure on real GDP growth in Nigeria covering the period 1961-2020. It employed both the descriptive statistical and ARDL econometric/data estimation approach. The data sources include; the World Bank development, indicator WDI,2018); the African Development Bank Database (AfDB) and the Nigerian Bureau of statistics for data relating to gross domestic price at 2010 constant prices (the dependent variable) and the Independent an explanatory/control variables including electricity consumption, railway lines, fixed and mobile phone lines, hospital infrastructure characterized by hospital beds and government expenditure (%o of GDP) and credit to the private sector. The results crayfish and simply implies that infrastructure drives economic only about 62%, a result that does support adequately the infrastructure-economic growth lotion ship and that is against the dual nature relationship of infrastructure and economic growth. These results the first is the argument that Nigeria and infrastructure face a number of challenges at the moment and therefore, the involvement of the private sector is the provision of infrastructure through the public-private partnerships (PPPs) arrangement is necessary now. From the results, all the variables shown mixed results (positive and negative). For example, hospital-bed coefficient in three periods lags a negative while in the previous period, it showed a positive relationship. Meanwhile, the coefficient of credit to the private sector showed positive relationship in the periods.

Policy Recommendations

In the light of the empirical evidence, the following are recommended for policy considerations.

i. In the long run, the estimated coefficient of economic growth is negative and, this implies that more complete effort in terms of policies is needed to make more investment in infrastructure for economic growth in Nigeria
ii. Both in the short-run and long-run, electricity consumption is negatively related to economic growth. Therefore, there is need to strengthen the Generating Companies (GENCOS) and Distributing Companies (DISCO) in this roles and to achieve the energy sector roadmap. Again, energy pricing is skewed towards the poor. Government is expected to play a leading role while rationally guiding the private sector involvement in the energy sector so as to come up with optimal pricing for energy in Nigeria.
iii. The hospital infrastructure is positively related to economic growth, this means that, policy efforts to improve on the existing hospital infrastructure in Nigeria should be improved upon.
iv. The Nigerian policy makers are also expected to expand infrastructure investment horizon through more budgetary allocations to capital expenditure.
v. In line with the above, government can incorporate strongly the private sector via the PPPs arrangement and infrastructure investment, this bridges the resource gap for government investment purposes.
vi. The government should fast-track the construction of railway in line with current government's efforts at rail construction in Nigeria and across the border countries. This will promote economic growth and trade integration.

vii. Credit to the private sector was found be positively related to economic growth throughout the reviewing period. Policy efforts geared toward credit allocation to the private sector at affordable rates.

The study contributes to the existing literature in the following ways: The study adds to the list of studies that has investigate the relationship between infrastructure and economic growth in Nigeria; It provides extensive analysis, incorporating trends and empirical set up to model economic growth and infrastructure as a driver, and among the first most studies alongside Tolulope and Taiwo (2013), that employed bed space in the hospital and railway lines as components of infrastructure**.**

The paper suggests the inclusion of water and sanitation, road transport, water irrigation facilities in the model build up. Again, the literature always advocated the bi-direction between infrastructure and economic growth. Therefore, part of future empirical examination would to examine the casualty between infrastructure and economic growth in Nigeria. For robustness and to avoid biasness, an index of infrastructure can be built in future studies through the principal component analysis (PCA).

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