International Journal of Advances in Engineering and Management (IJAEM)
Volume 4, Issue 7 July 2022, pp: 435-442 www.ijaem.net ISSN: 2395-5252

Effect of Infrastructural Spending on Welfare in Nigeria

John Akintayo OMIMAKINDE[1], Solomon Ayodele ODU[2] and Elizabeth Adeteju[3] OMIMAKINDE

National Centre for Technology Management, Obafemi Awolowo University, Ile-Ife, Nigeria

Submitted: 01-07-2022 Revised: 07-07-2022 Accepted: 10-07-2022

ABSTRACT
This paper examined the relative impacts of physical and social public spending on infrastructure on Per Capital Income (PCI) in Nigeria between 1986 and 2019. an Autoregressive Distributed Lags (ARDL) model approach to co-integration analysis was employed. It was evident from the results that an increase in spending on physical infrastructure reduces the level of per capita income while spending on social infrastructure was found to have increased per capita income in Nigeria. It is therefore recommended that increased investment should be made in education and health services to ensure increase in per capita income.

Keywords: Spending, Institution, Infrastructure, Per Capita Income

I. INTRODUCTION

Nigeria is no doubt suffering from infrastructural deficits, underutilization and maintenance of the available infrastructures. Despite its enormous endowment of natural resources and land mass, the country ranks 42nd among the world's 60 largest economies (Hauwa,Badiya and Lawal, 2015). According to World Development Report 1994, developing countries invest about $200billion annually in new infrastructure representing four percent of their national output and a fifth of their total investment. The World Bank recommends that 7- 9 percent of the GDP of developing countries should be invested in infrastructure. Although there has been dramatic increase in the amount of investment in infrastructure annually by the Nigerian government at various levels, but such investments have not yielded sufficient results in providing adequate public infrastructures like transportation, power, water, sanitation, telecommunications, and irrigation among others, to meet the needs of the people (Taiwo, 2014). Hence, there is a need for conscious government spending that will bring the nation to a state of equilibrium in terms of the desired level of infrastructural development.

However, addressing Nigeria's infrastructure challenges will require continuous spending of nearly $14.2 billion per year over the next decade which is equivalent to about 12 % of GDP (Foster and Pushak, 2014). The authors further stressed that Nigeria spends about $5.9 billion per year on federal infrastructure, equivalent to about 5 percent of GDP, while at federal level $2.5 billion a year is being lost owing to institutional inefficiencies. Specifically, electricity is by far the single-largest source of inefficiency, even though cost-recovery tariffs would be affordable for the majority of the population.

In most developing countries of the world where there are large infrastructural needs, much needed funds to service re-current expenditures must be directed towards meeting the needs and this will serve as government intervention programme to lessen the financial burden (Iheanacho, 2016). Also, infrastructure raises growth quality thereby reducing income disparity and poverty (World Bank Annual Report, 2017). However, funds for infrastructure provision were either embezzled or diverted to less productive needs which are prone to corruption creating a lacuna in infrastructure development (Fatai, 2016 and Taiwo, 2014).

This ugly situation has indeed culminated in low productivity growth, low income growth, low savings, and low level of industrial development and ultimately vicious cycle of poverty in the country. Infrastructural deficiency constitutes a great impairment to sustainable growth and development, raises unemployment, increase the cost of living and reduce the quality of life (Gaal and Afrah, 2017).

This paper contains five sections: Section one is the Introduction, Section two is the literature review; section three deals with methodology and

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model specification. Section four discussed the empirical findings with their detailed analysis. Finally, Section five contains the main conclusion of findings.

II. REVIEW OF LITERATURE

An empirical analysis of the relative impacts of federal capital and recurrent expenditures on Nigeria's economyrevealed that recurrent expenditure exerted greater impact on the nation's gross domestic product (GDP) than capital expenditure (Oziengbe, 2013). The findings of the paper also showed that the two components of expenditure had an insignificant impact on GDP in the short-run while recurrent expenditure had a greater impact than capital expenditure on GDP in the long-run. Similarly, Maku (2014) examined the link between government spending and economic growth in Nigeria and found out that private and public investments have no significant effect on economic growth during the period under review and therefore suggested that government spending should be channeled to other viable ventures in order to influence economic growth significantly and positively in Nigeria especially on education and infrastructural facilities.

In the same vein, Chude and Chude (2013) investigated the effects of public expenditure in education on economic growth in Nigeria. The results revealed that total expenditure on education has a long run relationship and is statistically significant with economic growth in Nigeria. The study concluded that economic growth is clearly influenced by both exogenous and endogenous factors of the public expenditure in Nigeria. On the contrary, the findings of Otiwu, Chukwu and Okere(2018) revealed that little or no significant short run relationship exist between Nigeria's real public expenditure and level of economic growth. This indicates a negative short-run effect on the level of economic growth in Nigeria.

Okoro(2011) revealed that an increase in government expenditure on social and physical infrastructures improves economic growth. This implies that government spending on health and education improves labour productivity which in turn enhances sustainable national output. In line with the study above,Yusuf, Babalola and Aninkan(2015)submitted that the provision of infrastructure services to meet the demands of business, households, and other users is one of the major challenges hindering the development of most third world countries.Similarly, it was reiterated that Nigeria has the capacity to drive some of the world's investments into its economy, but due to the poor state of infrastructuraldevelopment and ugly institutional quality, this opportunity could not be duly explored to the fullest (Taiwo, 2014).

Thedeplorable conditions of the infrastructures are as a result of the declining government spending on infrastructure, institutional decay, vandalisation of government properties**,** corruption, bureaucratic bottlenecks, poor maintenance culture and complete neglect of repairs of damaged facilities (Ogunlana,Yaqub andAlhassan, 2016). The authors concluded that said conditions had significant negative impact on social wellbeing of people in the country.

Telecommunications infrastructureis left behind in this regard as its effect on economic growth was found to be positive and this showed that there is a significant causal link between telecommunications infrastructure and GDP, especially when a critical mass of telecommunications infrastructure is present (Roller, and Waverman, 2015). This implies that the prominence of telecommunication investment in the economy necessitated greater economic output.

Obasikene (2017) examined the impact of government expenditure on the Nigerian economy and the results of the findings revealed that government expenditure (capital and recurrent) have positive linear relationship with economic growth in Nigeria. Specifically, capital expenditure has significant positive effect on the growth of the Nigerian economy while recurrent expenditure has an insignificant positive effect on economic growth in Nigeria. Also, Egbetunde and Fasanya (2013) examined the short-run and long-run relationship between public expenditure and economic growth. The results showed that variables are bound together in the long run. The associated equilibrium correction was significant confirming the existence of long-run relationships but the impact of total expenditure on economic growth is negative which is consistent with some past research work while recurrent expenditure had a little positive impact on economic growth.

The extent at which capital formation affects economic growth in Nigeria cannot be over-emphasised (Sunny and Osuagwu, 2016).The authors' findings revealed that there is a significant positive short-run and long-run relationship between capital formation and economic growth in Nigeria. Against this background, the rate of savings was foundinsufficient to enhance economic growth in Nigeria (Sunny and Osuagwu, 2016). The results of the findings suggested that the government should encourage savings, create enabling investment climate and improve the

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infrastructural base of the economy to build capital formation that can promote sustainable growth.

III. METHODOLOGY

3.1 Model Specification

Following the empirical work of Musgrave and Musgrave (1989), the growth model adopted for this study is the Mankiw, Romer and Weil (1992). The basic growth model of a Cobb-Douglas production function is stated as:

$$Y = A\,K^{\alpha}L^{1-\alpha} \quad \text{---------- 1}$$

Where, Y is the level of output (proxy for GDP), A is the index of technical change which is the efficiency parameter, K is the capital stock and L is the labour supply. If $\alpha = 1$, then another variance of the production function is derived as

$$Y = AK \quad \text{---------- 2}$$

The above model is called AK model. Where, A is the level of technology and K is capital stock in the economy. Thus, the baseline empirical model of this study is as stated below

$$\mathbf{PCI = AK} \quad \text{---------- 3}$$

The model is a linear systemusing two factors inputs; capital stock (K) and desired level of technology to attain the desired level of Per Capita Income (PCI) - which is synonymous to per capita Gross Domestic Product (GDP) and is based on the fact that all production generates an equal amount of income for individual within an economy (Okoro,2011).

Therefore, the AK model can be used by making technical progress (A) a function of institutional quality (INSQ) influencing the growth of factor inputs. Then,

$$\mathbf{A = f(INSQ)} \quad \text{---------- 4}$$

Substituting equation (4) into equation (3)

$$\mathbf{PCI = f(INSQ, K)} \quad \text{---------- 5}$$

Also, the relationship between government spending on infrastructure (SINF) and aggregates output has been the subject of many theoretical and empirical studies. However, income per-capita which is a measure of economic well-being can best be evaluated through the effect of infrastructural spending on the citizens (Hassaballa, 2017).Thus, equation 3 becomes

$$\mathbf{PCI = f(INSQ, SINF)} \quad \text{---------- 6}$$

Where,PCI =Per Capita Income,SINF=spending on Infrastructure and INSQ = Institutional Quality.
However, to assess the relative effects of physical and social infrastructure on per capita income, the variable SINFis broken into its spending on physical (SPINF) and social (SSINF) components (Ogun, 2010).
The model is further transformed as:

$$\mathbf{PCI = f(SPINF, SSINF, INSQ)} \quad \text{---------- 7}$$

Rewrite equation 7in a mathematical form as

$$\mathbf{PCI_t = \alpha + \gamma SPINF_t + \beta SSINF_t + \theta INSQ_t + \varepsilon_t} \quad \text{---------- 8}$$

3.2 Technique of analysis

In order to determine the short-run and long-run relationships among the variables of interest, the Autoregressive Distributed Lags (ARDL) model developed by Pesaran, Shin and Smith (2001) was employed to capture the relationship in equation (8). The technique was developed by Pesaran and Shin (1998) and was improved upon a few years later by Pesaran et al., (2001).

3.2.1 Short Run and Long Run Impact of Capital expenditure on infrastructure and Institutional quality on Per capita income

To examine the short run and long run effects among Capital expenditure on infrastructure, Institutional quality and Per capita income, the study follows the work of Egbetunde and Fasayan (2013) using an Autoregressive Distributed Lags (ARDL) model approach to co-integration analysis and is written as:

$$\begin{aligned}\Delta PCI = \alpha_0 &+ \sum_{i=1}^{\rho} \varphi_i \Delta PCI_{t-i} \\ &+ \sum_{i=1}^{\rho} \beta_i \Delta SPINF_{t-i} \\ &+ \sum_{i=1}^{\rho} \tau_i \Delta SSINF_{t-i} \\ &+ \sum_{i=1}^{\rho} \theta_i \Delta INSQ_{t-i} + \delta\ PCI_{t-1} \\ &+ \delta_2 \ln SPINF_{t-1} + \delta_3 \ln SSINF_{t-1} \\ &+ \delta_4 INSQ_{t-1} + e_t \quad \text{---------- 9}\end{aligned}$$

IV. EMPIRICAL ANALYSIS

4.1 Unit Root Test Results

The ADF results show that spending on physical infrastructure (LSPINF) is significant at

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Volume 4, Issue 7 July 2022, pp: 435-442 www.ijaem.net ISSN: 2395-5252

levels I(0), while PP result also shows that the variable is significant at I(0). These careful inferences and assertions were made since the t-statistic values are more than the t-critical values.

Table 1: Unit Root Test Results

	ADF			PP		
Variables	**Level**	**First Difference**	**Status**	**Level**	**First Difference**	**Status**
LPCI	-0.7133	-3.7509	I(1)	-0.8120	-3.8205	I(1)
	[0.8289]	[0.0082]*		[0.8017]	[0.0069]*	
LSPINF	-4.7419		I(0)	-3.8246		I(0)
	[0.001]*			[0.000]*		
LSSINF	-2.4627	-7.7567	I(1)	-2.2047	-7.7114	I(1)
	[0.1343]	[0.000]*		[0.2087]	[0.000]*	
LINSQ	-2.7842	-6.9247	I(1)	-2.7451	-7.0393	I(1)
	[0.0721]	[0.000]*		[0.0781]	[0.000]*	
Test critical values						
1% level		-3.6617				
5% level		-2.9604				
10% level		-2.6192				

Source: Author's computation from E-views 10, 2019

Note: * = 1%, ** = 5%, *** = 10% levels of significance

ADF = Augmented Dickey-Fuller test and PP = Philip-Perron test

The values in the squared bracket "[]" indicate the p-values

4.2 Cointegration Test

Having established from the unit root results that the time series data are integrated of orders I(0) and I(1). The paper, therefore, adopted Johansen cointegration techniques as suggested by Johansen and Juselius (1990). This study rejects the null hypothesis of no cointegration among the variables. The decision is hinged on the fact that Table 2 indicates that the value of Trace Statistic is higher than the corresponding Critical Value indicating two (2) cointegerating equations at 5% significance level respectively. Hence, the variables are cointegrated.

Table 2: Johansen Cointegration Test

No. of CE(s)	Eigenvalue	Statistic (Trace)	Critical Value (0.05)	Prob.**
None *	0.538625	54.55714	47.85613	0.0103
At most 1 *	0.435763	31.35083	29.79707	0.0329
At most 2	0.224129	14.1824	15.49471	0.0781
At most 3 *	0.196661	6.569343	3.841466	0.0104

Trace test indicates 2 cointegratingeqn(s) at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level

**MacKinnon-Haug-Michelis (1999) p-values

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4.3 Lag Length Criteria

The process was conducted in order to determine the optimum lag required to ensure serial correlation is removed from the estimation.The result of lag length criteria is shown In Table 3 below.

Table 3: Lag Length Selection Criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-25.9752	NA	0.0001	2.1411	2.3314	2.1993
1	57.0201	136.3494*	8.48e-07*	-2.6443	-1.6927*	-2.3534*
2	72.3927	20.8627	0.0000	-2.5995	-0.8866	-2.0758
3	89.1567	17.9615	0.0000	-2.6540	-0.1800	-1.8977
4	112.4351	18.2902	0.0000	-3.1739*	0.0614	-2.1849

* indicates lag order selected by the criterion

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

4.4 Long Run and Short Run Estimates of the Impact of Physical and Social Spending on Infrastructure and Institution on Per Capita Income in Nigeria

To achieve the relative impacts of physical and social public spendings on infrastructure on per capital income, an ARDL approach was employed. It becomes imperative to use ARDL bound test cointegration technique as it indicates long run and short run relationships among the variables including the error correction mechanism (ECM).

The bound test as shown in Table 4 indicates long run relationship among the variables in the model. The F-statistic (3.93) falls outside the upper bound critical value (3.67) at 5% level of significance. We therefore reject the null hypothesis of no long run relationship and accept the alternate hypothesis of long run relationship among physical and social public spending on infrastructure on per capita income.

The long run results as evident in Table 5 showed that the coefficient of physical spending on infrastructure (LSPINF) had negative and significant effect on per capita income (LPCI) at 5% level. The implication is that a unit change in physical infrastructure spending will reduce per capita income by 17.5 percent. The results support the submissions of Gaal and Afrah, (2017) that physical capital infrastructure spending is less relevant to the goal of increase in per capita income. Also, the result is in line with the study of Ogunlana, Yaqub and Alhassan,(2016) which opined that the negative relationship shows the deterioration in public utilities, which suggests that expenditure on physical infrastructure has not yielded positive results over time.

On the other hand, expenditure on social infrastructure (LSSINF) in the long run has positive and significant effect on per capita income (LPCI) at 5% level of significance. The implication of this is that a unit change in social spending on infrastructure will result in an increase in per capita income by 33.5 percent. In other words, the level of social infrastructural investment has a very strong positive influence on per capita growth in the country. This support in strong terms, the views of Ogun (2010) that investment in social infrastructure has greater potential to increase per capita income. This result also aligns with findings from Igwe et al. (2013) and Akinbobola, Adedokun and Akinrinade (2017). However, institutional quality (LINSQ) produced positive but insignificant long run relationship with per capita income in Nigeria. This result is in line with the study of Obasikene, (2017) which found that public corruption increases private entrepreneurial activity and thereby increase per capita income.

In Table 5, less significant variables in the full short run estimated model based on the optimal lag length were removed in order to estimate our parsimonious regression. The short run estimates showed that the present year value of physical infrastructure spending had negative and significant effect on per capita income at 5% level of

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significance. That is, a unit change in spending on physical infrastructure will lead to a decrease in per capita income by 4.8%. While, the immediate past year value of physical infrastructure spending has positive and significant relationship with per capita income in the short run at 5% level indicating that any unit change in physical infrastructure spending will result in an increase of 9.3% in per capita income. This is in line with the views of Otiwu, Chukwu and Okere, (2018). The results of the short run current year value of social expenditure on infrastructure have positive but insignificant relationship with per capita income. A unit change in social investment on infrastructure leads to 1.8 percent change in per capita income. This was also established by Sunny and Osuagwu (2016).

The short run result of institutions has insignificant positive effect on per capita income, that is, a unit change in institutional quality will result in 7.6 percent increase in per capita income. This result is in line with the findings of Maku (2014) that weak institutions can be positive in terms of stable and mutually beneficial exchanges of government privileges for bribes and kickbacks and also ease the stress of bureaucratic bottlenecks, which results in increase investment and per capita income. Empirical evidence shows that these variables are not significant in the short run.

Consequently, the coefficient of the error correction model (ECM), which is the speed of adjustment of per capita income of changes in explanatory variables in the model, shows a negative coefficient value of $ECM_{t.1}$ (-0.28). This indicates that the long run relationship is stable and any disequilibrium formed in the short run will be temporary and corrected over a period of time. The result is found to be negative and significant at 5% level; confirming the existence of a long run relationship among public expenditure on infrastructure, institution and per capita income in Nigeria. The value of the ECM (-1) shows that about 28% of disequilibrium errors are corrected.

Table 4: ARDL Bound Test

F-Bounds Test		Null Hypothesis: No levels of relationship		
Test Statistic	Value	Signif.	I(0)	I(1)
F-statistic	3.9299	10%	2.37	3.2
K	3	5%	2.79	3.67
		2.50%	3.15	4.08
		1%	3.65	4.66

Source: Author's computation from E-views 10, 2019

Table 5: ARDL Short Run and Long Run (Restricted Constant and No Trend)

Dependent Variable: LPCI

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Short Run Estimate				
C	1.7136	0.7735	2.2154**	0.0361
D(LSPINF)	-0.0486	0.0206	-2.3630**	0.0262
D(LSSINF(-1))	0.0931	0.0293	3.1747*	0.0040
D(LINSQ)	0.0766	0.1706	0.4490	0.6573
D(LSSINF)	0.0182	0.0303	0.6006	0.5535
ECM(-1)	-0.2780	0.0766	-3.6300*	0.0013
Long Run Estimate				
LSPINF	-0.1747	0.0651	-2.6819**	0.0128
LSSINF	0.3348	0.0755	4.4324*	0.0002
LINSQ	0.2756	0.6036	0.4566	0.6519
C	6.1648	2.3409	2.6335**	0.0143

Source: Author's computation from E-views 10, 2019

Note: * = 1%, ** = 5%, *** = 10% levels of significance

V. CONCLUSION

The relative impacts of physical and social expenditure on infrastructureon per capita income in Nigeria were manifested by the long run relationship established by the Bound Test ARDL technique. It was evident from both long run and short run results that increase spending on physical infrastructure reduces the level of per capita income, that is, higher investment in infrastructure does not improve the level of per capita income in the country. The findings are against apriori expectation as physical infrastructure spending is expected to boost per capita income. The negative relationship in this result could be attributed to institutional problems, where funds are being diverted to other sources or mispropriated. Contrarily, spending on social infrastructure was found to have increased per capita income in Nigeria, that is, higher investment in social infrastructure results in improved per capita income. Thus, government should spend and invest more on social infrastructure than physical infrastructure.It is therefore recommended that increased investment should be made in education and health services to ensure increase in per capita income.

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