International Journal of Multidisciplinary Research and Growth Evaluation.

# Macroeconomic effects of government infrastructural expenditure on economic growth in Nigeria

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## Article Info

## Abstract
It is replete in the economic literature that government expenditure on infrastructure affects economic growth positively. But some empirical studies have found a contradictory result in many countries. This study, therefore, examines the macroeconomic effects of government infrastructural expenditure on economic growth in Nigeria from 1981-2021. The objectives of the study are to determine the macroeconomic effects of government expenditure on transport and communication system, education, health, and road and construction on economic growth in Nigeria. The study utilized annual time series data on real gross domestic product (RGDP) and selected explanatory variables which include: government expenditure on transportation and communication, government expenditure on education, government expenditure on health and government expenditure on road and construction. The study adopted the autoregressive distributed lag (ARDL) data analysis technique based on augmented Dickey-Fuller unit root test which indicates that the variables are integrated of I(0) and I(1). Findings reveal that, in the long run, while government expenditure on health, and road and construction have significant but negative and positive effects on real gross domestic product respectively, government expenditure on transportation and communication, and education have positive and insignificant effects on real gross domestic product in Nigeria. The short run findings produced mixed results with one striking revelation that previous value of RGDP (RGDP at lag 1) generates positive effect on RGDP. The study, therefore, concludes that government expenditure on infrastructure affects economic growth in Nigeria within the period under review, and recommends that rational allocation and effective management of public funds should be made on infrastructure with strict supervision of approved public projects.

**DOI: https://doi.org/10.54660/.IJMRGE.2024.5.2.447-458**

## Introduction
It has been well documented in the economic literature that infrastructure is a strategic factor driving economic growth and development (Asian Development Bank [ADB], 2010; Babatunde, 2018) [7]. Development in whatever aspect cannot result in any improved economic growth if infrastructure such as telecommunication, transport, energy, water, health, housing and education are not invested on because infrastructures raises growth quality and reduces economic disparity and poverty level. Direct investment on infrastructure is capable of stimulating positive externalities in terms of making available production facilities and at the same time lowers costs associated with trade transaction and generate employment opportunities for the people. On the other hand, deficiency of infrastructure creates serious hindrance to sustainable growth and development.

Nigeria is experiencing an undersized growth due to lethargic infrastructure development. Resources channelled to the provision of infrastructure service were largely inadequate and sub-optimal (Fatai, Omolara & Taiwo, 2016) [15]. However, funds directed to the provision of infrastructure were either embezzled or out rightly diverted to less productive needs which are susceptible to corruption and this, however, created a lacuna in infrastructure development process (Fasoranti, 2012) [16]. According to Fatai et al., (2016) [15], the average economic growth rate in Nigeria increased from 26% to 34% between 1970 and 1999 and this increase was sustained by high revenue inflow from the oil sector. However, the rise in the growth rate did not reflected on Nigeria's infrastructure development needs. Further, Fatai et al., assert that the growth rate declined substantially from 24.2% to 8.48% during the period 2000 to 2014 respectively. In 2021, the economy expanded to 3.40%, the most since 2015 (when it grew by 2.79%), and compared to -1.92%, 2.27% and 1.98% in 2020, 2019 and 2018 respectively (Central Bank of Nigeria [CBN], 2022). The downward trend in the economic growth rate could be attributed to the poor state of infrastructure development (Fatai, et al., 2016) [15]. However, the government spending on infrastructure in Nigeria seems to be a waste of scarce resources and to the detriment of the tax payers because the growth in the economy does not physically depict infrastructure development. For example, Nigeria has failed to generate sufficient electricity nationwide despite huge spending on the power sector. Nigeria is the largest economy in sub-Saharan Africa, but limitations in power sector constrain growth. Nigeria is endowed with large oil, gas, hydro and solar resources, and it already has the potential to generate 12,522 megawatts (MW) of electric power daily from existing plants but most days it generates around 4000MW which is insufficient. Food is costly, drinkable water is scarce in many areas of the country. Moreover, the wellness statistics, such as poverty rates, are high (Raheem, Ayana, & Fashedemi, 2014).

Adewara and Oloni (2012) [1] argue that in spite of government increased expenditure on the provision of infrastructure in Nigeria, the contribution of the existing infrastructure is far from meeting the demand for it. The state of selected components of infrastructure in Nigeria is summarized below.

***Transportation and communication system:*** Government expenditure on transportation and communication system has increased tremendously over the years. According to Fatai, et al., (2016) [15], transport and communication budget estimates grew from 49.2% to 79.6% and later fell to 7.03% for the period 1987-1996, 1997-2006 and 2014 respectively. However, the growth rate of this estimate is not being reflected on the available transport and communication infrastructures. According to Government Training Institute (GTI) research report (2010), only 18% of the nation's 197,000 kilometers of federal road is covered and the situation is worse for state and local government roads. It can be said that while government infrastructural expenditures on transport increased over time, the available transport infrastructure have not increased and this might be as a result of corruption. Data collected from CBN Statistical Bulletin (2019) on government recurrent and capital expenditure show that transport and communication expenditure have not been stable. It was 290 million Naira in 1990, 3 billion Naira in

2000. It rose further to 90 billion naira in 2009 and fell to 20 billion naira in 2016. It rose again to 29 billion in 2017, and increased 30 billion in 2018 and 40 billion in 2019. The amount spent on transport and communication was very small in the 90s compared to the present decade and it is clear that expenditure on transport and communication have been unstable and unpredictable hence the need to know its impact on economic growth.

***Education expenditure:*** the demand for education has been on the increase and it is due to the fact that education is a key in economic liberalization. According to Okojie (2012) [30], enrolment in primary, post primary and tertiary institutions has risen tremendously. He stated that the number of primary schools in Nigeria increased from 15,703 in 1960 to 39,677 in 1995. This is greater than 100 percent increase. Further, by 1996-1997 academic sessions, the number of primary schools has increased to 40,204 with enrolment of 15,535,878. Same are the cases of secondary and tertiary institution with an unprecedented increase in demand without a corresponding increase in its sectorial expenditure. However, data from UNESCO Institute for Statistics show that the net enrolment (% of primary and secondary school children) is 71.36%, 64.6% and 65.9% for the period of 2008, 2009 and 2010 respectively. This is close to the net enrolment of 62.9% and 65.96% for the period of 2000 and 2001 respectively. Statistics shows that government expenditure on education has increased dramatically over the years and this might be to meet up with the increasing demand for education. Data from CBN statistical bulletin (2016) shows that government recurrent and capital expenditure on education in N170 million in 1981, N1.260 billion in 1991, N39.880 billion in 2001 and N335.800 billion in 2011. It further rose to 341.880 billion in 2016. It can be said that the government expenditure on education have risen dramatically today compared to 20 years ago. Hence the need to know whether these expenditures impact on economic growth. Data from CBN statistical bulletin (2018), revealed that, the allocation to the education sector from 2009-2018 is N4.038 trillion. This falls short UNESCO benchmark of 26% allocation of total budget to the education sector in developing countries.

***Health expenditure:*** Better health care is a primary human need. According to Bakare and Sanmi (2011) [8], fifty percent of economic growth differentials between developed and developing nations is attributable to ill-health and low life expectancy. Developed countries spend a high proportion of their gross domestic product (GDP) on health care because they believe that their resident health can serve as a major driver of economic activities and development. To this end, governments in Nigeria, over the years have been making efforts at ensuring that there is an increase in the level of public expenditure on health. In 1980, recurrent expenditure on health was ₦12.48 million. This figure rose astronomically to 132.02 million in 1985. This trend continues as the expenditure rose steadily from ₦575.3 million in 1989 to ₦68.20 million 1991 and further to 72290.07 million and 98.200 million in 2007 and 2008. It declined to 90.20 million in 2009 and rose to 99.10 million and 231.80 million in 2010 and 2011 and declined again to 197.90 million and 195.98 million in 2012 and 2014 and rose to 257.70 million in 2015 but declined to 200.82 million in 2006 and rose to 245.19 million in 2017. It rose further to 296.44 million in 2018 and to 388.37 million in 2019 (CBN,

2019).

The above-mentioned scenario clearly highlights the fact that health care expenditure in Nigeria has been on the increase over the years. Nevertheless, in spite of all these increases much impact has not been made in the area of reduction of infant, under five and maternal mortality since 1970. According to Bakare and Sanmi (2011) [8], the Nigeria's rate of infant mortality (91 per 1000 live births) is among the highest in the world, and the immunization coverage has dropped blow thirty per cent while mortality rate for children under age five is 192 deaths per one thousand. Bankare and Sanmi further stated that by 2011, more than one hundred and thirty- four thousand women died from pregnancy complications.

The poor infrastructure in virtually all the developing countries has led to sustained interest at considering whether government spending on infrastructure has yielded substantial result over time. In Nigeria for instance, the terrible state of most infrastructural facilities and the state of disrepair and lack of maintenance culture especially in electricity, roads, railways and water facilities as experienced by Nigerians affect the standard of living of the general public, which lowers their productivity and ultimately economic growth in the country. Since infrastructure provides social comfort to the citizens, infrastructural deficit thereby deteriorates workers condition thereby sinking their productivity. Another challenging channel through which poor infrastructure hinder economic growth is through transportation and communication. Poor road network, underdeveloped rail lines, oligopolistic airline market have hindered the transportation of goods in the country. Health infrastructure deficits eventually lead to vast capital flight in the sector since the rich seek better healthcare in developed countries thereby spending what should have been retained in the economy abroad. Apart from this channel, another channel through which health infrastructure deficit hinder economic growth is through the position or status of the labour force. A strong population is an active population and since most workers are not insured, their health is compromised and this in due course hinders productivity in the economy. Against this background, it is evident that infrastructural development is paramount in transforming the economy, thus good institutions could also help in contributing to growth. Government can promote economic growth by spending on infrastructures. Infrastructures are capital personified in roads, waterways, airways and other form of transport and communication including water supplies, electricity and public services like health and education. The fact that government spending on infrastructure improves economic growth is acceptable on the ground that infrastructure eases the difficulties and risk correlated with doing business, it improves the quality of the labour force, it increases productivity of firms, attract foreign investment and raises national income. Demand for infrastructure is driven largely by economic and population growth. Though the Nigeria government struggles with funding and procurement strategies aimed at addressing growing demand, there are various financing options to explore as infrastructure is not something that can be ignored by any government (Fasoranti, 2012) [16]. Adewara *et al.*, (2012) [1] argue that in spite of government increased expenditure on the provision of infrastructures in Nigeria, the contribution of the existing infrastructure is far from meeting the demand for it, raising the quality of economic growth and improving the standard of living of Nigerians. This raises the questions:

**a.** What is the macroeconomic effect of government expenditure on transportation and communication system (TRCO) on economic growth in Nigeria?
b. How does government expenditure on education (EDUC) impact on economic growth in Nigeria?
c. How does government expenditure on health (HLT) impact on economic growth in Nigeria?
d. What is the effect of government expenditure on road and construction (RCONS) on economic growth in Nigeria?

Sequel to the above questions, the objectives of the study are to determine:
a. The macroeconomic effect of government expenditure on transportation and communication system on economic growth in Nigeria;
b. The macroeconomic impact of government expenditure on education on economic growth in Nigeria;
c. The macroeconomic impact of government expenditure on health on economic growth in Nigeria;
d. The macroeconomic effect of government expenditure on road and construction on economic growth in Nigeria.
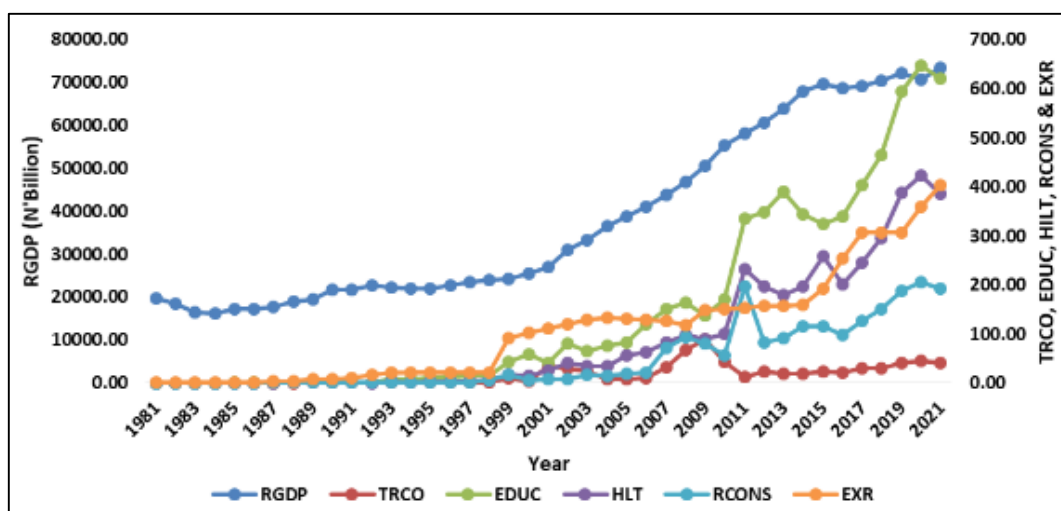


***Source***: Authors initiative with underlying data obtained from Central Bank of Nigeria (2022)

**Fig 1:** Trends of real GDP, selected government infrastructural expenditure and exchange rate in Nigeria

The remainder of this paper is structured in the following way. Section 2 presents literature review whereas section 3 briefly describes the materials and methods adopted for empirical analysis. Section 4 presents and discusses the empirical results while section 5 concludes the study.

## 2. Literature Review
### 2.1 Theoretical literature review
This subsection looks at stakeholder theory; Wagner's theory public expenditure; market friendly model of development; Keynesian theory; the big push theory; and the endogenous growth theory.

### A. Stakeholder theory
This theory is built on the assumptions that address morals and values in managing an organisation, and it is originally credited to Freeman (1984) [17]. Heath (2009) [18], opines that stakeholder theory recognises that different parties are involved in management, such as employees, customers, contractors, financiers, communities, public agencies, political groups, trade associations, competitors and trade unions, who sometimes probes government spending. Stakeholder theory is used in this study as a critical-diagnostic tool to identify the points at which stakeholders are vulnerable to breakdowns in the spending process in the absence of moral constraints on the part of government spenders. Stakeholders such as taxpayers, electorates, or citizens are interested in what the government offers from spending taxpayers' money. They expect a business-like approach to governance in the areas of utmost good faith, transparency and accountability, as enshrined in new public management theory (Babatunde, 2018) [7].

### B. Wagner's theory of public expenditure
According to Wagner's theory of public expenditure which was postulated by Adolph Wagner (1835–1917), with economic growth and development, a nation will experience increase in the activities of public sector. Wagner observed that during the period of industrial revolution, the share of public expenditure in total expenditure increased as real income per capita of the nation increased. The public sector has a role to play in society to ensure the smooth running of economic activities but the goals of government are sometimes numerous and have several stakeholders involved. Therefore, to avoid chaos, efficiency and equity should guide public spending (Hindrizia & Myles, 2005; Samuelson, 1955) [19, 34]. Efficiency has to do with the coordination, collection and monitoring of government revenue and expenditure towards the provision of services to the stakeholders. Equity is about the fair sharing of public gains among stakeholders. According to Magazzino, Giolli, and Mele (2015) [25], Wagner's law stipulates that in the process of economic development, the share of the public sector in GDP has been increasing over time.

### C. Keynesian theory
John Maynard Keynes published the General Theory of Employment, Interest and Money in 1936 during the Great Depression. According to Blinder (2008), and Jhingan (2010) [22], Keynes repudiated traditional and orthodox economics and contrasted his approach with the aggregate supply-focused classical economics which dominated economic thought prior to his publication. Keynesian theory denotes that government intervention can stabilise an economy, especially during a depression when there is little money to spend. The theory supports expansionary fiscal policy. It contends that with government intervention by creating public works and employment, spending increases. Based on this theory, Keynes advocated for increased government spending and lower taxes to stimulate demand and pull the global economy out of the depression.

### D. The market friendly model.
The market friendly model is a variant of the neoclassical counterrevolution associated principally with the 1990s writings of the World Bank and its economist (Todaro and Smith, 2011) [37]. Todaro and Smith opines that the model recognises that there are many imperfections in developing-country product and factor market and that the governments do have a key role to play in facilitating the operation of the market through 'non-selective' (market friendly interventions) - for example, by investing in physical and social infrastructures, health care facilities, educational institutions and by providing a suitable climate for private enterprise. According to Todaro and Smith the market friendly model views infrastructural expenditure as an effort made by government to correct market failures. It assumes that infrastructures are public goods (non-rival in consumption and non-excludable) and that private firms cannot provide them efficiently. Thus, governments are in the best position to provide them. This is in line with ADB (2010) description of the features of infrastructure. The model argues that infrastructure reduces the difficulties and risk associated with doing business and suggested that government should spend more on infrastructures since it increases productivity of firms, raises national income and improves the standard of living of the people. Most research has shown that infrastructural expenditure is an important factor that determines and impact on the level of GDP and standard of living. This can be seen in the works of Li & Li (2008), Raihan (2010), and Fasoranti (2012) [16]. However, Fasoranti point out that corruption and other political factors will restrain the ability of government to spend on infrastructures hence making the model unrealistic.

### E. The big push theory
This model was pioneered by Paul Rosenstein-Rodan in 1943. According to Krugman (1995), the big push model is a model in development economics that asserts that a big and comprehensive investment package can be helpful to bring economic development. The theory of the model argues that underdeveloped countries require large amount of infrastructural investment to embark on the path of economic development from their present state of backwardness (Todaro and Smith, 2011) [37]. The model advocates for large scale of programme of industrialisation which requires huge investments which are beyond the means of private sector. These investments in infrastructure and basic industries (like power, transport and communication) are lumpy (requires large funds) and have long gestation periods. According to Graham (2015), the role of the state in this theory is therefore to invest in these infrastructures. This is because even if the private sector had the prerequisite resources to invest in such a programme, it would not do so since it is driven by profit motives.

The big push is a model of how the presence of market failures can lead to a need for a concerted economy wide and probably public-policy-led effort to get the long process of

economic development under way or to accelerate it (Todaro and Smith, 2011) [37]. The model was popularized by Paul Krugman in his 1995 monograph titled *Development, Geography, and Economic Theory* and became the classic model of the new development theories of coordination failure of the 1990s. The model has been criticised by Fasoranti (2012) [16] on the ground that he assumes that every country has the needed resource to invest in infrastructure. However, these needed resources are lacking in developing countries and this acts as a setback to infrastructural investment.

## F. Endogenous growth theory

The endogenous growth theorists countered the neo-classical exogenous growth theory that growth is brought about by change in the rate of population growth and the rate of technological progress (Todaro and Smith, 2011) [37]. The purpose of endogenous growth theory is to seek some understanding of the interplay between technological knowledge and various structural characteristics of the economy and the society, and how such interplay results in economic growth (Howitt, 2000). It presupposes that long run economic growth is determined by forces that are internal to the economic system, particularly those forces governing the opportunities and incentives to create technological knowledge (Howitt, 2000). Arrow (1962) introduced the concept of learning by doing. His hypothesis was that at any moment in time new capital goods incorporate all the knowledge then available based on accumulated experience, but once built, then productive deficiencies cannot be changed by subsequent learning. Goods are valued according to the characteristics they contain, the set of goods produced in any period is endogenously determined, and learning by doing is the force behind sustained growth. It is shown that set of produced goods changes in a systematic way over time, with goods of higher quality entering each period and those of lower quality dropping out. Learning gives rise to a special kind of externality in production. Productivity increases are realized not only as a result of the explicit allocation of resources to capital accumulation and research and development, but also often as a by-product of the process of learning by doing (Dasgupta, 1988). Further, Nelson and Phelps (1966) stated that education can facilitate the diffusion and transmission of knowledge needed to understand and process new information and to successfully implement new technologies devised by others, which again promotes economic growth.

According to Todaro and smith (2011) [37], Romer (1986) had a paradigm shift from the idea of Arrow. He introduced the concept of 'learning by investment", by assuming knowledge as a product of investment in education. For this, Romer (1986) included knowledge into the production function. Another endogenous growth theory is the Lucas growth model. Lucas (1988) assumes that investment on education leads to the production of human capital which is the crucial determinant in the growth process. He divided the effect of investment in human capital into internal effects and external effects. The internal effect is that an individual worker undergoing training becomes more productive. And the external effect is the spill over and an increase in the productivity of capital and of other workers in the economy. He argued that it was investment in human capital that brings about spill over in the increase in the level of technology and not physical capital. The endogenous growth theory is criticized on the ground that it failed to establish which factor of production forces another; that is between human capital and physical capital. Also, it ignored the institutional impact on growth by laying more emphasis on human capital (Jhingan, 2010) [22].

## 2.2. Empirical literature review

Notable research works have been conducted in order to determine the impact of government spending on infrastructure on different economic variables like international competitiveness, and foreign direct investment, amongst other variables in Nigeria. These studies have also shown conflicting results based on their findings. However, few researches have been conducted to precisely estimate the impact of government spending on infrastructure and economic growth in Nigeria. Barro (1988) was one of the earliest writers on the impact of government expenditure on economic growth and development. He extended existing growth models and gave birth to the endogenous growth model that incorporates the government sector. Within this frame work he found that the economy's growth rate and saving rate individually rose with the ratio of productive government expenditure to gross national product (G/Y) but each rate eventually reaches a peak and subsequently declines. Li and Li (2008) used Grey Relational Analysis to study the relationship between infrastructure investments and economic growth in China from 1997 to 2006. The conclusion was that there is a strong positive relationship between investments in transport, communication and power infrastructures. That is, as investment on infrastructures increases economic growth rate. Seethepalli, Bramati and Veerdas (2008) tried to find out how relevant infrastructure expenditures is to economic growth in East Asia using co-integration test and granger causality test for the period 1995 to 2006. The finding was that an increase in infrastructural expenditures increases the growth rate of GDP. Thus, infrastructure expenditure is an important driver of growth rate of GDP. Raihan (2011) [32] used the complex computable general equilibrium (CGE) model based on the social accounting matrix (SAM) to look at the impact of infrastructure investment on Bangladesh by emphasizing the flows of products and funds in the economy for the period 1995 to 2015. The impact of infrastructure investment is estimated by simulating a 20% rise in expenditures in construction, social services, transport, and utilities and looking at the resulting changes across the economy. The increase in infrastructure-related expenditures was estimated to raise overall gross domestic product (GDP) by more than 8% and increase the incomes of a broad range of people by 6%−8%. Abu and Abdullah (2010) investigated the relationship between government expenditure and economic growth in Nigeria from the period ranging from 1970 to 2008. They used disaggregated analysis in an attempt to unravel the impact of government expenditure on economic growth. Their results reveal that government total capital expenditure, total recurrent expenditure and education have negative effect on economic growth. On the contrary, government expenditure on transport, communication and health result in an increase in economic growth. They recommend that government should increase both capital expenditure and recurrent expenditure including expenditure on education as well as ensure that funds meant for development on these sectors are properly utilized. Akinlabi, Jegede and Kehinde (2011) [3] examined public infrastructure as an approach to

poverty alleviation and economic growth in Nigeria using vector autoregressive (VAR) framework. The study used real per capital expenditure on economic service and real per capital income on social and economic services as proxy to infrastructure. They used level of fiscal deficit to proxy quality of governance with the assumption that in any economy where level of infrastructure leads to poverty alleviation, the quality of governance must be a contributory factor. They found out that; public infrastructure granger causes poverty alleviation directly through economic growth, fiscal deficit does not granger cause poverty alleviation and they concluded that, continuous increase in public infrastructure through increase in capital expenditure on economic, social and community service and qualitative governance will alleviate poverty in Nigeria. Bakare and Sanmi (2011) [8] investigated the relationship between health care expenditures and economic growth in Nigeria. The ordinary least square multiple regression analytical method was used to examine the relationship between health care expenditures and economic growth. The data analysis showed a significant and positive relationship between health care expenditures and economic growth. The study thus recommended that Nigerian policy makers should pay closer attention to the health sector by increasing its yearly budgetary allocation to the sector. Furthermore, they were of the view that the key to good results lies not in ordinarily increasing particular budgetary allocation but rather in implementing a public finance system that, to the extent possible, links specific expenditure and revenue decisions and ensure the usage of the allocated fund as transparently as possible. Enimola (2011) [14] employed the Vector Error Correction (VEC) estimate to investigate empirically the influence of infrastructure investment on economic growth in Nigeria from 1980 to 2006. The findings of the study revealed a positive steadily declining long run impact of infrastructure on economic growth.

Fasoranti (2012) [16] examined the effect of government expenditure on infrastructure on the growth of Nigerian economy. The period covered was between 1990 to 2010 and she used government expenditures on education, government expenditure on environment and housing, health services, transport and communication, agriculture, and security, and inflation rate as explanatory variables and gross domestic product as explained variable. Some of the findings include; long run relationship between the growth of the economy and government expenditures in education, environment and housing, health services, water resources, inflation rate, agriculture, security, transport and communication. The paper observed that government expenditures on health services, transport and communication imparted negatively on growth while expenditures in agriculture and security were not significant in the growth of the economy. In line with this, Babatunde *et al.* (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. The study submitted that infrastructure investment directly impacted on the overall output and indirectly stimulates growth of other sectors. Adewara and Oloni (2012) [1] explored the relationship between the composition of public expenditure and economic growth in Nigeria between 1960 and 2008 using the Vector Autoregressive models (VAR). Their findings show that

expenditure on education has failed to enhance economic growth due to the high rate of rent seeking in the country as well as the growing rate of unemployment. They also found that expenditure on health and agriculture contributed positively to growth. Ayo and Ifechukwu (2012) [6] examined the causality relationship among economic growth, government expenditure and inflation rate in Nigerian over the period 1970 – 2001. The study utilized both the Augment Dickey – fuller (ADF) and the Phillip – Perron (PP) test to examine the properties of the variable. The variables were observed to be stationary, though not in their level form but in their first difference. In addition, the Johansen and Juseluss (JJ) co-integration techniques indicated the presence of co integration among the variable while the tri-variate Vector Error Correction Model (VECM) showed the presence of bidirectional causality between government expenditure and economic growth in the short run. The study also showed that a unidirectional causality existed from economic growth and government expenditure to inflation while no feedback from inflation rate was observed. Based on these findings the study recommends that government should implement policies that would moderate government spending in order to reduce inflation rate. Desmond, Titus, Timothy and Oduche (2012) [12], examined the effect of public expenditure on economic growth in Nigeria during the period 1970 – 2009 using the OLS multiple regression model and time series data. Time series data included in the model were the GDP and various components of government expenditure. The result of the analysis showed that capital and recurrent expenditure on economic services had insignificant negative effect on economic growth during the period under study. Also, capital expenditure on transfer had insignificant positive effect on economic growth. The authors then recommended more allocation of expenditure to the series with significant positive effect. Akanbi, Abalaba and Afolabi (2013) [2], studied the impact of sectoral infrastructure on economic growth, adopted the generalized Cobb-Douglas production function and extended the neoclassical growth model to include transport infrastructure stock to show the impact of transport infrastructure on economic growth in Nigeria for the period 1981 to 2011. The ordinary least squares regression (OLS) results revealed that transport output and investment made on transport infrastructure in Nigeria make significant positive contribution to growth. Nedozi, Obasanmi and Ighata (2014) [26] analysed infrastructural development and economic growth in Nigeria using Simultaneous analysis and Two Stage Least Square method. Data was collected for the period 1990 to 2012 and the study showed a strong positive relationship between infrastructure and growth but infrastructure returns were not significant in the estimation. Private domestic investment however showed a strong negative relationship between infrastructure and economic growth. Osundina, Ebere and Osundina (2014) [31] examined the relationship between government spending on infrastructure and poverty reduction in Nigeria. Per capita income was used to proxy poverty reduction. Time series data of 43 years were employed and Vector Error Correction model showed that there was a long run relationship between government spending on infrastructure and poverty reduction in Nigeria. The regression result showed that government spending on building and construction has a positive and significant effect on poverty reduction in Nigeria, while government spending on transportation has a negative and significant effect on poverty reduction. The effect of

government spending on education and health were insignificantly negative and positive respectively. The study recommended that the government of federal republic of Nigeria should increase spending on building and construction as poverty reduction responds to it brilliantly well. The study also recommended that the government of federal republic of Nigeria should increase spending on health as good health and death reduction responds to it brilliantly well. Obi and Obi (2014) examined impact of education expenditure on economic growth as a means of achieving the desired socio-economic change needed in Nigeria. The study used time series data from 1981 to 2012. The Johansen's co-integration analysis and ordinary least square (OLS) econometric techniques were used to analyse the relationship between gross domestic product (GDP) and education expenditure. Findings indicate that though a positive relationship subsists between education expenditure and economic growth, but a long run relationship does not exist over the period under study. The paper further suggests the improvement of the education system through efficient use of public resources through good governance, accountability and transparency. Edame (2014) [13] examined the trends of public expenditure on infrastructure, and economic growth in Nigeria from the period of 1970 to 2010. The Vector Error Correction (VEC) technique was employed. The VEC result revealed that public expenditure on transport/telecommunication, water supply, housing/environment, road construction and electricity supply is very low especially in the short-run and long-run; equilibrium is static and showed weak adjustment.

Fatai, Omalara and Taiwo (2016) [15] analysed the effect of public and private investment on infrastructures and its impact on economic growth in Nigeria during the period 1970 to 2014. The Engel-Granger (1987) co-integration and Error correction mechanism (ECM) were employed to analyse the unit root procedures, ascertain the long run relationship and establish the values of long run parameters. 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. Nigeria's experience in terms of infrastructure development show that government needs to design an economic policy that would raise the quality of infrastructures and at the same time makes provisions for human capital development for sustained growth. Siyan and Adegoriola (2016) [36] investigated the nexus between infrastructural development and economic growth in Nigeria. The study employed annualized data from 1981 to 2014 along with the co integration, and Vector Error Correction Model (VECM) as the prime method of analysis. Findings show that, there is long run relationship between infrastructure development and economic growth in Nigeria. VECM had the expected negative sign, and is between the accepted region of less than unity. It also shows a low speed

adjustment towards equilibrium. Infrastructural development on road and communication show a positive relationship with economic growth, while private investment, degree of openness and education produced negative relationship with economic growth.

Most works on infrastructural expenditure and economic growth shows that infrastructure expenditure impacts positively on economic growth although some has shown a negative impact and even an insignificant impact. Author's estimation of result differs for many reasons: authors use different variables and define them in different ways because of lack of statistical data. Also, econometric problem arises while using different model to estimate the impact of infrastructure on economic growth as such, in performing regional estimates, important characteristics are overlooked and the result do not show the real impact of investment in infrastructure. Further, the causal relationship which exists between infrastructure and economic growth has been difficult to establish. This is because more infrastructures may encourage growth and an increase in standard of living, but richer countries can easily afford more infrastructures. This study estimates the macroeconomic effects of government expenditure on transport and communication, education, health, and road and construction on economic growth in Nigeria using autoregressive distributed lag technique. It is very difficult finding studies that combined these variables for Nigeria, so this study fills this knowledge gap and the findings of this study will be beneficial to government and policy makers.

## 3. Materials and Methods
### 3.1 Theoretical framework of the study
The theoretical framework for this research study is based on the Keynesian model. The Keynesian model believes that increase in government spending on infrastructure should promote economic growth. In view of the theoretical predictions, we study the effect of government infrastructural expenditure on economic growth in Nigeria from 1981 to 2021 using the model adopted by Fasoranti (2012) [16] but with modification to include additional variables and exclude some of the variables capable of generating econometric problems. The model has the capacity to produce parameters that are consistent with theory and of good fit. Unlike most existing studies, the present study carried out several diagnostic tests of model adequacy to check how "good" the fitted model is and gauge the error process of the effects of government infrastructural expenditure on economic growth in Nigeria.

### 3.2. Model specification
The functional form of the model which expressed economic growth (proxy by real gross domestic product) as a function of the explanatory variables is stated as;

$$RGDP = f(TRCO, EDUC, HLT, RCONS, EXR). \tag{1}$$

The parameterized version of equation 1 is presented as:

$$RGDP_t = \beta_0 + \beta_1 TRCO_t + \beta_2 EDUC_t + \beta_3 HLT_t + \beta_4 RCONS_t + \beta_5 EXR_t + \mu_{1t} \tag{2}$$

RGDP = real gross domestic product; TRCO = transportation

& communication expenditure, EDUC = education

expenditure, HLT = health expenditure, RCONS = road and construction expenditure, EXR = exchange rate, t = time, $\mu_{1t}$ is the error terms or stochastic term. $\beta_0$ is the intercept parameter while $\beta_1$, $\beta_2$, $\beta_3$, $\beta_4$ and $\beta_5$ are coefficient of the variables. The parameter $\beta_0$ (intercept) signifies that even without the impacts of these variables in our model, the economy will continue to grow because it is not equal to zero. The parameter $\beta_1 - \beta_4$ are the coefficients of the independent

variables while $\beta_5$ is the coefficient of exchange rate which is a control variable. These coefficients denote the degree of change of the dependent variable (RGDP) as a result of a unit change of the independent variables. The $U_t$ is the error term and it is used to capture the impact of other variables that are not included in the model. Based on a priori or theoretical expectations, $\beta_1$, $\beta_2$, $\beta_3$, $\beta_4$, > 0 while $\beta_5 > 0$ or < 0 depending on the direction of exchange rate fluctuation.

The ARDL dynamic representation of equation 2 is specified in equation 3 below

$$\Delta LNRGDP_t = \pi_0 + \pi_1 LNRGDP_{t-1} + \pi_2 LNTRCO_{t-1} + \pi_3 LNEDUC_{t-1} + \pi_4 LNHLT_{t-1} + \pi_5 LNRCONS_{t-1} + \pi_6 EXR_{t-1} +$$
$$+LN\pi_{7t-1} + \sum_{j-1}^{k} \beta_{1,j} \Delta RGDP_{t-j} + \sum_{j-0}^{k} \beta_{2,j} \Delta TRCO_{t-j} + \sum_{j-0}^{k} \beta_{3,j} \Delta EDUC_{t-j} + \sum_{j-0}^{k} \beta_{4,j} \Delta HLT_{t-j} + \sum_{j-0}^{k} \beta_{5,j} \Delta RCONS_{t-j} + \sum_{j-0}^{k} \beta_{6,j} \Delta EXR_{t-j} + \mu_{1t}.$$

(3)

Where $\beta_1$ to $\beta_6$ are the coefficients of the short-run parameters, $\pi_1$ to $\pi_6$ are the coefficients of the long-run parameters, $\Delta$ = first difference operator, LN denotes variables in the natural log form, K is the lag order selected by Akaike Information Criterion (AIC), while $\mu_{1t}$ is the white noise assumed to be normally distributed.

### 3.3. Model justification/description of variables/data
The model justification refers to the reason behind the choice of variables that constitute the model. The variables of the model were carefully selected based on the related literature reviewed in the course of this study. Real gross domestic product (RGDP) which is the dependent variable is used to proxy economic growth while transportation & communication expenditure (TRCO), education expenditure (EDUC), health expenditure (HLT), and road and

construction expenditure (RCONS) are the core explanatory variables of the model. Exchange rate (EXR) is added to the model to open up the economy as no economy is self-sufficient nowadays. Using this model, the dependent variable economic growth proxy by RGDP depends on government expenditure on transport and communication, education, health, construction and exchange rate. The variables will help us know if actually, government expenditure on infrastructure has effect on economic growth. Based on economic theory, all the explanatory variables are expected to have positive effect on RGDP except EXR that may have negative or positive effect depending on the direction of its fluctuation. This paper made use of secondary annual time series data spanning 1981 to 2019. A brief description of these variables and their data sources are presented in Table 1.

**Table 1:** Description of variables in the model/data

| Variables | Description | Source |
|---|---|---|
| RGDP | Total Real GDP (N'Billion) | CBN Statistical Bulletin, 2022 |
| TRCO | Federal Government Expenditure on Transport & Communication (N'Billion) | CBN Statistical Bulletin, 2022 |
| EDUC | Federal Government Expenditure on Education (N'Billion) | CBN Statistical Bulletin, 2022 |
| HLT | Federal Government Expenditure on Health | CBN Statistical Bulletin, 2022 |
| RCONS | Federal Government Expenditure on Road & Construction (N'Billion) | CBN Statistical Bulletin, 2022 |
| EXR | Naira Official Exchange Rate Per US Dollar | CBN Statistical Bulletin, 2022 |

*Source*: Compiled by the author from CBN Statistical Bulletin, 2022

### 3.4 Estimation techniques and procedure
This study employs the autoregressive distributed lag (ARDL) technique developed by Pesaran, Shin and Smith (2001) for the analysis of data. The choice of this technique is because of its merits over other techniques such as Johansen co-integration and Engle Granger static procedure. The Johansen co-integration allows for I(1) variables only but ARDL methodology allows for a mixture of I(0) and I(1) variables for estimating both short run and long run coefficients. This technique is also appropriate for finite sample size. ARDL technique is better suitable for this study as the variables are integrated of I(0) and I(1).
The augmented Dickey- Fuller (ADF) unit root test were employed to test for the stationarity of the series so as to avoid analysing spurious relationships. The decision rule is that the ADF test statistic must be greater than the Mackinnon critical value at 1%, 5% or 10% in absolute term before the variables can be adjudged stationary. The study moved on to test for co-integration among the variables to determine whether there exist long-run relationships between RGDP and the selected government infrastructural expenditure. The use of

the ARDL bounds test for co-integration has been applied for the estimation of F-statistic, that determines whether a long run relationship exists for the data under study or not. The condition for the existence of a long-run relationship is that the ARDL bounds test F-statistic value must be greater than the critical value of the upper bound at 5%. Significant level. Subsequently, they study estimated the short run and long run effects of the selected government infrastructural expenditure on RGDP in Nigeria. The error correction term (ECT) shows the rate at which RGDP adjusts to changes in the explanatory variables. Hence, the greater the coefficient of the ECT, the higher the speed of adjustment of the model from short run to long run and vice versa.
Lastly, the study conducted several diagnostic tests of model adequacy to check how "good" the fitted model is and gauge the error process of the effects of the selected government infrastructural expenditure on RGDP in Nigeria. Specifically, the study adopted the Breusch-Godfrey (BG) test for serial correlation, the Breusch-Pagan-Godfrey heteroskedasticity test, the Jarque-Bera (JB) test of normality, and the cusum and cusum of squares tests of stability. The condition for no

serial correlation and absence of heteroskedasticity is that the probability Chi-square values of the Observed R-squared and F-statistic values must be more than 5%. Whereas the condition for the existence normality is that the probability value of the Jarque-Bera coefficient must be greater than 5%; that of stability is that the cusum and cusum of squares line must appear within the acceptable region of the graph.

## 4. Empirical Analysis
### 4.1 ADF unit root of stationarity
The result of the ADF unit root test of stationarity is presented in Table 2.

**Table 2:** Summary of the augmented Dickey-Fuller (ADF) unit root test

| Variables | ADF test at level | t-statistic I(0) | ADF test at 1st difference | t-statistic I(1) | Result |
|---|---|---|---|---|---|
| LNRGDP | -0.414596 | -2.612874 | -3.381704 | -2.948404** | I(1) |
| LNTRCO | -2.779150 | -2.615817*** | -8.103448 | -3.621023* | I(0) |
| LNEDUC | -2.758617 | 2.615817*** | -5.140959 | -3.639407* | I(0) |
| LNHLT | -2.858272 | -2.622989*** | -10.11210 | 3.621023* | I(0) |
| LNRCONS | -1.307076 | -2.612874 | -5.811156 | -3.632900* | I(1) |
| EXR | -0.489442 | -2.610263 | -4.257626 | -3.621023* | I(1) |

***Source:*** Author's computation using Eviews. *, **, *** denotes rejection of null hypothesis at 1%, 5%, or 10% level of significance

The results in Table 4.1 indicate that government expenditure on transport and communication, education, and health are stationary at levels, whereas real gross domestic product, government expenditure on road and construction and exchange rate are stationary at first difference. Thus, the variables are integrated of I(0) and I(1). The null hypothesis of unit root is therefore rejected since the ADF test statistics are greater than the critical values at the indicated levels of significance. Thus RGDP and the explanatory variables are stationary at I(0) and (1). The study moved on to verify whether the combination of these variables is cointegrated using ARDL bounds test to cointegration. The lag length order selection criteria and the ARDL bounds test to cointegration results are presented in Tables 3 and 4 respectively.

**Table 3:** VAR lag order selection criteria for the model

| Lag | LogL | LR | FPE | AIC | SC | HQ |
|---|---|---|---|---|---|---|
| 0 | -323.5657 | NA | 3.603939 | 18.30920 | 18.57312 | 18.40132 |
| 1 | -155.8719 | 270.1733* | 0.002468* | 10.99288 | 12.84032* | 11.63769* |
| 2 | -122.6529 | 42.44648 | 0.003430 | 11.14738 | 14.57834 | 12.34488 |
| 3 | -74.72925 | 45.26124 | 0.002935 | 10.48496* | 15.49943 | 12.23514 |

***Source:*** Authors computation using Eviews

Lag order selected by the criterion is indicated by *; LR: sequential modified LR test statistic (each test at 5% level); FPE: final prediction error; AIC: Akaike information criterion; SC: Schwarz information criterion; HQ: Hannan-Quinn information criterion. Lag one is selected based on the results in Table 3.

**Table 4:** Result of ARDL bounds test to cointegration

| Test statistic | Value | k |
|---|---|---|
| **F-statistic** | **5.187274** | **5** |
| Critical Value Bounds | | |
| Significance | I0 Bound | I1 Bound |
| 10% | 2.26 | 3.35 |
| 5% | 2.62 | 3.79 |
| 2.5% | 2.96 | 4.18 |
| 1% | 3.41 | 4.68 |

***Source:*** Authors computation using Eviews

The result in Table 4, leads to rejection of the null hypothesis of no long run relationship as the F-statistic value of 5.187274 is greater than the critical upper (I1) bounds values of 3.79 at 5% level of significance. This confirms the existence of cointegration or long run relationship among the variables. Having established the existence of long run relationship, short run and long run macroeconomic effects of the explanatory variables on RGDP are estimated. The results are presented in Table 4.4 in subsection 3.

### 4.2. Interpretation of results

**Table 5:** ARDL short run and long run results (dependent variable: LNRGDP)

| | **Short run** | **Result** | | |
|---|---|---|---|---|
| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
| D(LNRGDP(-1)) | 0.219275 | 0.135507 | 1.618183 | 0.1252 |
| D(LNTRCO) | -0.001249 | 0.011307 | -0.110428 | 0.9134 |
| D(LNTRCO(-1)) | 0.017120*** | 0.008940 | 1.915008 | 0.0735 |
| D(LNEDUC) | -0.024579 | 0.020059 | -1.225324 | 0.2382 |

| D(LNEDUC(-1)) | 0.019379 | 0.012960 | 1.495319 | 0.1543 |
|---|---|---|---|---|
| D(LNHLT) | -0.004146 | 0.019950 | -0.207799 | 0.8380 |
| D(LNRCONS) | 0.026435*** | 0.012520 | 2.111427 | 0.0508 |
| D(LNRCONS(-1)) | -0.036702** | 0.013195 | -2.781505 | 0.0133 |
| D(EXR) | 0.000181 | 0.000331 | 0.545974 | 0.5926 |
| D(EXR(-1)) | -0.001690** | 0.000580 | -2.916355 | 0.0101 |
| CointEq(-1) | -0.370032* | 0.102125 | -3.623335 | 0.0023 |
| | **Long run** | **Result** | | |
| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
| LNTRCO | 0.012951 | 0.051442 | 0.251756 | 0.8044 |
| LNEDUC | 0.014344 | 0.056974 | 0.251764 | 0.8044 |
| LNHLT | -0.151882*** | 0.082093 | -1.850110 | 0.0829 |
| LNRCONS | 0.272033* | 0.033942 | 8.014750 | 0.0000 |
| EXR | 0.002954* | 0.000688 | 4.291569 | 0.0006 |
| C | 25.773715* | 0.070618 | 364.971510 | 0.0000 |
| R-squared | 0.998940 | F-statistic | 793.6067 | |
| Adjusted R-squared | 0.997681 | Prob(F-statistic) | 0.000000 | |
| Durbin-Watson stat | 2.017110 | | | |

**Source**: Authors computation using Eviews
*, ** and *** denotes significant variables of the model at 1%, 5% and 10% significance levels respectively

The result in Table 5 reveals that, in the short run, real gross domestic product (RGDP) at lag 1, government expenditure on transport and communication (TRCO) at lag 1, government expenditure on education (EDUC) at lag 1, government expenditure on road and construction (RCONS) and exchange rate (EXR) made positive macroeconomic effects on RGDP. While the effects of TRCO at lag 1, and RCONS are significant, those of RGDP at lag 1, EDUC at lag 1 and EXR are not significant. Quantitatively, a unit increase in RGDP at lag 1, TRCO at lag 1, EDUC at lag 1, RCONS and EXR increases RGDP by about 0.219, 0.017, 0.019, 0.026 and 0.00018 units respectively. Conversely, TRCO, EDUC, HLT, RCONS at lag 1and EXR at lag 1 made negative macroeconomic effect on RGDP with only that of EXR at lag 1 being significant. Specifically, a unit increase in TRCO, EDUC, HLT, RCONS at lag 1and EXR at lag 1 reduces RGDP by 0.001, 0.024, 0.004, 0.036 and 0.001 respectively. The result further indicates that, in the long run TRCO, EDUC, RCONS and EXR made positive macroeconomic effects on RGDP while only HLT made negative macroeconomic effect on RGDP. While, HLT, RCONS and EXR are significant, TRCO, and EDUC, are not significant. Numerically, a unit increase in TRCO, EDUC, RCONS and EXR generates about 0.012, 0.014, 0.27 and 0.002 increases respectively in RGDP. Interestingly, the error correction term (ECT) is well behaved as it is negatively signed and significant. The ECT of 0.37 indicates that about 37% deviation from equilibrium is corrected periodically to ensure convergence at the long-run. This speed of adjustment is very low which may be an indication low investment on the selected infrastructure in Nigeria within the period under review. The R-squared coefficient of 0.99 denotes that about 99% variations in RGDP are jointly accounted by changes in the explanatory variables of the model while the remaining 0.01% may be attributed to the error term. The probability F-statistic value of 0.000000 shows that the overall model is significant in explaining the macroeconomic effects of government expenditure on the selected infrastructure on RGDP in Nigeria. One striking finding of this study is that the previous value of RGDP (i.e., RGDP at lag 1) made positive but insignificant effect on RGDP thus stressing the multiplier or replication effects of RGDP on itself.

### 4.3. Discussion of findings

It can be deduced that government expenditure on transport and communication, education, and road and construction made positive macroeconomic effect on economic growth in Nigeria although they are all insignificant in the long-run except that of construction. We also observed that government expenditure on health, a significantly negative macroeconomic effect on economic growth in the long-run. These disappointing results of public infrastructural expenditure on growth in Nigeria may be, attributed to the incessant corrupt practices in the country such as; incomplete projects, diversions of funds and embezzlement of public funds by some corrupt public office holders (Desmond, Titus, Timothy & Oduche, 2012) [12]. The positive long run results of government infrastructural expenditure on transport and communication, education, and road and construction support a priori expectation. The result of expenditure on transport and communication corroborates the finding of Siyan and Adegoriola (2016) [36] but contradicts the result of Fasoranti (2012) [16] while that of education contradicts the findings of Adegoriola (2016) [36]. Conversely, the negative effects of government health expenditure on growth contradicts theoretical exposition and the findings of Adewara and Oloni (2012) [1] and Bakare and Sanmi (2011) [8] but lends credence to the findings of Fasoranti (2012) [16]. Also, exchange rate has a significant positive effect on economic growth in Nigeria. This calls for concerted effort to induce favourable trade balance and liberalisation of exchange rate in Nigeria.

These findings are indications that real economic growth cannot be sustained by only humongous recurrent expenditures and fiscal expansion without fiscal discipline and adequate investment in other cooperant capital projects considering the level of infrastructural deficit in the country. Our result buttresses the recommendation of Presbitero (2012) that the government should ensure that the total expenditure is kept within a reasonable proportion by blocking all leakages and wastages in public financing in the country. Further, the findings imply that in order to adequately harness the expected returns of government expenditure in the economy, the Nigerian government has to be decisive and more transparent in its fight against financial

corruption and diversion of public funds especially those that are allocated for the execution of capital projects across the country.

In addition, this study found that, in the short run, government expenditure on education exerted a negative and insignificant macroeconomic effect on economic growth. This result supports the findings of Obi *et al*. (2014) who opined that the negative relationship between government expenditure on education and economic growth in Nigeria is attributable to the fact that educational sector has not been productive as expected. This is evidenced by the use of outdated curriculum devoid of entrepreneurial and creative programmes resulting in poor quality of graduates, increasing cases of cultism in schools and high rates of drop-outs. The implication is that there is need for review of school curriculum at all levels of education, improvement of the education system through

efficient use of public resources through good governance, accountability and transparency.

**Table 6:** Summary of the results of residual diagnostic tests of model adequacy

| Breusch-Godfrey serial correlation LM test | | | |
|---|---|---|---|
| F-statistic | 0.837201 | Prob. F | 0.4535 |
| Obs*R-squared | 3.845665 | Prob. Chi-Square | 0.1462 |
| Heteroskedasticity test: Breusch-Pagan-Godfrey | | | |
| F-statistic | 0.576863 | Prob. F | 0.8741 |
| Obs*R-squared | 14.63533 | Prob. Chi-Square | 0.7455 |
| Jarque-Bera test of normality | | | |
| Jarque-Bera | 1.025277 | Probability | 0.598913 |

**Source:** Authors computation using Eviews; Tests critical values are compared at 5% level of significance
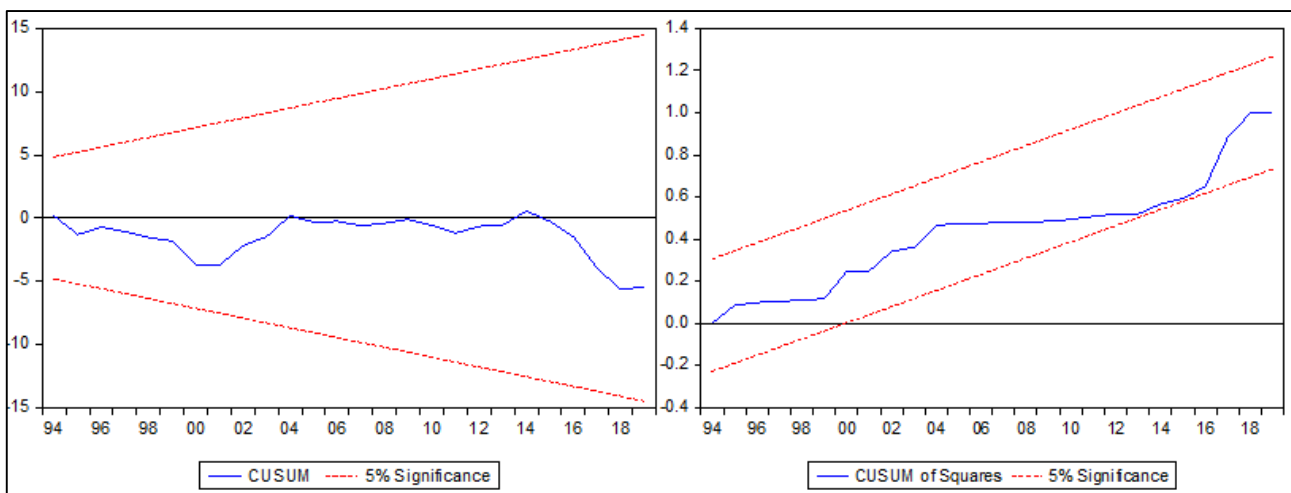


**Fig 1:** Result of CUSUM and CUSUM of Squares test of stability

The residual tests passed the diagnostic tests of normality, autocorrelation and heteroskedasticity as the probability values of both F-statistic and observed R-squared are greater than 0.05. The parameter stability of estimated function has been the more crucial test. This stability of the model is confirmed by the outcome of CUSUM and CUSUM of squares tests. It can be seen that the CUSUM and CUSUM of squares lines appear within the acceptable region of the graph. This shows that the coefficients are stable and no instability in the model. Thus, it can be concluded that the results are appropriate for policy formulation.

## 5. Summary, Conclusion and Recommendations
### 5.1 Summary and conclusion
This study examines the macroeconomic effects of government infrastructural expenditure on economic growth in Nigeria for the period of 1981 to 2021. The objectives of the study are to determine the macroeconomic effects of government expenditure on transport and communication, education, health, road and construction on economic growth proxy by real gross domestic product in Nigeria. The Study adopted the autoregressive distributed lag (ARDL) technique of data analysis based on the outcome of augmented Dickey-Fuller unit root test of stationarity which reveals that the variables are integrated of I(0) and I(1). The ARDL bounds test to cointegration indicates a long run relationship among the variables which necessitates the estimation of both short run and long run macroeconomic effects of the explanatory

variables on economic growth. The estimated model includes exchange rate as control variable to open up the economy.

Findings indicate that in the short run, government expenditure on transport and communication (TRCO) at lag 1, government expenditure on education (EDUC) at lag 1, government expenditure on road and construction (RCONS) and exchange rate (EXR) made positive macroeconomic effects on RGDP whereas TRCO, EDUC, HLT, RCONS at lag 1and EXR at lag 1 made negative macroeconomic effect on RGDP. In the long run, TRCO, EDUC, RCONS and EXR made positive macroeconomic effects on RGDP while only HLT made negative macroeconomic effect on RGDP.

In line with the objectives of this study and the results obtained in the empirical analysis, the study concludes that government expenditure on infrastructure affects economic growth in Nigeria within the period under review.

### 5.2 Policy recommendations
Based on the empirical findings, the study recommends as follows:
1. The government should increase its expenditures on transport and communication, education, health, and road and construction as these are major determinants of economic growth and as such should be given adequate attention;
2. The government should ensure rational, effective and efficient management of allocated funds by blocking all leakages and wastages in public financing in order to get

maximum investment in infrastructure and its contribution to growth of the economy;
3. The government should ensure adequate supervision and monitoring of approved public projects and disbursed funds until the projects are logically concluded.
4. The government should keep tab on the exchange rate to ensure that it moves in the right direction as it made significant effects on growth in both short and long run indicating that it's a critical factor driving economic growth in Nigeria.

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