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Public Infrastructure Expenditure and Economic Growth in Nigeria: A Test of the Big Push Theory

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Abstract

This study attempts to test the Big Push Theory by investigating the impact of public infrastructure expenditure on economic growth in Nigeria employing annual data from the Central Bank of Nigeria (CBN) and the World Development Indicators (WDI) covering the period 1983-2018, using the Ordinary Least Square (OLS) method of estimation. The empirical results revealed that government expenditure on transport and communication (GETC) was positive and significantly influenced economic growth while the other variables which are government expenditures on education (GEDU), government expenditure on healthcare (GEHC); social and community services (GESCS) though were positive, but were insignificant in boosting the economy. This finding supports the Big Push Theory that posits that only massive Government investment efforts in development policies could guarantee a proportionate economic growth in the economy. The study therefore recommended amongst others that Government should massively invest in public infrastructure like education, healthcare, Social and Community services, as bit-by-bit investment over the years had led to wastage of scarce resources.

Keywords: Public infrastructure, GDP, Government expenditure, Economic growth, Nigeria

Introduction

Economists have identified adequate expenditure on public infrastructure and health as a means of improving the living

standards of a people, as well as the growth and development of a country. Investment in public infrastructure has remained a critical issue in developmental process, especially in developing countries in Sub-Saharan Africa, whose economies are characterized by structural rigidities, weak institutional framework, and decline in productivity level, as well as inconsistent economic policies (Edame, 2014). Empirical literature support that a positive relationship exist between government spending through successive yearly budgets and economic growth. The central question that arises is whether or not successive public sector spending actually increases the long run steady state growth rate of the economy (Kweka & Morrisssey, 2000). Opinion varies as some researchers argue that increased government expenditure on public infrastructure enhance economic growth. On the contrary, empirical studies reveal that increased government spending does not necessarily increase economic growth in Saudi-Arabia and Tanzania (Ghali, 1997; Kweka & Morrisssey, 2000). This lackluster economic growth may be the resultant effect of government financing her expenditure by domestic borrowings that may eventually crowd out private investors (Ohwofasa, Matthew & Erakpoweri, 2018).

Over the years, Nigeria's economic growth has not reflected the huge amount of government resources expended on public infrastructure. To escape the low income equilibrium trap, Nigeria and other developing countries need to publicly coordinate their level of investment in infrastructural and health capital. According to the big push theory, coordinated infusion of public capital in forms of education, roads, power plants, dams, airfields and hospitals will help to boost and reshape the economy, as bit by bit level of investment would only lead to wastage of scarce resources (Rosenstein-Rodan, 1943).

Table 1: Average GDP growth rate, government expenditure on infrastructure in Nigeria (5-year Average) 1983-2012

Years	GDP growth rate (Annual %)	Govt. Expenditure on Education **(₦' Billion)**	Govt. Expenditure On health. **(₦' Billion)**
1983-1987	-18.25	0.222	0.096
1988-1992	26.58	1.684	0.454
1993-1997	10.48	9.262	3.238
1998-2002	3.336	170.644	20.348
2003-2007	12.51	98.782	53.458
2008-2012	6.036	231.22	143.444

Source: *Authors' computations using WDI (2015) data and CBN annual report (2018)*

Table 1, presents the 5-year average of GDP growth rate (annual percent) and government expenditure on education and health (₦' Billion) from 1983-2012 in Nigeria. It can be seen that between the periods 1983-1987, the average GDP growth rate was negative despite the slight positive investment of government in these public infrastructure. It rose to 26.58 percent and later fell to 10.48 percent during 1988-1992 and 1993-1997 respectively. From 1998-2002 and from that period till 2008-2012, despite the steady increase in government expenditure in each successive period, GDP growth rate in the country has been fluctuating. This implies that the huge increase in government expenditure on infrastructure in the country did not reflect on GDP growth rate, which may suggest corruption in the utilization of the nation's resources.

In view of the foregoing, the objective of this paper is to test the Big Push condition of coordinated public infrastructural and health expenditure of government and its effect on economic growth in Nigeria. In doing this, this paper uses the natural log of GDP as proxy for economic growth, and he dependent variable; while the natural log of government expenditure on education, government expenditure on healthcare, government expenditure on social and community service and government expenditure on transport and communication serves as independent variables and proxies for infrastructural and health capital. The rest of the paper is organized

as follows: section two addresses the empirical literature and gap in the literature reviewed; section three deals with the methodology and model specification; section four focuses on the empirical analysis of results while section five entails conclusion and policy recommendations.

Review of Empirical Literature

In the literature, several empirical studies on the relationship between government expenditure on public infrastructure and economic growth of developed and developing countries abound. While evidence from some empirical studies support a positive causal relationship between government expenditure on public infrastructure and economic growth, others hold contrary views. Kweka and Morrissey (2000) in their empirical study on government spending and economic growth in Tanzania, used annual data covering the period 1965-1996 and adapted Ram (1986) simple growth accounting model, where they disaggregated total government expenditure into expenditure on (physical) investment, consumption spending and human capital investment. Their study revealed that increased productive expenditure by government on infrastructure led to a negative impact on the growth in the country. Their result support the general public notion in Tanzania, that government expenditure on infrastructure was usually not productive. Ghali (1997) researched on the impact of government spending on economic growth in Saudi Arabia. He used the vector autoregressive (VAR) method of analysis to examine the intertemporal interactions between growth rate of per capita GDP and share of government spending in GDP. The study revealed that government spending does not increase Saudi Arabia's per capita out growth. The study recommended fiscal policy measures in terms of increased government spending to tackle the country's deficit budget financing.

Agenor and Moreno-Dodson (2006) in their paper entitled public infrastructure and growth: new channels and policy implication used transport, water supply and sanitation, information and communication technology as proxies for infrastructure and adopted endogenous growth model with transitional dynamics method of analysis. They concluded that infrastructural expenditure reduces poverty and positively relates to economic growth. Edame

(2014) examined the relationship between public infrastructure and economic growth in Nigeria using error correction method of analysis and time series data from 1970-2010, to compare the trend in public expenditure between military and democratic government in the period under review. The results of the ECM support cointegration and possible existence of a long run equilibrium between public expenditure growth and government revenue, population density, openness, external reserves and rate of urbanization which were proxies for infrastructure. The empirical results indicate that the aforementioned proxies for infrastructure remarkably shaped economic growth in Nigeria in both dispensations.

Nedozi, Obasanmi and Ighata (2014) investigated infrastructural development and economic growth in Nigeria using OLS method of analysis. Their study supports other studies that posit a positive relationship with economic growth. The study concluded that adequate attention must be given to infrastructural development in the country through successive budgetary allocations, if the government intends to grow the economy. In a similar study carried out by Srinivasu and Rao (2014) on the role of infrastructural development and economic growth: prospect and perspective with particular reference to India, the empirical estimates of transport, telecommunication, energy, health, housing and educational facilities which were proxies for infrastructure were all significant and positively influences the level of output. They concluded that more access to these variables were prerequisite for the overall development of the economy.

Fasoranti (2012) assess the effect of government expenditure on infrastructure proxied by government expenditure on education, health services, agriculture, security, transport and communication on the economic growth of Nigeria, using annual time series data from CBN for the period 1977-2009. The empirical results revealed that government expenditures on health services, transport and communication did not conform to apriori expectations, while expenditure on agriculture and security were not significant. Ohwofasa et al (2018) examined the analysis of government expenditure in Nigeria using unemployment, poverty level and megawatt of electricity as measures of welfare and proxies for economic growth. Their study revealed that increase in government expenditure though were significant, but have not fully impacted

in reducing the level of poverty and unemployment amongst the citizens in the economy. This implies that successive government spending through budgetary allocation does not actually impact on the level of poverty and unemployment rate in the country.

In a recent paper, Muhammad (2019) found that infrastructure disaggregated into public and private infrastructural investment had positive but different effects on output level in Pakistan. The researcher recommended that government should enact policies targeted at creating a friendly environment that will make private investment to thrive in that country. Adenikinju (2005) in a survey study of analysis of cost of infrastructure failures in a developing economy with emphasis on Nigeria, identified poor state of electricity supply as a major cause of failures of many small-scale business operators in the country. He adduced these problems to the continuous acquisition of very expensive back up generating plants needed to cushion these firms from incessant power outages. The researcher advocates institutional reforms of the power supply sector to stem this tide in the country.

Alshahrani and Alsadiq (2014) carried out an empirical investigation of government spending and economic growth in Saudi-Arabia. They conclude that private domestic and public investment, as well as healthcare expenditure stimulate economic growth in the long run, while trade openness and expenditure on housing impact on growth in the short run. From the empirical studies revealed, it was generally agreed that government expenditures on infrastructure significantly determines output level and can either positively or negatively influence output level. Some of the studies measured economic growth using GDP (Kweka & Morrissey, 2000; Ghali, 1997; Nedozi, Obasanmi & Ighata, 2014; Fasoranti, 2012; Ohwofasa, Matthew & Erhapoweri, 2018). These studies showed that government infrastructure impacted on economic growth (GDP), though the relationship between government expenditure on infrastructure and output level (GDP) was mixed.

Different variables were used as proxies for government expenditures on infrastructure. Private domestic and public investment as proxies for healthcare (Alshahrani and Alsadiq, 2014); infrastructure disaggregated into public and private investment (Muhammad, 2015); government revenue, population density,

openness, external reserves and rate of urbanization (Edame, 2014); government expenditure disaggregated into physical investment, consumption spending and human capital investment (Kweka and Morrissey, 2000); share of government spending on GDP (Ghali, 1997); government expenditure on telecommunication, energy, health, housing and educational facilities (Srinivasu & Rao, 2014). From the empirical works reviewed, none of the studies took into consideration the joint effect of all the variables on economic growth (GDP) as hypothesized by the Big Push theory. This paper, therefore, made some efforts to fill this gap and contribute to the existing literature.

Methodology and Model Specification

This study made use of secondary data covering the period of 36 years ie 1983-2018 obtained from the World Development Indicators (WDI) 2015, and the Central Bank of Nigeria statistical bulletin of various years, 2018. The data was used to obtain the descriptive statistics which shows the characteristics of the data, the Granger Causality tests to ascertain the causal relationship and direction of causality amongst the variables, and the Augmented Dickey Fuller (ADF) test to ascertain the stationarity of the variables used. Finally, the ordinary least square regression method of analysis was used to analyze the impact of government expenditure in infrastructure on economic growth in Nigeria and to ascertain the impact of bit-by-bit level of this infrastructural expenditure.

The functional form of the model is specified as follows:

$$GDP = f(GHC, GEDU, GETC, GESCS) \quad (1)$$

Where: GDP = Gross Domestic Product in (₦' Billion)

GHC = Government expenditure on Healthcare in (₦' Billion)

GEDU = Government expenditure on Education in (₦' Billion)

GETC = Government expenditure on transport and communication expressed in(₦' Billion)

GESCS = Government expenditure on social and community service in (₦' Billion)

The econometric model in log-linear time trend form is specified as:

$$\ln GDP = \beta_o + \beta_1 \ln GHC_t + \beta_2 \ln GEDU_t + \beta_3 \ln GETC_t + \beta GESCS_t + U_t \quad (2)$$

The apriori expectations are: $\beta_1 > 0$, $\beta_2 > 0$, $\beta_3 > 0$, $\beta_4 > 0$

lnGDP = log of Gross Domestic Product, lnGHC = Log of Government expenditure on healthcare

lnGEDU = log of Government expenditure on education, lnGETC = log of Government expenditure on transport and communication

lnGESCS = log Government expenditure on social and community service

β_o = intercept, U_t = Error term, t = time trend

The data collected was used to test the relationship between economic growth proxied by GDP and government expenditure on infrastructure proxied by the independent variables stated in equation (2). The apriori expectation is that a huge investment in all the independent variables will invariably positively impact on output in Nigeria.

Empirical Analysis

In this section, we present the analysis of the data used. The analysis consists of the use of descriptive statistics and econometric analysis of the relationship between government expenditure and economic growth in Nigeria from which inferences and policy recommendations will be made.

Table 2: Descriptive statistics of the dependent and independent variables

	LGDP	LGEHC	LGEDU	LGETC	LGESCS
Mean	27.41898	22.93530	23.75037	21.88874	22.59477
Median	28.22816	23.72892	24.64079	22.80956	23.15357
Maximum	30.03948	26.41511	26.86595	25.22341	26.49779
Minimum	23.07559	17.50439	18.89068	17.21671	17.21671
Std. Dev.	2.349816	2.837126	2.632104	2.385295	2.982921
Skewness	-0.568932	-0.442870	-0.587548	-0.517828	-0.229150
Kurtosis	1.930244	1.815999	2.009896	1.973412	1.852513
Jarque-Bera	3.658667	3.279592	3.541734	3.189697	2.290149
Probability	0.160521	0.194020	0.170185	0.202939	0.318200

Source: Authors' computation (2020) using *E-Views 7.0*

From table 2, GDP has a mean value of 27.41 percent for the period 1983-2018; with a standard deviation of 2.34. The minimum and maximum values of GDP in the period are 23.07 percent and 30.03 percent respectively. Its skewness value is -0.57 and this indicates that the distribution of GDP is negatively skewed. Its kurtosis of 1.93 which is less than 3, implies that the distribution of GDP is platykurtic. The Jarque-Bera statistics of 3.65 with a probability value of 0.16 (16%) indicates that GDP is normally distributed. The average amount spent by Government on health care (GEHC) is 22.93 percent in the period under review, with a standard deviation of 2.83. The minimum and maximum expenditure of Government on health care stood at 17.50 percent and 26.41 percent respectively. Government's average expenditure on education for the period 1983- 2018 stood at 23.75 percent of its total budgets; with a standard deviation of 2.63. The minimum and maximum education expenditure patterns were 18.89 percent and 26.86 percent respectively. The average expenditure of Government on Transport and Communication (GETC) was 21.88 percent for the period under review; with a standard deviation of 2.39. The minimum and maximum values of GETC were 17.21 percent and 25.22 percent respectively. The mean value of Government expenditure on Social and Community Services (GESCS) was 22.59 percent in the period under review; with a standard deviation of 2.98. The minimum and maximum expenditure value stood at 17.21 percent and 26.50 percent respectively.

All the variables, (GEHC, GETC, and GESCS) were negatively skewed from their skewness values; their kurtosis values were all less than 3, which implied platykurtic distribution. The Jacque-Bera statistics and probability (*p*) values of these variables which were greater than 1 percent implied that all the variables were normally distributed.

Table 3: Pairwise Granger Causality Test Results

Null Hypothesis:	Obs	F-Statistic	Prob.
GEDU does not Granger Cause GDP	34	0.55352	0.5809
GDP does not Granger Cause GEDU		4.51037	0.0197
GETC does not Granger Cause GDP	34	1.98500	0.1556
GDP does not Granger Cause GETC		4.22241	0.0246
GEHC does not Granger Cause GDP	34	0.09302	0.9114
GDP does not Granger Cause GEHC		5.38825	0.0102
GESCS does not Granger Cause GDP	34	0.10137	0.9039
GDP does not Granger Cause GESCS		2.17369	0.1319
GETC does not Granger Cause GEDU	34	4.00209	0.0292
GEDU does not Granger Cause GETC		4.41009	0.0213
GEHC does not Granger Cause GEDU	34	1.28105	0.2930
GEDU does not Granger Cause GEHC		0.52635	0.5963
GESCS does not Granger Cause GEDU	34	1.32152	0.2823
GEDU does not Granger Cause GESCS		2.89692	0.0713
GEHC does not Granger Cause GETC	34	3.17672	0.0566
GETC does not Granger Cause GEHC		3.63162	0.0391
GESCS does not Granger Cause GETC	34	0.37952	0.6875
GETC does not Granger Cause GESCS		2.82156	0.0759
GESCS does not Granger Cause GEHC	34	1.26718	0.2968
GEHC does not Granger Cause GESCS		1.37959	0.2677

Source: Results Extract from E-views 7.0

Table 3 reports the results of the Granger causality tests to determine the direction of causality between each pair of variables. The rejection of each of the null hypothesis is based on the significance of the F-test for that particular relationship. We lay emphasis on the relationships that are of interest to the study, particularly the relationship between Gross Domestic Product (GDP) and the rest variables (GEDU, GETC, GEHC and GESCS). As depicted in table 3, the Pairwise Granger causality tests revealed that Government expenditure on education (GEDU) does not Granger cause Gross Domestic Product (GDP); however, on the contrary, Gross Domestic Product (GDP) Granger causes Government expenditure on education (GEDU). This implies that there is a unidirectional causality between GDP and GEDU, with the causality running from GDP to GEDU.

The pairwise causality tests revealed that Government expenditure on Transport and Communication (GETC), Government expenditure on health care (GEHC) and Government expenditure on Social and Community Services (GESCS) does not Granger cause Gross Domestic Product (GDP) as depicted from their respective F-test values. However, GDP Granger causes GETC, GEHC, and GESCS with the causality running from GDP to the aforementioned variables respectively. This implies that there is a unidirectional causality between GDP and GETC, GEHC and GESCS.

Table 4: Unit Root Test for variables at levels

Source: *Authors' computation using E-Views 7.0*

The A[illegible] analyze the unit root of the variables. Correct and appropriate specification and estimation of time series models require that we determine whether the time series are stationary or non-stationary in order to avoid spurious regressions (Iyoha, 2004). A time series is stated as non-stationary if its mean and variance are dependent on time, however, a time series is stated as stationary if the mean and variance are constant over time. The apriori expectation when using the ADF test is that a variable is stationary when the value of the ADF statistics is greater than the critical value. From table 4, all the variables were non-stationary at levels which indicate the presence of unit root because the ADF test statistics of the variables in absolute terms was less than their appropriate critical values at 5% level of significance.

Table 5: Unit Root Test for variables at first difference

Variables	ADF Test statistics	95% critical ADF value	order of integration	Remark
D (LGDP)	-6.6394	-2.9511	I (1)	stationary
D (LGEDU)	-7.4737	-2.9511	I (1)	stationary
D (LGEHC)	-9.7244	-2.9511	I (1)	stationary
D (LGESCS)	-8.1568	-2.9511	I (1)	stationary
D (LGETC)	-7.7342	-2.9511	I (1)	stationary

Source: Authors' computation using *E-Views 7.0*

Table 5 reveals that all the variables become stationary at first difference, indicating the absence of unit root amongst the variables and thereby satisfying the stationarity property in their first differences.

Table 6: OLS Regression Results

Dependent Variable: LGDP
Method: Least Squares
Observations: 36

Variables	**Coefficients**	**t-statistics**
C	7.3269	7.0496
LGEDU	0.2491	0.9237
LGETC	0.2886	2.6554
LGEHC	0.2101	0.7281
LGESCS	0.1343	1.1310
Summary Statistics R-Squared = 0.9601 Adjusted R-Squared = 0.9549 F-Statistics = 186.6579Prob. (F-Statistics) = 0.0000 DW Statistics = 1.70		

Source: Results extract from *E-Views 7.0*

The results from table 6 revealed that the coefficient of determination (R-Squared) of the model is 0.96. This simply implies that 96 percent (%) of the systematic variations in Gross Domestic

Product (LGDP) is explained by the independent variables. The adjusted R-Squared indicates that about 95 percent (%) of the systematic variations in the dependent variable (LGDP) are attributed to the explanatory variables (LGEDU, LGETC, LGEHC & LGESCS). The F-statistics of 186.65 is large and it passes the conservative 1% significance test. This implies that a significant linear relationship exist between GDP and all the explanatory variables taken together. The Durbin-Watson (DW) tests of 1.70 indicate the absence of serial correlation amongst the variables. This implies that the errors in the different time periods of our data used in this model are not correlated.

From the estimated results, the signs of all the coefficients of the variables conform to theoretical expectations. From the estimated results, Government expenditure on Transport and Communication (GETC) is positive and statistically significant in enhancing economic growth in Nigeria in the period under review. The results revealed that a 1 percent rise in Government expenditure on Transport and Communication (GETC) would result in about 28 percent increase in economic growth (GDP). This results suggest that in recent years that government has embarked on privatization of most of its transportation and telecommunication investment, the returns from such privatization programmes has yielded huge revenue accrued to government in terms of tax payments due to efficiency in the operations and management of such enterprises by private companies. The incidence of corruption usually associated with government owned public utilities in the country have been reduced. The other variables that are Governments' expenditure on education (GEDU); Healthcare (GEHC); and Social and Community Services (GESCS) were positive but insignificant in influencing economic growth (GDP) in Nigeria. This implies that these expenditures by government though positively impact on the nation's economic growth, however, the level of investment by government in these public goods have not yielded the most desired returns. This low level of returns from government's investment in these public goods may be attributed to the bit-by-bit investment style of government. The millennium Development Goals (MDGs) and later the Sustainable Development Goals (SDGs) were designed to improve living standards through acquisition of skills through education and health status of the populace through adequate budgetary allocations of government yearly budgets. Regrettably, over the last

couple of years, in Nigeria the budgetary amount appropriated by successive government yearly for investment in education and healthcare has always been paltry.

Conclusion and Policy Recommendations

This study examined the impact of government expenditures on public infrastructures proxied by education, transport and communication, healthcare, Social and community services investment. The study tested the validity of the Big Push Theory using the Ordinary Least Square method of analysis on annual time series data on Nigeria covering the period 1983-2018. The results obtained from the study indicates that Government expenditures on transport and communication have not been bit-by-bit. This investment may have been supplemented by the massive private investors' participation in transport and communication infrastructure in the country. The results also implied that on education, healthcare, social and community services have not been adequate over the years. The major finding of this paper is that while governments' expenditure on transport and communication was positive and statically significant, the other variables used in the model were though positive, but were statistically insignificant in influencing economic growth in Nigeria. The Big Push theory was validated by the estimated results that the government need to massively invest simultaneously in education, healthcare, social and community services in the economy adequately, as a bit-by-bit investment of government would only lead to wastage of scarce resources in Nigeria.

In light of the above findings, the article recommends as follows: (i). In order to avoid wastage of scarce resources in the long run, successive government in Nigeria should endeavour to invest massively in education, healthcare, social and community services which are key determinants of economic growth and adhere to infrastructural developmental plans in the country to ensure continuity in governance and to avoid policy somersault that has characterized the Nigerian state. (ii) Government should ensure periodic project evaluation and proper monitoring to ensure that the amount budgeted for public infrastructure are fully expended, as this would reduce the recurring incidence of corruption usually perpetuated by project contractors.(iii) Governments' yearly

budgetary allocation to healthcare services should be increased to reflect the minimum 15% budgetary allocation as recommended by the 2001 Abuja Declarations and framework for action by the African Union (AU). (iv) Adequate measures should be taken by government to support private sector investment participation as this policy would attract more foreign direct investment inflows into the country to complement government efforts.

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