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Public Infrastructures: An Approach to Poverty Alleviation and Economic Development in Nigeria

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Abstract

Following an extensive debate on alleviating poverty in developing countries, this paper focus on how investment in public infrastructures could lead to poverty alleviation and consequently economic development. This paper emphasized the market-based growth popular amongst donor countries and looks at the issue from a direct approach to alleviating poverty through public intervention in the economy. Using Co-integration and Granger causality test for the period 1981 *to 2006, the findings revealed no existence of co-integrating vector in the series used. Public infrastructure was found Granger cause GDP, but fiscal deficit does not Granger cause GDP. Both RES and RESCS have strong causal effect on the real gross domestic product (GDP). The paper ascertained that public infrastructure expenditure significantly alleviate poverty directly through increase in gross domestic product (GDP). However, the paper maintained that continuous increase in public infrastructure through increase in capital expenditure on economic, social and community services and qualitative governance would alleviate poverty in Nigeria.*

Keywords: Public Infrastructure, Poverty Alleviation, Economic Development, Nigeria.

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1.0 Introduction

Public infrastructures provision to meet the demands of businesses, households and other users is one of the major challenges of economic development in the world. Infrastructure services-including power, transport, telecommunications, provision of water and sanitation and safe disposal of wastes are central to the activities of households and to economic production. This reality becomes evident when natural disasters or civil disturbance destroy or disable power stations, roads and bridges, telephone lines, canals and water mains. This outcome is frequently a consequence of inadequate incentives embodied in the institutional arrangement for providing these infrastructure services. The Lapses involved in the supplies of these services has a strong link to slow economic growth, poverty and environmental degradation.

Conceptually, infrastructure is broad term that embraces public investment in physical assets and social services (Ogun, 2010). Infrastructure services has been studied and considered important for ensuring that growth is consistent with poverty reduction; this is evident in the important for ensuring, that growth is consistent with poverty reduction; this is evident in the sense that poverty is not just an absolute lack of basic needs, but also exclusion from the goods, services, rights and activities which constitute the basis of citizenship.

However, the main thrust of this paper is to find out whether the increasing provision of public infrastructures which helps quality of life reduces poverty? Also this paper thus attempts to provide empirical evidence on the causal looks at the relationship between public infrastructures, poverty alleviation and economic development in Nigeria.

This paper is organized as follows. Section 2 reviews the theoretical framework and previous empirical studies on public infrastructure and poverty reduction with economic development linkage. Section 3 describes data set and methodology. Section 4 presents results and discussion. Finally, Section 5 provide conclusion and recommendations

2. Review

2.1 Theoretical Framework

In the literature, three theories abound on the effectiveness of public infrastructure on poverty reduction. The first theory argued that investment in education and health, which embraces investment in education and health, is more relevant to the goal of poverty reduction than physical infrastructure (Jahan and McCleery, 2005; Ogun, 2010). The second theory

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upholds that investment in both physical and social infrastructures reduce poverty (Jalilian and Wesis, 2004). The last theory maintains that investment in infrastructure in general has no effect in poverty (Jerome and Ariyo, 2004).

As earlier analyzed, infrastructure is important for ensuring that growth is consistent with poverty reduction. Access to at least minimal infrastructure services is one of the essential criteria for defining welfare. The poor can be identified as those who are unable to consume a basic quantity of clean water and who are subject to unsanitary surroundings with extremely limited mobility or communications beyond their immediate settlement. As a result they have more health problems and fewer employment opportunities. Access to clean water and sanitation has the most obvious and direct consumption benefits of reduction in mortality rate and morbidity. It also increases the productive capacity of the poor and can affect men and women in different ways. For example, the poor women in particular must commit large shares of their income or time to obtaining water and fuel win as well as to carrying crops to the market. This time could otherwise be devoted to high .priority domestic duties such as child care, or to income earning activities. Having access to transport and irrigation can contribute to higher and more stable incomes, enabling the poor to manage risks.

It is a reality to assert that, raising the productivity of farms and of rural transport, an increase ill the incomes of rural workers and reduction in food prices to the urban poor would be achieved. These were the results and consequences of the integrated rural development launched by 'the Babangida's administration in 1985. An adequate transport network reduces regional variation in food prices and the risk of famine by facilitating the movement of food from surplus to deficit areas. It has been observed (from studies carried out by the USA Agency for International Development in Botswana, Cape Verde and India) that the construction and maintenance of some infrastructure - especially roads and waterworks-can contribute to poverty reduction by providing infrastructure and would lead to a higher level of economic development. Relaxation centre, city halls, biological and botanical gardens designed for easing stress and holiday travel also helps indirectly in the workforce contribution to economic development. In 1984, 81 percent of the total populations of household’s in Nigeria were provided with electricity, out of 376km per million persons paved roads in 1988, 60 percent was in good condition (world development indicators. 1994). As these indicators improved, economic welfare and other development indicators improved notably.

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While there is still no consensus on the magnitude or on the exact nature of the impact of infrastructure on growth many studies on the topic have concluded that the role of infrastructure in growth is substantially significant, and frequently greater than that of investment in other forms of capital (World Development Report, 1994).

In a way, one would suggest that improvement in infrastructure will lead, to a higher economic growth. The relationship has not been confirmed yet in many developing countries, the provision of improved infrastructures, which leads to improvement in infant mortality rate, leading to rise in population figure, which consequently results in increased level of unemployment in developing countries would not improve or lead to increase economic growth but would instead lead to a fall in real per capital: income (Real GNP/Population). It should however be noted that, public infrastructures benefits outweighs its consequences.

Sectoral studies focusing on rural infrastructures effect on the local economy in certain developing countries have revealed more about the nature of the apparent benefits. It has been discovered by researchers that lower transport costs, increased farmers' access to market can lead to considerable agricultural expansion and that modern irrigation methods brought higher yields. At the same lime, because, improved communications (through roads) lowered banks' cost of doing business, banks expanded lending to fanners and farmers used the funds to buy fertilizer, further increasing yields.

All these are practically focusing economic growth. While households with electricity increased from 48 percent to 81 percent in 1984 and the population with access to safe water grew to 42 percent, of the total population in 1990 (World Development Indicators, 1994), growth of production averaged 4.6 percent in between 1970-80 and 2.3 percent in between 1980-92. These relationships suggest a potential payoff in terms of economic growth, yet they do not provide a basis for prescribing appropriate levels, or sectoral allocations, for infrastructure investment. Other evidence confirms that investment in infrastructure alone does not guarantee growth; several studies have revealed a low level returns for infrastructures on economic growth (Aschauer, 1993).

A number of studies have found also the causation runs in both directions (growth and infrastructures). Yet more sophisticated estimates that address these issues either have concluded that the positive results were not much affected by different economic methods or have found no noticeable impact of infrastructure on growth, a study of the economic returns to individual

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World Bank project shows that, when overall economic policy conditions are poor the returns to infrastructure investment decline. Returns are lower by 50 percent or more in countries where conditions are more favourable. In this case, most developing countries (Nigeria inclusive) fall into the category of countries with restrictive trade policies and therefore would not expect infrastructure development impact, felt much on the indices of economic growth (GDP).

Infrastructure spending cannot, therefore overcome a weak climate therefore overcome a weak climate for economic activity immediately, but overtime, an improved or multiplier effect on productive activities. It has been noted also that the adequate quantity and reliability of infrastructure are key factors in the ability of countries to compete international trade even in traditional commodities. In pact, because of infrastructure problems, shipping costs from African to Europe are 30 percent higher for plywood than those from Asia to Europe.

These costs are being borne by exporters. In this sense, imported items cost relatively higher than what would obtain in Asia. The completion for new export markets is especially dependent on high-quality infrastructure. During the past two decades, increased globalization of world trade policies has arisen not only from the liberalization of trade policies in many countries but also from major advances in communications, transport, and storage technologies. These advances centre on management of logistics to achieve cost savings in inventory and working capital and to respond in inventory and working capital and to respond more rapidly to customer demand. It is in this capacity that we can justify the direct relationship between infrastructure investments and a sustained economic growth.

3.2. Review of Related Literature

There have been extensive and wide ranges of literature on the direct and active reduction of poverty alleviation through infrastructure development. The controversial issue has been whether alleviating poverty through infrastructure development lead to economic growth or otherwise in the past two decades of poverty research in developing countries. There has been a better appreciation of the fact that policies fostering economic growth need not be inconsistent with reducing poverty. In many countries (in East and South East Asia) growth-promoting policies have substantially reduced mass poverty (Ogun, 2010).

Lipton and Ravallion (1995) report estimates for eight developing countries (Bangladesh, Brazil, Cote'd Ivore, India, Indonesia, Morocco, Napal and Tunisia) revealed that a 2 percent

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annual rate of growth in consumption per person will typically result in decline in the poverty lines and assuming growth to be distributional neutral. The effects of growth on inequality depends, of course on the initial distribution of assets, the nature of imperfections in markets (particularly the capital market) the pattern of growth, factor bias in technology and government policies (on say, social welfare and openness to international competition). In general, the most important way for economic growth to help the poor is by expending their opportunities for productive infrastructures, and this will indirectly result to an increased and sustainable economic development.

Tendler (1979) asserted in his research on some developing countries that the promotion of rural electrification (RE) projects in development assistance programmes (World Bank) will promote integrated rural development significantly by encouraging productive municipal as well as traditional household, electricity usages. In a similar joint research project, Butler, Poe and Tendler (1980) though discovered in Bolivia that the positive impact of rural electrification project was social and that electrical power did not appear to play a catalytic role in economic development nor was it a precondition for it. He did however tail to note that electrification projects should be linked to other development activities.

Adeniji (1983) explored the relationship between transportation and economic growth in the context of Nigeria, using annual data set on real GDP and expenditure on transportation for the period of 1975 to 1983. The estimated result of the relationship shows significant and positive relationship between transportation and real GDP in Nigeria. Several other studies have been conducted on the efficiency, operational characteristics and economic effects of urban transport systems in Nigeria (Adeyemo, 1991; Olarewaju, Fadare, Akinlo & Alawode, 1995).

Olarewaju, Fadare, Akinlo & Alawode (1995) concluded in their study on transportation system in Nigeria that a tail based mass transit mode, is the appropriate response to the urban mobility crises in Lagos metropolis “It is a well known fact that, the 3rd mainland bridge constructed some years has improved and eased logistic inadequacies in Lagos”. This again will have indirectly contributed immensely to improved and timely services of economic units.

In many Third World cities, nearly half of the population is living in slum and squatter settlement (see Appendix 1). More than one-quarter of the inhabitants in most large cities are estimated to be living in absolute poverty (Oberai, 1992). Peter Van Dijk (1995) asserted in his study of development perspectives in Africa that economic development is important for the

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reduction of poverty in developing countries. He confirmed that the urban informal sector is one way in which economic development filters, through to the poorer sections of the population.

The United Nation study in 1991 revealed that nearly 45% of the 5.1 billion populations of the developing countries will be living in the urban areas but by the year 2025 it could have the highest percentage of 53% of the total population (United Nations, 1991). Most population distribution policies designed showed limited success so far. The implications of these demographic trends for employment creation, provisions of loud and housing, social services and protection of the urban environment are staggering.

Urbanization has created new opportunities and the development of the urban informal sector can contribute to economic growth. Peter Van Dijk (1995) concluded that governments should formulate and implement macroeconomic policies necessary to create conditions and a more positive attitude for economic growth in the informal sector of the urban areas.

Recognizing the harm to health, economic productivity, and quality of life that can result from inadequate water supplies, international donors and the government of developing countries have mounted numerous efforts to correct the problem. The international community affirmed its commitment to improving quality of life and poverty alleviation. It is imperative to note that though the relative returns to government from investments in public infrastructures is low, once the public expenditure programmes is however directed towards the poor, the multiplier effect is felt on productive activities.

A study traced public social sector expenditures for nine Latin American countries in the 1980s. It found that real per capita public social spending on health education and social security fell during some pan of the 1980s in every country in the study. The share of health and education expenditures in total government expenditures also fell, even as that of social security rose. In spite of lower returns, equity and efficiency of social service indicators generally improved in the 1980s. Possible explanations for this paradox include measurement error, time lags, the current reaping of the benefits of past investments in women education and in water and sewerage systems, technological innovation the growing role of non-governmental organization and the response of the market-oriented private sector to enhanced expectations and demand (Grosh, 1990). Hence, raising investments in public expenditures is an important conduct for reducing poverty.

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3. Econometric Methodology

3.1 Model Specification

This paper adopted a Vector Autoregressive (VAR) framework to achieve the empirical results. The choice of a VAR model will help us obtain quality economic properties, strong statistical inference and sound economic postulate of the specified model.

Following Jahan and Mcleery (2005), the impact of infrastructure on economic growth and poverty reduction takes the form of first-round effects followed by subsequent impacts. The primary model showing the effect of public infrastructure on poverty reduction and economic development is specified thus:

$$GDP = f(RES, RESCS) \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (Eq. 1)$$

Where:

GDPt is Gross domestic product as proxy for economic development

RESt is real per Capital Expenditure on Economic Service used as proxy for infrastructure

RESCSt is real per capital expenditure on social and community services, another proxy for infrastructure

In any economy the extent to which infrastructure leads to poverty reduction through economic growth depends on the quality of governance and the institutional setting. Hence, quality of governance proxy by level of fiscal deficit (FD) is included as an important explanatory variable in our test model. Therefore, the model above will be transformed into the new model presented below:

$$GDP = f(RES, RESCS, FD) \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (Eq. 2)$$

In a more explicit and econometric form, equation (2) can be stated as

$$GDP_t = \alpha_0 + \alpha_1 RES + \alpha_2 RESCS + \alpha_3 FD + \varepsilon_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (Eq. 3)$$

Where

FD is Fiscal deficit as proxy for quality of governance

t is the time trend

ε_t is the random error term

3.2 Description of Data and Sources

To capture the effect of public infrastructure on poverty reduction through economic development, Economic development was proxied by the GDP; Real per Capital Expenditure on

Economic Service and Real per Capital Expenditure on Social and Community Services are used as proxy for Public Infrastructure. The data covers the period from 1981 to 2006. All the variables are taken annual basis from various issues of Central bank of Nigeria (CBN) Statistical Bulletin.

3.3 Estimation Technique

3.3.1. Unit Root Test

First, the Augmented Dickey Fuller (ADF) tests (Dickey and Fuller, 1981) and Phillips-Perron (PP) tests (Phillips and Perron, 1988) are used to test the level of stationarity or order of integration of the variables under consideration. The ADF test is based on the following regressions.

$$\Delta y_t = \alpha_0 + \alpha_i y_{t-1} + \sum_{i=1}^{n} a_i \Delta y_t + \varepsilon_t \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (Eq.4)$$

$$\Delta y_t = \alpha_0 + \alpha_i y_{t-1} + \sum_{i=1}^{n} a_i \Delta y_t + \delta t + \varepsilon_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (Eq.5)$$

From the equations above, y is a time series, t is a linear time trend, Δ is the first difference operator, α_0 is a constant, n is the optimum number of logs in the dependent variable and ε_t is the random error term. The difference between equation (3) and (4) is that the equation 3 includes just drift. However, the equation 4 includes both drift and linear time trend. This study also employs the Philip-Perron (PP) test due to Phillips (1987) and Phillps and Perron (1988). Since the possibility of the presence of structural breaks makes the ADF test unreliable for testing stationarity. The presence of a structural break will tend to bias the ADF test towards non-rejection of the null hypothesis of a unit root. The regression equation for the PP test is given by

$$\Delta y_t = \alpha_0 + \beta_i y_{t-1} + \varepsilon_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (Eq.6)$$

3.3.2 VAR Co-integration Test

Secondly, we test the presence or otherwise of co-integration between the variables of the same order of integration through forming a co-integration regression equation. The existence of long-

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run equilibrium (stationary) relationships among economic variables is referred to in the literature as co-integration. The Johansen procedure was employed to examine the issue of co-integration and provide not only an estimation methodology but also explicit procedures for testing for the number of co-integrating vectors as well as for restrictions suggested by economic theory in a multivariate setting. Engel and Granger (1987) pointed out that a linear combination of two or more non-stationary variables may be stationary. If such a stationary combination exists, then the non-stationary time series are said to be co-integrated. The VAR based co-integration test using the methodology developed in Johansen (1991, 1995) was used.

Johansen's methodology takes its starting point in the vector auto regression (VAR) of order P given by

$$y_t = \mu + \Delta_1 y_{t-1} + \ldots\ldots\ldots + \Delta_p y_{t-p} + \varepsilon_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (Eq.7)$$

Where

y_t is an nx l vector of variables that are integrated of order commonly denoted (1) and ε_t is an nx 1 vector of innovations.

This VAR can be rewritten as

$$\Delta y_t = \mu + \eta_{yt-1} + \sum_{i=1}^{p-t} \tau_i y_{t-1} + \varepsilon t \ldots\ldots\ldots\ldots\ldots\ldots (Eq.8)$$

Where

$$\eta = \sum A_{i-1} \quad and\ \tau_i = -\sum_{i=l+1}^{p} A j$$

To determine the number of co-integration vectors, Johansen (1988, 1989) and Johansen and Juselius (1990) suggested two statistic tests, the first one is the trace test (λ trace). It tests the null hypothesis that the number of distinct co-integrating vector is less than or equal to q against a general unrestricted alternatives q = r. the test calculated as follows:

$$\lambda\ trace\ (r) = -T \sum_{i=r+1} In\ (1 - \hat{\lambda}) \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (Eq.9)$$

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Where

T is the number of usable observations, and the $\lambda_{I,s}$ are the estimated eigenvalue from the matrix. The Second statistical test is the maximum eigenvalue test (A max) that is calculated according to the following formula

$$\lambda \max(r, r+1) = -T\ In\ (1 - \lambda r + 1) \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots (Eq.10)$$

The test concerns a test o the null hypothesis that there is r of co-integrating vectors against the alternative that r + 1 co-integrating vector.

3.3.3. VAR and Granger-Causality

After testing for co-integration, we test for causality between the variables. One implication of Granger representation theorem is that if two variables, say X_t and Y_t are co-integrated, an Error Correction term (ECT) is required to be included (Granger, 1988) in the following bivariate autoregression:

$$GDP_t = \alpha_0 + \sum_{i=1}^{n} \alpha_{1t}\ GDP_{t-1} + \sum_{i=1}^{n} \alpha_{2t} RES_{t-1} \sum_{i=1}^{n} \alpha_{3t} RESCS_{t-1} + \sum_{i=1}^{n} \alpha_{4t} FD_{t-1} + ð_1 ECT_{t-1} + \varepsilon_t \ldots \ldots (Eq.11)$$

$$RES_t = \alpha\beta_0 + \sum_{i=1}^{n} \beta_{1t}\ GDP_{t-1} + \sum_{i=1}^{n} \beta_{2t} RES_{t-1} \sum_{i=1}^{n} \beta_{3t} RESCS_{t-1} + \sum_{i=1}^{n} \beta_{4t} FD_{t-1} + ð_2 ECT_{t-1} + \varepsilon_t \ldots (Eq.12)$$

$$RESCS_t = \varphi_0 + \sum_{i=1}^{n} \varphi_{1t}\ GDP_{t-1} + \sum_{i=1}^{n} \varphi_{2t} RES_{t-1} \sum_{i=1}^{n} \varphi_{3t} RESCS_{t-1} + \sum_{i=1}^{n} \varphi_{4t} FD_{t-1} + ð_3 ECT_{t-1} + \varepsilon_t (Eq.13)$$

$$RESCS_t = \psi_0 + \sum_{i=1}^{n} \psi_{1t}\ GDP_{t-1} + \sum_{i=1}^{n} \psi_{2t} RES_{t-1} \sum_{i=1}^{n} \psi_{3t} RESCS_{t-1} + \sum_{i=1}^{n} \psi_{4t} FD_{t-1} + ð_4 ECT_{t-1} + \varepsilon_t (Eq.14)$$

Where:

GDPt is Gross Domestic Product

RES is the real per Capital Expenditure on Economic Service used as proxy for infrastructure;

RESCS is the real per capital expenditure on social and community services, another proxy for infrastructure;

FD is the fiscal deficit;

The term ECT_{t-1} is the error correction term derived from the long-run co-integrating relationship in equation 3. Note that the estimate $ð_1$, $ð_2$, $ð_3$, and $ð_4$ can be interpreted as the speed of

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adjustment. According to Johansen and Juselius (1987), the existence of co-integration implies the existence of causality relation between the variables under constraint > 0. If co-integration relationship between the variables GDPt, RESt, RESCSt and FDt, does not exit, the term ECT will be removed and the bivariate autoregression equation (13) and (14) becomes:

$$GDP_t = \alpha_0 + \sum_{i=1}^{n} \alpha_{1t}\ GDP_{t-1} + \sum_{i=1}^{n} \alpha_{2t} RES_{t-1} \sum_{i=1}^{n} \alpha_{3t} RESCS_{t-1} + \sum_{i=1}^{n} \alpha_{4t} FD_{t-1} + \varepsilon_t \ldots\ldots\ldots (Eq.15)$$

$$RES_t = \alpha\beta_0 + \sum_{i=1}^{n} \beta_{1t}\ GDP_{t-1} + \sum_{i=1}^{n} \beta_{2t} RES_{t-1} \sum_{i=1}^{n} \beta_{3t} RESCS_{t-1} + \sum_{i=1}^{n} \beta_{4t} FD_{t-1} + \varepsilon_t \ldots\ldots\ldots (Eq.16)$$

$$RESCS_t = \varphi_0 + \sum_{i=1}^{n} \varphi_{1t}\ GDP_{t-1} + \sum_{i=1}^{n} \varphi_{2t} RES_{t-1} \sum_{i=1}^{n} \varphi_{3t} RESCS_{t-1} + \sum_{i=1}^{n} \varphi_{4t} FD_{t-1} + \varepsilon_t \ldots\ldots (Eq.17)$$

$$RESCS_t = \psi_0 + \sum_{i=1}^{n} \psi_{1t}\ GDP_{t-1} + \sum_{i=1}^{n} \psi_{2t} RES_{t-1} \sum_{i=1}^{n} \psi_{3t} RESCS_{t-1} + \sum_{i=1}^{n} \psi_{4t} FD_{t-1} + \varepsilon_t \ldots\ldots\ldots (Eq.18)$$

Rejecting (accepting) Ho; $\alpha_{21} = \alpha_{22} = \ldots\ldots\ldots\ldots\ldots = \alpha_{2m}$ through Ho; $\psi_{21} = \psi_{22} = \ldots\ldots\ldots = \psi_{2m}$ in equations (11, 12, 13, and 14) or equations (15, 16, 17, and 18) suggests that the variables do (do not) Granger cause one another. These tests enable us to reveal the relationship of no causality, unidirectional causality of feedback causality between the variables.

Empirical Analysis

4.1. Unit Root Test

First is to test if the relevant variables in equation (2) are stationary and to determine their orders of integration. We use both the Augmented Dickey Fuller (ADF) and Phillips - Perron (PP) tests to find the existence of unit root in each of the time series. The results of both the ADF and PP tests are reported in Table 4.1.1 and 4.1.2.

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Table 4.1.1: Unit Root test

Variables	ADF (Intercept and Trend)	PP (Intercept and Trend)	Order of integration
FD	-2.793(-4.394)*	-2.298(-4.374)*	1(0)
LGDP	-2.615(-4.374)*	-4.055(-4.374)*	1(0)
LRES	- 2.538(-4.374)*	-4.701(-4.374)*	1(0)
LRESCS	-3.759(-4.374)*	-4.700(-4.374)*	1(0)

Note: Significance at I % level. Figures within parenthesis indicate critical values.
Mackinnon (1991) critical value for rejection of hypothesis of unit root applied.
1(0) indicates integration at levels.
Source: Authors' Estimation using Eviews 6.0.

The result in table 4.1.1 shows that all the variables were not stationary in levels. This can be seen by comparing the observed values (in absolute terms) of both the ADF and PP test statistics with the critical values (also in absolute terms) of the test statistics at the 1 %, 5% and 10% level of significance. Result from table 1 provides strong evidence of non stationarity. Therefore, the null hypothesis is accepted and it is sufficient to conclude that there is a presence of unit root in the variables at levels, following from the above result, all the variables were differenced once and both the ADF and PP test were conducted on them, the result as shown in table 4.1.2

Table 4.1.2: Unit Root test

Variables	ADF (Intercept and Trend)	PP (Intercept and Trend)	Order of Integration
FD	-4.541(-4.416)*	-4.418(-4.394)*	1(1)
LGDP	-5.367(-4.394)*	-8.295 (-4.394)*	1(1)
LRES	-4.242(-4.394)*	-8.916(-4.394)*	1(1)
LRESCS	-4.990(-4.394)*	-9.015(-4.394)*	1(1)

Note: * denotes Significance at 1%. Figures within parenthesis indicate critical values.
Mackinnon (1991) critical value for rejection of hypothesis of unit root applied.
1(1) indicates integration at first difference
Source: Author's Estimation using Eviews 6.0.

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Table 4.1.2 above reveals that all the variables were stationary at first difference, on the basis of this, the null hypothesis of non-stationary is rejected and it is safe to conclude that the variables are stationary. This implies that the variables are integrated of order one, i.e. 1 (1).

4.2. Cointegration Test Result

Having confirmed the stationarity of the variables at 1(1), we proceed to examine the presence or non-presence of cointegration among the variables, when a cointegration relationship is present, it means that gross domestic product, real per capital expenditure on economic service, real per capital expenditure on social and community services and fiscal deficit, share a common trend and long-run equilibrium as suggested theoretically. We started the cointegration analysis by employing the Johansen and Juselius multivariate cointegration test. Table 4.2.1 and 4.2.2 shows the result of the cointegration test. In the tables both trace statistic and maximum Eigenvalue statistic indicates no cointegration at the 5 percent level of significance, suggesting that there is no cointegrating or long run relations between the variables so tested (i.e.FD,LGDP, LRES and LRESCS)

Table 4.2.1: Unrestricted Cointegration Rank Test (Trace)

Hypothesized No.of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None	0.539290	39.13311	47.85613	0.2550
At most 1	0.395930	20.53346	29.79707	0.3874
At most 2	0.296296	8.435887	15.49471	0.4200
At most 3	9.84E-05	0.002361	3.841466	0.9591
Trace test indicates no cointegration 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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Table 4.2.2: Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None	0.539290	18.59965	27.58434	0.4461
At most 1	0.395930	12.09757	21.13162	0.5380
At most 2	0.296296	8.433525	1426460	0.3363
At most 3	9.84E-05	0.002361	3.841466	0.9591
Max-eigenvalue test indicates no co integration at the 0.05 level				
*** denotes rejection of the hypothesis at the 0.05 level**				
****MacKinnon-Haug-Michelis (1999) p-values**				

4.3. Granger Causality Test Result

Table 4.3.1: Pair-wise Granger Causality test between LGDP and LRES

Null Hypothesis:	Obs	F-Statistics	Probability
LRES does not Granger LGDP	24	7.64378	0.0049
LGDP does not Granger LRES		1.06014	0.3660

The result obtained from the Granger causality test in table 4.3.1 revealed that gross domestic product does not Granger cause real per capital expenditure on economic service. On the other hand, real per capital expenditure on economic service Granger causes gross domestic product (proxy for development, hence poverty reduction) in Nigeria. This indicates that causality runs from real per capital expenditure on economic service to gross domestic product.

The model was estimated using two lags for the variables. Granger-causality results reported in Table 4.3.1 suggest that the null hypotheses that real per capital expenditure on economic service (RES) does not Granger cause Gross domestic product (GDP) is rejected, which indicates that causality runs from increase in infrastructure to increase in gross domestic product, hence poverty reduction.

According the results obtained from the Granger causality test, the real gross domestic product does not Granger cause the real per capital expenditure on economic service in Nigeria. On the other hand, the real per capital expenditure on economic service Granger causes the real gross domestic product. These results were statistically significant for both data samples. Based

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on these results, we can conclude that the government policy on infrastructural development, which would like to influence the real per capital expenditure on economic service, should not use the real gross domestic product to conduct its policy. Nigeria is yet to attain development and there is evidence of high level of poverty among the citizen.

Table 4.3.2: Pair-wise Granger Causality test between LGDP and LRESCS

Null Hypothesis:	Obs	F-Statistics	Probability
LRESCS does not Granger LGDP	24	5.99572	0.0123
LGDP does not Granger LRESCS		0.14344	0.8673

Following the result table 4.3.1, the null hypothesis that real per capital expenditure on social and community services (LRESCS) does not Granger cause LDGP is rejected but LGDP does not Granger cause LRESCS, further confirming a unidirectional causality from real per capital expenditure on social and community services (proxy of infrastructure provision) to GDP.

Table 4.3.3: Pair-wise Granger Causality test between LGDP and FD

Null Hypothesis:	Obs	F-Statistics	Probability
FD does not Granger LGDP	24	0.19428	0.8250
LGDP does not Granger FD		0.31235	0.7354

Granger-causality results reported in Table 4.3.3 shows fiscal deficit (FD) does not Granger cause real gross domestic product and also real gross domestic product does not Granger cause fiscal deficit, which indicates that causality does not run from either of the variable.

5. Conclusion

The paper has empirically attempted to investigate the public infrastructure: an approach to poverty alleviation and economic development in Nigeria by employing the cointegration and Granger-causality test; using annual data for the period 1981-2006. The Johansen multivariate cointegration test indicates no cointegration or long run relationship between public infrastructure proxy by real per capital expenditure on economic service and real per capital expenditure on social and community services and poverty alleviation and economic

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development in Nigeria. The Granger causality test results show that causality run between public infrastructure and poverty alleviation and economic development in Nigeria.

The results suggest that real gross domestic product in Nigeria increases as government expenditure on infrastructure increases. According to Bruno, Squire and Ravallion (1995) policies that are designed to foster economic growth will significantly aimed at specifically alleviating poverty. As expenditure on public infrastructure increases, there is also the increase in gross domestic product (i.e. economic development), hence a decline in the level of poverty. This means that if government expenditure on public infrastructure fall the real gross domestic product of the country will equally fall. This may result to poverty incidence.

Empirically, we find support in for influence of public infrastructure on poverty alleviation and economic development. The result of VAR-Granger causality at two lag periods confirmed a unidirectional causality running public infrastructure (i.e. RES and RESCS) to economic development, hence poverty reduction. The paper gives support to the arguing for public infrastructure expansion in the country.

However, for infrastructural investment to lend to economic growth and ultimate development maintenance culture should be imbibed in Nigeria or otherwise public spending would only outrageously be inflationary. In deciding on public spending for infrastructure, policy makers should frequently and sufficiently look beyond the near-term impacts but the overall long-run impact, because when public spending on infrastructures is not adequately utilized, it can crowd out more productive investment in other sectors and this will be harmful and a recession in those sectors become feasible.

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APPENDIX 1

Percentage of Population Living in Slums and Informal Settlements in Selected Cities

Countries/Capital cities	Year	Percentage (%)
Addis Ababa	1980	85
Bombay	1988	57
Cairo	1980	84
Delhi	1981	50
Lagos	1981	58
Manila	1980	40
Mexico	1980	40
Nairobi	1986	36
Sao Paulo	1980	32
Seoul	1988	12

Sources: (ILO, Nega city survey, 1990); United Nations Centre for Human Settlements (Habitat), Global reports on human settlements, 1986, Table 5.1, 'Table 5.18 and several country reports.

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