

## Impact Analysis of Infrastructural Renewal on Nigerian Economy

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### Abstract

*This paper investigates the impact analysis of infrastructural renewal on Nigerian economy. The data used is time series between 1981 to 2017 for government spending on road, communication, education and private capital. The sources of the data are from National Bureau of Statistics, Central Bank of Nigeria and World Development Index. In order to avoid spurious results, Augmented Dickey Fuller's stationarity test and Johansen's co-integration test was conducted while Vector Error Correction Model (VECM) was employed as methodology to analyse the results. Findings show that government spending on infrastructure has long-run relationship with Nigerian economy. Government expenditure on road and communication has positive and significant impact on Nigerian economy. Government expenditure and private investment has negative but significant impact on Nigerian economy. The study recommends that government should improve expenditure on road and education in order to boost economy and bring the economy to path of progress and prosperity. Since the government alone cannot provide all infrastructures for the citizens, it should partner with private sector using Public Private Partnership in the provision of infrastructure amenities in order to increase economic growth in Nigeria.*

**Keywords:** Government Spending, Infrastructure, Nigerian Economy

**JEL Classification:** E62, H54, O55, O4

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### 1. Introduction

Public spending is one of the key tools used by government to stabilize the economy. Capital spending is important towards the development of every economy either developed or underdeveloped economies. According to Okoro (2013), efficient allocation of resources among the various levels of government which include organs, strata and arms of government, and the condition for their fiscal capacity necessitate the need for public spending in the economy.

The term, capital expenditure can be defined as spending on fixed assets. It spends on items that will endure for a long time and can be used for the provision of goods and services. Government expenditure on building of new hospital, construction of new roads, purchase of new equipment or networks among other assets form examples of capital expenditure of the government (IMF, 2010). The size of government expenditure and its effect on economic growth of a nation has been a subject of interest among scholars all over the world. There are two basic functions that every government performs. First is to maintain law and order which include the protection and securing the lives of the citizenry and secondly, to provide essential infrastructural amenities such

as education, health services, drinkable water, electricity, good road among others (Al-Yousif, 2000).

It has been debated over the years by scholars that increasing government expenditure, especially those relating to socio-economic and physical infrastructure, fosters economic growth. For instance, it is believed that expenditure on education and health will raise the level of GDP through improvement on the well-being of people, thereby increasing productivity. In a similar vein, expenditure on infrastructure such as communications, roads, water, electricity and so on will lead to reduction in production costs and increase firms' profitability; thereby enhancing economic growth (Taiwo & Agbatogun, 2011).

The determination of the effectiveness of government expenditure towards the growth of the economy and fostering rapid economy depend mainly on whether it is productive or unproductive. Productive government expenditure would impact the economy in a positive manner, while the unproductive expenditure would have negative effect on the economy; *ceteris paribus* (Oziengbe, 2013). Economic growth entails increase in per-capita Gross Domestic Product (GDP). Over the years, economists have been concerned with the source of economic growth (Roller & Waverman, 2009). Therefore, the role of infrastructure has gained renewed attention over the years. According to Calderon and Serven (2004) and Estache, Speciale and Veredas (2005), from the policy view point, the renewed interest in infrastructure can be traced to the world-wide developments that occurred over the last two decades. The first was the retreat of the public sector since the mid-1980s in most developing and industrial countries from its sole role in the provision of infrastructure, leaving the scene for private sector participation in the provision of infrastructure. This was part of the worldwide effort towards increasing reliance on markets and private sector activity (privatisation of public utilities) and embracement of concessions and other forms of public-private-partnership (PPP).

Infrastructure contribute to improving the quality of life by generating amenities, providing consumption goods (transport, energy and communication services) and contributing to macroeconomic stability. Several years after independence and democratic government, successive government have not given adequate attention to infrastructural provision like road, electricity, portable water, education and health facilities. This neglect, has led to perennial traffic congestion, power outages in major cities, poor quality of roads, scarcity of potable water, irrigation and industrial water, poor education and health services among others. All these lend credence to the inadequate existing infrastructural facilities. Even educational institutions are not equipped with basic infrastructure that enhances human capital development. Infrastructure in certain isolated areas can serve as inducements to attract certain levels of industrial activities to such places. Thus, infrastructure provision, facilitates investment in less developed areas. With the provision of electricity for example, farmers in rural areas can easily process their harvested cassava roots into garri flour. The provision of infrastructural facilities is therefore, fundamental for successful rural transformation and agricultural improvement.

Infrastructure is a general word for various undertakings in an economy which are usually referred to as "social overhead capital" by development economists. Infrastructure therefore includes system of transport, communication and public (social) services. The functionality of these services lead to benefits and improves the lives of the generality of people (Ogbozobe, 1997). The public services are amenities provided by the government for the commons, which is the general public. The amenities include: health care, postal and telecommunication, water supply, electricity, education, etc. Infrastructural provision is important for economic growth and

development of every country. The availability of the infrastructure encourages private investors and assists the country in diversifying the economy. Economic diversification will assist in reducing unemployment, poverty level, manage environmental problems and the ever growing population of the developing countries.

The oil prices increased tremendously in the 1990s and 2000s in the international market and many countries use the earnings to improve infrastructural facilities and saved for the rainy days. This could not be said of Nigeria where the proceeds of the increase in the oil prices could not be translated into improved infrastructural amenities in the country as a whole. In the recent years, the price of oil which is the major source of financing public expenditure in Nigeria has fallen to its lowest level in 20 years and the infrastructural amenities are in the worst possible state. In Nigeria, several government policies have led to infrastructure deterioration, which has been characterised by erratic power supply, inefficient telecommunication, poor urban and rural road networks, which inevitably resulted in a near stagnant economic performance (BPE, 2003).

Based on the above nexus between capital expenditure and infrastructural services in Nigeria, a study such as this, is plausible to support current government policies in taking Nigerian infrastructural provision to the next level. This study, therefore, seeks to examine the impact of capital expenditure on infrastructure renewal in Nigeria. Furthermore, the paper seeks to answer the following questions: Does capital expenditure on infrastructural amenities bring about increase in Nigerian economy? Does infrastructural renewal in Nigeria have short and long-run impact on the economy?

## **2. Literature Review**

The issue of the relationship between government expenditure and economic growth has been a focus of discussion among scholars in recent times. Oyinlola and Akinnibosun (2013) have carefully traced back the theoretical foundation of this relationship to the days of scholars like Wagner (1883) and Keynes (1936). While Wagner advocated that economic growth leads to government expenditure, Keynes postulated that economic growth is caused by government expenditures. Generally, most governments all over the world embark on public expenditure to stimulate the economy. They believe the economy cannot grow unless with government intervention and government expenditure represents a veritable instrument for controlling the economic variables. Scholars have argued that public expenditures on socio-economic and physical infrastructure enhance economic growth. Also, Aschauer (1989) found that public investment on infrastructure has elasticity of output.

Theoretically, both Keynesian and Neoclassical economists provided useful tools for government intervention in undertaking fundamental roles of allocation, stabilization, distribution and regulation, particularly in situations when market forces prove inefficient or their outcomes are socially unelectable, which is government capital expenditure (Usman, 2011).

Siyam and Adegioriola (2017) explored the nexus between infrastructural development and Nigerian economic growth, using data from 1981 to 2014. Vector Error Correction Model (VECM) was employed in the analysis. Findings from the study revealed that there is long run relationship between infrastructural development and Nigerian economic growth. VECM has the expected negative sign and is between the accepted region of less than unity. It also shows a low speed adjustment towards equilibrium. Infrastructural investment in road and communication show a positive relationship to the Nigerian economic growth, while private investment, degree of openness and education produced negative relationship to economic growth. They suggested that government should show more commitment to improving infrastructure, improving and

monitoring budgetary allocation to education to increase human capital development that is capable of using available infrastructure and resources for the attainment of economic growth. Government should also encourage the private sector with series of incentives to encourage their participation in investment activities, which will inevitably lead to economic growth.

Shuaib and Ahmed (2015) examined the impact of public finance on the growth of the Nigeria economy, using time series data from 1960 to 2013. They utilized Switching Least Square Tests and Transition Matrix test. The results revealed that public finance has a direct relationship with economic growth which is statistically significant at 5% level as discovered from the results of the various diagnostic tests. From the result of the findings, the study recommended that government should ensure that funds are internally generated and the Nigerian government should ensure that the internally generated funds are utilized judiciously. The last resort of government when the entire sources of funds become depleted is borrowing and there is the need for the government to escalate its capital expenditure in Nigeria. Corruption is a menace in any economy; therefore, government should wage a war against with all its ramifications in order to achieve economic growth. Shuaib, Mohammed and Igbinosun, (2015) investigated the impact of government expenditure on economic development in Nigeria, using time series data from 1960 to 2013. The study employed various econometric and statistical analytical methods to examine the relationship between government expenditure and economic development. They utilized various diagnostic tests on Nigeria's time series data from 1960-2013. The empirical result showed that there is a significant or direct relationship between government expenditure and economic development in Nigeria.

Al-Shatti (2014) examined the impact of public expenditure on economic growth in Jordan between 1993 and 2013. The tool of analysis was ordinary least square multiple regression model. The study investigated the contribution of each capital and recurrent expenditure on education, health, economic affairs and housing and community utilities in the total expenditure; and then identified the impact each one of them has on economic growth in Jordan. Results showed that there is a statistically significant impact of recurrent expenditure on health, economic affairs and housing and community utilities and capital expenditure on health and economic affairs on economic growth. There is no statistical significant impact of recurrent expenditure on education and of the capital expenditure on education, housing and community facilities on economic growth in Jordan. The joint effect of these components of (capital and current) public expenditure on economic growth is statistically significant as indicated by the computed F-statistics and its probability. The study therefore submits that there is an impact of public expenditure on economic growth. Ogedengbe, Shuaib and Kadiri (2013) empirically investigated the impact of the health sector on the growth of Nigerian economy using annual time series data from 1970 to 2010. They used real gross domestic product as a proxy for economic growth, total government expenditure on education, total government expenditure on health, enrolments into tertiary school, senior secondary school enrolments and primary school enrolments as proxy for human capital development. The data was tested for stationarity using Augmented Dickey Fuller (ADF) and Phillip Perron (PP) tests. Co-integration tests and Granger Causality were also used. The results revealed that there is a long-run relationship between government expenditure on education, government expenditure on health, and human capital development as a proxy for tertiary school enrolments, secondary school enrolments and primary school enrolments and economic growth. All the variables have short and long run relationship with each other as revealed by Granger-causality test. They therefore concluded that there is a feedback mechanism between human capital development and economic growth.

Egbetunde and Fasanya (2013) analysed the impact of public expenditure on economic growth in Nigeria from 1970 to 2010. The main tool of analysis used was bound testing (ARDL) approach which examined both the long-run and short-run relationships between public expenditure and economic growth. The results of the study revealed that total public expenditure has negative effect on economic growth while recurrent expenditure has little significant positive effect on economic growth.

Nworji and Oluwalaiye (2012) examined the impact of government spending on road infrastructure development on economic growth in Nigeria for the period 1980 to 2009. The study employed multiple regression analysis model specified on the basis of hypothesized functional relationship between government spending on infrastructural development and economic growth. Indicators used for government spending are values for defense, transport/communication, and inflation rate as the explanatory variables, while gross domestic product constituted the explained variable. The model for the study was estimated using the Ordinary Least Square (OLS) technique, and further evaluation was carried out using the coefficient of determination to explain the variations between the dependent and independent variables. The outcomes showed that transport and communication, including defense, individually exerted statistically significant impact on the growth of the economy; while inflation exerted positively but statistically in the period reviewed. However, the variables jointly exerted statistically significant impact on the growth of the economy.

Wang (2011) examined the total health care expenditure data of 31 countries from 1986 to 2007 in order to examine the causality between health care expenditure and economic growth. Econometric tools used were panel and quartile regression analysis. The results of the study showed that health expenditure growth enhances economic growth; but economic growth reduces health care expenditure growth. Taiwo and Agbatogun, (2011) analyzed the implications of government spending on the growth of Nigerian economy over the period of 1980 to 2009. Using Johansen Co-integration, unit root test and error correction model, it was revealed that total capital expenditure, inflation rate, degree of openness and current government revenue are the variables that have significant impact on growth in Nigeria. In the final analysis, future expenditure on capital and recurrent items should be managed along with adequate manipulation of other macroeconomic variables to ensure steady and/or accelerated growth.

### 2.1 Theoretical Framework

It is already well known from the literatures that models of economic growth can generate long-run growth without relying on theories of population change, as in Becker and Barro (1988), or technological progress due to Romer (1986). A general feature of these models is the presence of constant or increasing returns in the process of accumulating the factors of production (Lucas, 1988). In contrast to models in which capital exhibits diminishing marginal productivity, the stock of knowledge can endlessly grow. Even in a situation where all inputs of production are held constant, there is no reason why knowledge must also be constant at some steady state and, accordingly, no further research should be undertaken; Barro (1990), and Angelopoulos, Malley and Philippopoulos (2007).

Assume an open economy that embraces a large number of competitive firms. Without loss of generality and aggregating across firms, the production function may be given the following expression:

$$Y = AK^{\alpha} (hL)^{1-\alpha} \dots\dots\dots 1$$

where: Y denotes output, K is the private-sector capital, and L stands for labour, with  $\alpha$  and  $1-\alpha$  being the shares of private capital and labour, respectively. Parameter A reflects the constant technology level, with  $A > 0$ .

The assumption of constant returns becomes more plausible whenever, as in our case, capital is broadly viewed to encompass both human and physical capital. Indeed, parameter h represents human capital and we consider it to be a function of the existing total (private and public) capital of the economy. Our economy depends solely and exclusively on the growth rate of government expenditures in infrastructure rather, than on the prudent or efficient use of human capital in the steady state. However, we should not forget the production-enhancing role of the efficiency. The efficient use of government expenditures in infrastructure, has been positively contributing to a proportionate increase of the output level and, consequently, to the overall rate of economic growth.

**3. Methodology**

In order to avoid spurious result, the secondary data sourced from National Bureau of Statistics (NBS), Central Bank of Nigeria (CBN) and World Development Index (WDI) will be tested using various pre-test which include; Stationary test using Augmented Dickey Fuller (ADF) (Dickey and Fuller, 1979; Challis and Kitney, 1991 & Gujarati, 2004). Also, we shall confirm the co-integration status of the variables using Johansen co-integration test (Johansen, 1988). The methodology for the study shall be the Vector Error Correction Model (VECM) in order to establish the long-run relationship among the variables under consideration which include; proportion of private investment to GDP, government spending on road, government spending on communication as a proxy for non-transportation stock and government spending on education.

*3.1 Model Specification*

Following the relationship between infrastructure and economic growth explained in the above theoretical framework, as well as the works of Pooloo, (2009) and Nkechukwu and Okoh, (2015), the structural equation can be stated thus:

$$GDP = f(PRIINV, EXROAD, EXCOM \& EXEDU) \dots\dots\dots 2$$

In order to capture the response of the exogenous variables on the dependent variables, equation (2) can be stated in linear form thus:

$$GDP_t = \alpha + \beta_1PRIINV_t + \beta_2EXROAD_t + \beta_3EXCOM_t + \beta_4EXEDU_t + \mu_t \dots\dots\dots 3$$

Where GDP stands for Gross Domestic Product; PRIINV represents the private investment to GDP; EXROAD is the government spending on road transportation while EXCOM is government spending on communication as a proxy for non-transportation and EXEDU is government spending on education.  $\mu$  is the error term.  $\alpha$  is the constant,  $\beta_1 - \beta_5$  represent the parameters of the explanatory variables. The apriori expectation from the result should be that  $\beta_1, \beta_2, \beta_3 \& \beta_4 > 0$ .

#### 4. Result

##### 4.1 Unit Root Test

Table 4.1: Stationarity Test Result

Variable	ADF Test Statistics	Test Critical Value	Level
GDP	-7.610362	-4.26274(1%)	I(1)
		-3.55297(5%)	
		-3.20964(10%)	
		-4.26274(1%)	
		-3.55297 (5%)	
PRIINV	-8.625674	-3.20964(10%)	I(1)
		-4.26274(1%)	
		-3.55297 (5%)	
		-3.20964(10%)	
		-4.26274(1%)	
EXROAD	-5.166726	-3.55297 (5%)	I(1)
		-3.20964(10%)	
		-4.26274(1%)	
		-3.55297 (5%)	
		-3.20964(10%)	
EXCOM	-4.484296	-4.5743 (1%)	I(0)
		-3.55297 (5%)	
		-3.20964(10%)	
		-4.5743 (1%)	
		-3.6920 (5%)	
EXEDU	-5.860210	-3.2856 (10%)	I(1)

The unit root critical values of hypothesis rejection were from MacKinnon (1990)

Source: Authors Computation, 2019

The result of the stationarity test is shown in the table above. The five variables (GDP, PRIINV, EXROAD, EXCOM and EXEDU) were tested for stationarity with the aid of Augmented Dickey-Fuller (ADF) test. As is the case most times, only EXCOM was stationary at levels I(0) while other variables (GDP, PRIINV, EXROAD and EXEDU) were stationary at first difference I(1).

##### 4.2 Co-integration Test

Johansen's co-integration test is used to show the existence of one co-integrating equation in the system and to determine the existence of long run relationship among the variables. Since the two conditions are satisfied, we can estimate the model formulated using VEC method.

Table 4.2: Johansen Co-integration Test

Unrestricted Cointegration Rank Test (Trace)					
Hypothesized	Eigenvalue	Trace Statistic	Critical Value	Prob.**	
(0.05)					
No. of CE(s)					
None *	0.825231	236.9292	150.5585	0.0000	
At most 2 *	0.573807	113.3767	88.80380	0.0003	
At most 3 *	0.524298	76.70361	63.87610	0.0029	
At most 4 *	0.402146	44.75621	42.91525	0.0323	
At most 5 *	0.205504	9.892040	12.51798	0.0132	

Trace test indicates 5 cointegrating eqn(s) at the 0.05 level; \* denotes rejection of the hypothesis at the 0.05 level

Source: E-views Output, 2019

In table 4.2, the result of Johansen co-integration test shows that there exist co-integration which means long run relationship among variables (GDP, PRIINV, EXROAD, EXCOM and EXEDU). The result shows that all the variables converge in the long run thereby indicating that there is long run relationship among variables. According to the trace statistic, the long-run relationship exists at 5% level of significance.

#### 4.3 Vector Error Correction Model

The VEC model is used to determine the short-run adjustment parameters and that of co-integrating equations parameters. The short-run and long-run results are in tables 4.3 and 4.4 respectively.

Table 4.3: Normalized long run co-integration equation results

LGDP	LPRIINV	LEXROAD	LEXCOM	EXEDU
1.000000	-0.158774	0.130991	0.330499	-0.077770
	(0.02939)	(0.02214)	(0.03004)	(0.00877)
	[-5.91745]	[5.91745]	[11.0008]	[-8.86693]

Note: Standard errors in ( ) & t-statistics in [ ]

Table 4.4: Vector Error Correction Model Result

LGDP	LPRIINV	LEXROAD	LEXCOM	EXEDU	CointEq1
1.000000	-0.019842	0.013310	0.050830	-0.001704	-0.019666
	(0.20017)	(0.01020)	(0.04935)	(0.00384)	(0.04195)
	[-1.37176]	[1.30440]	[1.02992]	[-0.44373]	[-2.4688]

Note: Standard errors in ( ) & t-statistics in [ ]

The estimated results showed that government spending on road as well as communication has a positive and significant impact on economic growth in the long-run. Private investment and government expenditure on education has negative but significant impact on economic growth in the long run. Furthermore, impacts of the explanatory variables on the dependent variable are statistically significant in the long-run. The normalized long run co-integration equation results show that 1 percent increase in growth of infrastructure on telecommunication and road will lead to 13 percent and 15 percent increase in economic growth respectively. The private investment and government spending on education results are not in line with a prior expectation of positive relationship with economic growth in the long run. The implication of the result is that, private investment has not grown to the level it will have a positive impact on economic growth in Nigeria. Most of the private investors provide the needed infrastructures for their businesses which make most of the capital for the businesses to be spent in providing road, energy among other infrastructures. The result from government spending on education does not produce the expected outcome on economic growth in Nigeria. In addition, the short-run result shows that VEC model has expected sign which is negative and is statistical significant. This means that the



short-run disequilibrium will be brought to equilibrium in the long-run at the rate of 2 percent. The exogenous variables agreed with the long-run relationship.

#### 4.4 VECM Forecast Error Variance Decomposition

The short-run dynamic property of VECM in this study is further supported by FEVD tests. As a result of this, variance decomposition in this section provides information about the relative importance of each random innovation affecting the variables in the VECM. Variance decomposition analysis indicates the proportion of movements in a sequence due to its own shocks and shocks to other variables. It shows the fraction of the forecast error variance for each variable that is attributed to its innovation and innovations in the other variables in the model.

Table 4.5: Forecast Error Variance Decomposition

Variance Decomposition of LGDP						
Period	S.E.	LGDP	LPRIINV	LEXROAD	LEXCOM	EXEDU
1	0.0301	100.0000	0.0000	0.0000	0.0000	0.0000
2	0.0520	92.6157	5.6751	0.5174	1.0788	0.0007
3	0.0699	89.1062	4.0006	0.5818	6.1663	0.0804
4	0.0857	87.4732	3.2459	0.3891	8.6656	0.1619
5	0.1005	86.7652	2.4414	0.3346	9.7014	0.2931
6	0.1147	86.3275	1.9092	0.2651	10.4682	0.4117
7	0.1268	85.2328	1.5758	0.2696	11.8475	0.4513
8	0.1394	83.4328	1.3165	0.4227	13.7164	0.4633
9	0.1525	81.9944	1.1322	0.7530	14.9259	0.4454
10	0.1652	80.9621	0.9841	0.9812	15.8131	0.4324

Source: Authors Computation

The result from the above table shows that GDP accounts for most of the variations and changes in itself with the average of 80 percent. Communication infrastructure contributed more after the 10th years with the average of 15 percent. The next variable that contributes to GDP after the 10<sup>th</sup> period is road infrastructure with the average of 0.98 percent, followed by education with the average of 0.43 percent after the 10<sup>th</sup> period. In order to achieve government objective at improving the infrastructural amenities in Nigeria in the long-run, there is need to increase expenditure on Communication, road and educational infrastructures which will contribute more to the GDP. Government should also increase the use of private investment in financing infrastructural amenities since it contributes to growth in the long run.

#### 5. Conclusion and Recommendations

The result has shown that, there is long run relationship between infrastructural renewal and economic growth in Nigeria. The long run relationship was confirmed from the statistical significance of the variables and the positive relationship of the infrastructural renewal in road and communication with the economic growth in Nigeria for the period of study. As for other variables considered, it was deduced that, private investment, degree of openness and education produced negative relationship with economic growth in Nigeria for the period of study. The

implication of this is that, apart from the need for the government to increase commitment to improving infrastructure in the country, it is essential for the manufacturing sector to be appropriately developed (to harness the advantages of openness of the economy), improve budgetary allocation to education and monitor the spending to increase human capital development that is capable of utilizing available infrastructure and resources for the attainment of economic growth. Lastly, given the interconnectivity between infrastructure and effective operation of investment, the private sector should be encouraged with series of incentives to increase their participations through Public Private Partnership (PPP). This will improve infrastructural renewal in Nigeria and in turn lead to economic growth and development in the country.

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