An empirical analysis of transport infrastructure investment and economic growth in Nigeria

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Abstract: The paper investigated the impact of public sector investment in transport on economic growth, using Nigeria as a case study. The empirical model for the study was developed from the endogenous growth framework in which transport investment entered into the production function as input, using the Ordinary Least Squares (OLS) estimation technique and time series properties tests conducted on variables. Data for the study covered from 1977 to 2009. The findings showed that transportation played an insignificant role in the determination of economic growth in Nigeria. An increase in public funding and complete overhauling of the transportation system in the country are suggested.

Keywords: Infrastructure, Investment, Transport, Economic Growth

1. Introduction

Earlier thought of investment was considered as the adjustment from a given level of capital that plays a critical part in economic growth models and is an essential component of aggregate demand that also has considerable effect on economic activities both in the short and the long run [1] and [2]. Recognition has been given to the relevance of infrastructure in determining economic development and growth over a long time. Recent literature is also replete with studies on the role of public and private investment and their impact on economic growth. Both public and private investment have been shown to have a positive impact on economic growth in long run, but in the short run only the private investment has a significant relationship with growth [3], [4], [5] and [6]. Reference [7] in particular argued that much as of 1970s, the decline in productivity in the United States of America (U.S.A) and other developed economies heightened especially highway and other transport infrastructure. This further posits investment analysis as an impetus for empirical research into the relationship between economic growth and infrastructure.

Earlier thought of investment was considered as the adjustment from a given level of capital that plays a crucial role in the models of economic growth and it is an essential component of aggregate demand that also has considerable effect on economic activities both in the short and the long run [1] and [2]. The benefits and importance of infrastructure to economic growth have been recognized for a long time. Recent literature is also replete with studies on the role of public and private investment and their impact on economic growth. Both public and private investment have been shown to have a positive impact on economic growth in long run, but in the short run only the private investment has a significant relationship with growth [3], [4], [5] and [6]. Reference [7] in particular argued that much of the decline in productivity in the United States of America (U.S.A) and other industrial countries that occurred in the 1970s was precipitated by dwindling rates of public capital investment, particularly in highway and other transportation infrastructure. This further posits investment analysis as an impetus for empirical research into the relationship between economic growth and infrastructure.

Reference [8] identified two schools of thought with
respect to the link between infrastructure and economic growth. Firstly, the Keynesian school starts with the notion that any income or infrastructure can only be generated by economic growth itself in the first place. On the other hand, the Neo-Classical approach treats infrastructure as a production factor in the same style as labour and capital, as embedded within the Endogenous Growth Theory.

However, the jury is still out on the link between the growth of the economy and the provision of infrastructure. Some authors contended nonexistent link or indeed weak linkage. Reference [9] also argue for non-provision of public infrastructure.

Good transportation infrastructure is essential in economic development. It promotes factor mobility and reduces trade costs. In addition, it promotes market integration, thereby providing avenue for the reduction of price volatility and reallocation of resources in line with comparative advantage. Investments in transportation infrastructure can also influence the productive capacity through its use as a direct input in the production process thereby increasing such resources. For example, a newly constructed road allows goods to be transported to market quicker thereby reducing the total cost of production and transportation. The creation of infrastructure can on the other hand, determine the national output. The generation of intermediate products and attendant multiplier effect may cause this to happen. Indirectly, such infrastructure can also enhance the productivity of existing resources. Furthermore, it can lead to “agglomeration effect” which is the magnetic or catalytic pull or attraction of resources from other regions to the area of infrastructural development by lowering production and distribution costs, stimulating private investments, improving labour productivity and engendering technological innovations. In the light of the considered effect of transportation infrastructure on economic growth, there is the need to empirically examine whether transportation capital causes economic growth causality in the Nigerian case.

Earlier
2 macro-econometric studies on the roles of public infrastucture investments in economic growth, mostly from the developed countries have adopted aggregate time series. Reference [7] expanded the 2 conventional production function to include the public capital or its components while [10] also utilized 2Cobb-Douglas production function with an assumption of constant return to scale across all inputs

Earlier functional studies on the investments in public infrastructure from the developed economies deployed aggregate time series. Reference [7] expanded the production function in its conventional form to include the public capital. Reference [10] in addition, assumed constant return to scale for all the inputs, utilising the Cobb-Douglas production function. However, serious methodological problems often beset such analysis as spurious correlation (non-stationarity) is usually manifested. Attempts at correcting the non-stationarity problem by first differencing of time series data was bedeviled with the problem of working only on the short run relationship between and among the series. The opinion expressed by [11] was that given the lack of robust data, time series data are of limited use.

Another approach that has been proposed for examining infrastructure is the growth nexus. This is the use of cost function method that avoids the multi-collinearity problem may cause spurious results arising from biases in the estimated coefficient. The problem of causality may also arise. However, this may not arise when using production function approach because the inputs prices instead of quantities are exogenously determined. However, [12] posited that cost functions require the assumption of an optimal mix of inputs which is more plausible for applications to individual firms opted a (micro data) than to aggregate or even industry-level data.

Our approach in this study is the use of a variant of augmented Solow model econometric framework employed by [13] to scrutinize the relationship between economic growth and investment in transport infrastructure in developing countries using Nigeria as the case study. We decomposed capital investment into three types, namely private capital, transport and other public capital investment.

We are interested in investigating the determinants of growth. The basis for exploring the issue is the Growth accounting pioneered by [14] and [15].

The organisation of the rest of the study is as follows: Section 2 provides an overview of transport infrastructure investment in Nigeria. In section 3 a review of the literature encompassing theoretical, empirical and methodological issues on infrastructure and growth is provided. Section 4 focuses on the analytical framework, the specification of the empirical model, discussion on data sources and estimation and discussion of results. The final section, section 5 provides a conclusion to the paper.

2. Overview of Transport Infrastructure Investment in Nigeria

Without doubt, transportation is a critical determinant and promoter of development with known responsibility for the promotion of interregional and nodal enhancement of national and indeed international growth and development. It also accounts for variations in income migration, and geographical unemployment. Nevertheless, transport investment and growth along with economic development are a complex process, particularly in developing countries like Nigeria [16]. They contended that the industrialised economies are quite different with respect to the links between the two variables, due to the adequacy of transport infrastructure in their climes [16, pp.264]. In most developing countries, investment in transport is major. In some cases this may account for up to 40 percent of the budget. It is against this background that the overview of
transport infrastructure investment in Nigeria is imperative, starting with highlight of the various transport modes in the country.

2.1. Trend in Transport Infrastructure Investment in Nigeria

Table 1: Percentage Share of Planned Public Sector Expenditure on Transport Sector 1962-1998

<table>
<thead>
<tr>
<th>Plan</th>
<th>Plan Period</th>
<th>% Share of the Transport Sector</th>
</tr>
</thead>
<tbody>
<tr>
<td>Third National Development Plan</td>
<td>1975-1980</td>
<td>22.2</td>
</tr>
<tr>
<td>Fourth National Devt Plan</td>
<td>1981-1985</td>
<td>15.2</td>
</tr>
<tr>
<td>First National Rolling Plan</td>
<td>1990-1993</td>
<td>11.6</td>
</tr>
<tr>
<td>Second National Rolling Plan</td>
<td>1994-1996</td>
<td>8.6</td>
</tr>
<tr>
<td>Third National Rolling Plan</td>
<td>1996-1998</td>
<td>10.1</td>
</tr>
</tbody>
</table>

Source: Onokala, 2012 [17]

In Nigeria, after political in 1960, government pumped a considerable amount of money into transport infrastructure especially in the first 25 years (see table 1). The percentage share of the transport sector was between 15.2% and 27%. However, the magnitude of the actual investment declined to 11.6% in 1990 and further to 8.6% in 1996.

In terms of public sector capital expenditure between 1986 and 2007 (the period that data was available), capital investment in the transport sector had increased tremendously over time in absolute terms. For example, the magnitude of transport investment rose from N516 million to N19.241 billion and reached a peak of N35.23 billion in year 2007 (see Figure 1).

Figure 1: Transport and Communication Component of Government Total Capital Expenditure 1986 – 2007


It may also be of interest to compare transport capital expenditure with other components of the economic and social infrastructure sector. It is observed that transport sector performed well below agriculture, defence and education. When the average of each of the five components is compared over the period of 1986 and 2000, transport was second to the last and barely above defence sector as shown in Figure 3.

Figure 3: 1986 – 2007 Average of Federal Government Capital Expenditure by Components (N’million)


However, the percentage share of the transport sector in the total capital expenditure oscillated during the period under consideration, though in a state of flux but on downward trend. For instance, it was about 6% in 1986, rose to a peak of 8.4% in 1988 and was at the lowest ever of about 0.7% in 1999 and since then, continues to fluctuate to about 5% in 2007 (see figure 2).

2.2. Transport Investment Sectoral Allocation

2.2.1. Transport Investment Sectoral Allocation

The allocation of government investment is shown Table 2. Many different modes transport were established with the road transport being prominent between 1962 and 2000. The
lowest allocation was to the air transport sector. The railway was also heavily invested in surpassing the waterways seaports.

Table 2 also shows that the preponderance of transport network followed the inherited colonial heritage with emphasis of the transportation of goods for export [19] and [20].

Road transportation have been emphasized by both the state and federal government independence. The railway transport plays some decent roles until late 1960. However, the volume of human and goods traffic trickled down to almost nothingness by the 1970s. The passenger traffic dropped to 6.1 million in 1971 from 11.3 million in 1963. The volume of freight has also dropped steadily.

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Highway</td>
<td>54.0</td>
<td>58.8</td>
<td>72.4</td>
<td>70.0</td>
<td>72.6</td>
<td>65.0</td>
<td>70.2</td>
<td>66.14</td>
</tr>
<tr>
<td>Railway</td>
<td>14.0</td>
<td>17.2</td>
<td>10.6</td>
<td>15.0</td>
<td>3.8</td>
<td>14.2</td>
<td>13</td>
<td>12.54</td>
</tr>
<tr>
<td>Port (sea)</td>
<td>25.0</td>
<td>13.0</td>
<td>9.0</td>
<td>9.0</td>
<td>5.9</td>
<td>7.5</td>
<td>4.6</td>
<td>10.57</td>
</tr>
<tr>
<td>Waterways</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3.8</td>
<td>3.3</td>
<td>3.0</td>
<td>3.37</td>
</tr>
<tr>
<td>Port (Air)</td>
<td>7.0</td>
<td>11.0</td>
<td>8.0</td>
<td>6.0</td>
<td>5.6</td>
<td>2.6</td>
<td>2.3</td>
<td>6.07</td>
</tr>
<tr>
<td>Others</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>8.4</td>
<td>7.4</td>
<td>6.9</td>
<td>7.57</td>
</tr>
<tr>
<td>Total</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td></td>
</tr>
</tbody>
</table>

Source: Filani, 2012 [20]

It is important to draw attention to the fact that transport sector in Nigeria has witnessed tremendous and fundamental reforms geared towards creation and developing more focused strategy that can improve productivity of other sectors of the economy and more responsive to demand of users and stakeholders. For instance, concessioning has been adopted in almost all transport sub-sectors, including the Nigeria Railway Corporation, Nigeria Ports Authority, Federal Airport Authority of Nigeria and Inland waterways. In addition, ownership and administration of road transport by Federal and some State governments have been deregulated and some sections of the highway are concessioned to some private concern.

Despite remarkable changes and reforms that are taking place in the development of the transport sector, the transport systems infrastructure in the country remains essentially unimodal as over 95% of domestic freights and passengers are moved by road.

3. Literature Review

Several studies have examined the influence of public capital on the growth of the economy. Some focused on the determinants. Infrastructure can contribute to output growth either directly or indirectly.

Research by [21] finds direct impact because in production, transport like labour and materials are costs directly affecting the output. Similar position has been taken by [22] who contend that transportation can and do act as propellant of economic growth and development. However, [23] is of the opinion that growth model (exogenous or endogenous growth model) to be used will depend on the type of infrastructural shock. They claimed that in an exogenous growth model, the effect is transitory while in an endogenous growth model, the effect is in most cases results to permanent changes in income per capita.

The indirect channels reveal that beyond the direct inclusion of infrastructure in production function, there is countless transmission channels through which infrastructure can affect growth. Reference [24] and [25] independently considered infrastructure as enhancing indirectly the productivity of workers through reduction in adjustment costs. In similar vein, infrastructure investments impacts through human development, as investment are made on improving health [26] and [27].

The type of methodology deployed and data employed have affected the results obtained. Reference [3] was one of the earliest on this subject. In his twenty-year (1966 – 1985) study of the G7 countries. Employing panel data tool, the result of the study shows how important public infrastructure capital is in explaining aggregate output of the private sector. Reference [11] confirmed the findings of [3] and concluded that coefficient estimates for infrastructure is indeed statistically significant. The results of these two studies illuminate the fact that the productivity slowdown
However, in response to the results of these two earlier studies, subsequent studies argued that the result estimates lack reality because the impact of the private capital investments is less than that of public sector capital investments. Therefore, they concluded that the estimates are likely to have been overstated.

Reference [28] used simultaneous equations approach in their study of 28 metropolitan areas between 1980 and 1984 to establish that local public infrastructure has significant and positive impact on per capita income. Employing the same simultaneous-equation approach as in [28] and [29] examined the contribution of transport infrastructure accumulation to regional growth in France between 1985 and 1992. To eliminate a potential source of bias in the estimates produced by the production function, they modelled the political economy process driving infrastructural investments. Their empirical findings claimed that electoral concerns and influence activities were significant in determining the cross-regional allocation of transportation infrastructural investments. Specifically, there was little evidence that infrastructure spending maximizes economic return. However, [30] in their own study argued that a trans-log function instead of a Cobb-Douglas function produces a better result. They therefore used OLS procedure for estimating the parameters in their model. The result asserts that aggregate public capital has a significant and positive relationship to state output.

Using the same trans-log function, [6] argued that in order to trigger output, investment in infrastructure is although necessary but it is not sufficient. Reference [7], using similar technique additionally took into account of the random effects, and controlled for the price of energy input [4] in their study of seven OECD countries between 1963 and 1988 came to the conclusion that public investment is significant in determining productivity and growth but its contribution is very low as the output elasticity stood at 0.05. The observed low output elasticity in [4] can therefore be attributed to the adjustment for energy input price and the account for random effects.

Considering more recent studies, in opposition to earlier studies of partial equilibrium analysis, [31] estimated a general equilibrium model of production and consumption to investigate the U.S. economy. He concluded that public infrastructure is beneficial to firms and consumers, but when there is a significant expansion of infrastructure capital, producers and consumers would be worse off. Reference [32] investigated the Spanish economy from 1850 to 1935 employing Vector Autoregressive (VAR) techniques to study separate infrastructure into local-scope infrastructural investment and nationwide infrastructure investment. The conclusion was that local-scope infrastructure impact was positive and significant, but nationwide infrastructure was insignificant.

OLS to 2SLS Reference [26] using both OLS and 2SLS, studied the effect of transportation access on the regional outcomes of China (1986- 2005). The result of the study positive causal impact of greater proximity on per capita GDP growth rates. The comparison between OLS and 2SLS showed that the OLS results were less and less noisier than the 2SLS estimates.

With respect to developing countries, the effect of transport investment on economic growth was investigated by [33] using the contribution of transport capital to growth for a sample of Sub Saharan African (SSA) countries from 1980 to 2000 and also for Small Island Developing States (SIDS) from 1985 to 2000 using both cross sectional and panel data analysis. In both sample cases, the study argued that transport capital has been a contributor to the economic progress of the countries under investigation. Furthermore, he observed that transportation capital have been more productive than the overall capital investment in SSA case, whereas the average productivity level of overall capital stock in SIDS case was observed. In another study by [13] of 33 African countries for the period of 1980 to 2002, findings show that transport capital is an important element for development. A bi-causality relationship between economic growth and transport capital existed.

At the local level in Nigeria, some of the studies carried out including that of [34], [35] and [36] showed that transportation expenditure has a significant effect on output growth. Reference [35] adopted an extended Cobb-Douglas production function and an OLS estimation technique to investigate the Nigerian economy between 1980 and 1997. The result shows that all the six infrastructural components are directly related with GDP.

The study by [36] reveals that tangible expenditure of infrastructure an annual increase of 12 factors from 1.9 to 18 percent is required to be made, if Nigeria is to attain the same level of development with those of Asian economies. This spending level should span about ten years. He therefore advocated for the need for urgent reform programmes that will enhance infrastructure development if really the country’s vision 2020 programme is to be realised.

Arising from the discussions, the literature no consensus has been arrived at in the literature. The need for this study is therefore manifest.

4. Analytical Framework and Methodology

4.1. Analytical Framework

There are two basic discernible primary benefits an economy can derive from an improved transportation system. These benefits are reduced transportation cost and increased accessibility. Given these benefits, it is expected that transportation will impact economic growth directly and indirectly (through other avenues) as the case may be. According to [37], in the cost benefit analysis (CBA) of
transportation investment, the direct user benefits of travel time, reduced vehicle operating cost and safety are mainly considered.

In addition, transport infrastructure investments have social-economic spill-over which is referred to as the indirect impacts – greater specialization, greater wider markets, greater economies of scale, private sector involvement, and production rationalization and reorganization [13].

The channels through which transport infrastructure investment affects output and economic growth is summarised by [13] as adapted in Figure 4, indicating that transport infrastructure investment has direct primary effects on intermediate input cost and provides increased accessibility. This in turn leads to relocation and agglomeration effect, increase efficiency of private capital, attraction of inward and foreign direct investment, provides wider markets, produces labour market and employment effects. All these effects ultimately lead to improved aggregate productivity, hence, enhance economic growth.

![Diagram](source: Adapted from Seetanah (2009) [13]

**Fig. 4: Transmission Channel between transport infrastructure investment and economic growth**

Given the above, a number of theoretical expositions that demonstrate the linkages between infrastructural capital (transport) investments and economic growth have been provided in the literature. The linkage often discussed in this context take the form of the following labour augmenting model.

\[ Y(t) = F[K(t), A(t)L(t)] \]  

(1)

The above model assumes that at any point in time, the economy has some amount of capital (K), labour (L) and knowledge or effectiveness of labour (A), and these are combined to produce output (Y). From the production function, 't' denotes time which indirectly enter the production function through knowledge, labour, and capital. In particular and over time, the output (Y) obtained from given quantities of labour and capital increases. The basic assumption of the model is that for technological progress the value of A must rise because the growth determinants are of interest to this study. The growth accounting by [14] and [15], provides a basis for exploring the issue.

From equation (1), the growth of output is represented as:

\[ Y(t) = \frac{\partial Y(t)}{\partial K(t)} K(t) + \frac{\partial Y(t)}{\partial L(t)} L(t) + \frac{\partial Y(t)}{\partial A(t)} A(t) \]  

(2)

where the dot over a variable denotes a derivative with respect to time; that is \( O(t)/\dot{O}(t) \). The division of the two sides of the equation \( Y(t) \) and modifying the terms on the right hand side:

\[ \frac{\dot{Y}(t)}{Y(t)} = \frac{\dot{K}(t)}{K(t)} \frac{\partial Y(t)}{\partial K(t)} + \frac{\dot{L}(t)}{L(t)} \frac{\partial Y(t)}{\partial L(t)} + \frac{\dot{A}(t)}{A(t)} \frac{\partial Y(t)}{\partial A(t)} \]

where \( O(t)/\dot{O}(t) \) is the growth rate of O which refers to its proportional rate of change. Equation (2) is rewritten as follows:

\[ \frac{\dot{Y}(t)}{Y(t)} = \alpha_y(t) \frac{\dot{K}(t)}{K(t)} + \alpha_l(t) \frac{\dot{L}(t)}{L(t)} + R(t) \]  

(3)

where:

\[ \alpha_y(t) = \frac{[\partial Y(t)/\partial K(t)]}{[\partial Y(t)/\partial O(t)]} \]  

is the elasticity of output with respect to labour (L) at time t, \( \alpha_l(t) = \frac{[\partial Y(t)/\partial L(t)]}{[\partial Y(t)/\partial O(t)]} \) is the elasticity of Y with respect to K, and

\( R(t) \) represents \[ \frac{[\partial Y(t)/\partial A(t)]}{[\partial Y(t)/\partial O(t)]} \] which is measured as residual in the equation. Finally, the decomposition of the output growth into its constituents parts (labour, capital and the residual) is given in equation (3).

### 4.2. Empirical Model and Data

From the analytical framework, a modified version of the augmented Solow model as deployed [13] is adopted. Capital investment is broken into transport, private capital, and other public capital investment. Thus, the relationship among variables of interest in this study is presented in equation (4).

\[ Q = f(\text{Pinv, Trans, Opinv, Edu}) \]  

(4)

Where \( Q \) represents total output measured by the gross domestic product, \( \text{Pinv} \) is the private physical capital, \( \text{Trans} \) represents transportation capital, \( \text{Opinv} \) is the other public capital investment, and \( \text{Edu} \) is the secondary school enrolment which accounts for the quality of labour.

Equation (4) is transformed further into an empirical econometric model by taking the growth of all the variables under investigation and adding the error term, thus, we have:

\[ Q = \beta_0 + \beta_1 \text{Pinv} + \beta_2 \text{Trans} + \beta_3 \text{Opinv} + \beta_4 \text{Edu} + \mu, \]

\[ \beta_1, \beta_2, \beta_3, and \beta_4 > 0 \]  

(5)

Equation (5) shows that the a priori expectation states that the elasticity parameters \( \beta_1 \) to \( \beta_4 > 0 \), which implies that all
the variables are expected to have a direct relationship with total output. This explains that as private investment, transportation capital, other public capital investment, and quality of labour increase, output also increase and vice versa. \( B_0 \) is the constant term and \( u_t \) is the stochastic term representing other variables not included in the model but which affect the level of output.

In order to arrive at a reliable estimate of the elasticity parameters, this study investigates the unit root properties of the variables under study using the Augmented Dickey Fuller, ADF (1979) Test. Finally, all the variables are in real terms except education (\( Edu \)). The data for the study are mainly secondary and cover the period from 1977 to 2009. The study does not extend beyond 2009 due to none availability of the data for all the variables after 2009. The data are sourced from the [38], [18] and [39].

### 4.3. Estimation and Discussion of Results

The results of empirical analysis carried out in the study are presented in Tables 3, 4, and 5 which include the time series test and the regression results. As a prelude to the regression analysis,

Granger causality test is carried out on the surface assessment of the causation and direction economic growth and investment in transport infrastructure. The result of the test given in

<table>
<thead>
<tr>
<th>Null Hypothesis:</th>
<th>Obs</th>
<th>F-Statistic</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>TRANS does not Granger Cause Output</td>
<td>31</td>
<td>0.04890</td>
<td>0.82659</td>
</tr>
<tr>
<td>Output does not Granger Cause TRANS</td>
<td>0.18454</td>
<td>0.67079</td>
<td></td>
</tr>
</tbody>
</table>

An important consideration often is the series stationary test. This exercise is conducted on all the variables of the model to test for the null hypothesis of non-stationarity. Using the Augmented Dickey Fuller (ADF) test, the unit root result as shown in Table 4 however indicates that all the variables of the model are stationary at their original level, that is, they are integrated of order one I(0). This implies that the deviation around their mean values is zero. A closer look at the results show that the stationary levels of the variables range between 5 per cent and 1 per cent.

<table>
<thead>
<tr>
<th>Variable</th>
<th>ADF Without Trend</th>
<th>ADF With Trend</th>
<th>Order of Integration</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Level</td>
<td>First Diff</td>
<td>Level</td>
</tr>
<tr>
<td>Output</td>
<td>-3.00***</td>
<td>-8.71***</td>
<td>-4.03**</td>
</tr>
<tr>
<td>Pinv</td>
<td>-5.45***</td>
<td>-7.84***</td>
<td>-5.98***</td>
</tr>
<tr>
<td>Trans</td>
<td>-3.17**</td>
<td>-6.12***</td>
<td>-3.44*</td>
</tr>
<tr>
<td>Opinv</td>
<td>-5.22***</td>
<td>-7.69***</td>
<td>-5.12***</td>
</tr>
<tr>
<td>Edu</td>
<td>-3.24**</td>
<td>-9.44***</td>
<td>-3.37*</td>
</tr>
</tbody>
</table>

Notes:

*, ** and *** implies significance at 10%, 5% and 1% level respectively. Critical Values for ADF tests are the following:

- In the model without trend: Level form:
  - -3.6661 (1%), -2.9627 (5%) and -2.6200 (10%)
  - First difference: -3.6752 (1%), -2.9665 (5%) and -2.6220 (19%)
- In the model with trend: Level form:
  - -4.2949 (1%), -3.5670 (5%) and -3.2169 (10%)
  - First difference: -4.3082 (1%), -3.5731 (5%) and -3.2203 (10%)

In the regression analysis, the growth rates of all the variables are used. Since all the variables are I(0), this implies that coefficient estimates obtained from using such data will be unbiased when OLS technique is employed. Various estimations of the empirical model are performed; however, the estimation that yielded the best result is reported in Table 5. The result indicates that the effect of transportation investments is of little relevance in determination of output growth.

Specifically, the result indicates

- that there exists an insignificant positive relationship between growth in transportation investment and growth

Specifically, the result indicates that there exists a positive but insignificant connection between the rate of economic growth in transportation investment in Nigeria. Specifically, a unit increase in transportation infrastructure investment over two previous periods will result in a marginal rise of 0.003 units in output.

Despite the insignificant impact, the positive relationship implies that as public sector transportation investment increases over time, output tends to rise. The insignificant relationship between the transportation investment and growth can be adduced to continuous decline in government expenditures in the transport sector relative to other sectors in Nigeria over the years (as noted in Figure 3). Reference [34] noted that the economic downturn of the 1980s which resulted from the oil glut coupled with the huge external debt that led to the adoption of the structural adjustment programme (SAP) in 1986 caused contraction of the public sector and reduction in its spending.

All other variables in the model exhibit the a priori expectations (positive relationship) in terms of their signs, except education (\( Edu \)) that exhibits a negative but significant relationship with output growth. Private
investment ($P_{inv}$) has a significant positive relationship with output growth, indicating the importance of other forms of private investment in stimulating growth. Other public investment ($O_{inv}$) have a weak significant positive relationship with output growth. Although transportation investment is highly insignificant in the model, all the variables of the model are jointly significant in determining variations in GDP as the F-statistics stood significant at one per cent level. However, their explanatory power is weak as $R^2$ stood at 0.5553. Finally, the Durbin-Watson (DW) statistic shows the absence of autocorrelation in the model as it stood at 1.6414 and greater than $R^2$.

<table>
<thead>
<tr>
<th>Table 5: OLS Regression Results</th>
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<tbody>
<tr>
<td>Variable</td>
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<tr>
<td>C</td>
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<tr>
<td>Inv</td>
</tr>
<tr>
<td>Trans(-2)</td>
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<tr>
<td>Opinv</td>
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<td>Edu(-1)</td>
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</tbody>
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$R^2 = 0.5553$
D.W. = 1.6414
F-statistic = 7.8029
Prob(F-statistic) = 0.0003

*, *** indicate 10 percent and 1 percent significance level respectively

5. Conclusion

The development of transportation system is very often regarded as significant for the economic development of a country; as transportation investment has both direct and indirect effects on the economy. Consequently, this study has examined the impact of transportation capital investment on economic growth in Nigeria between 1977 and 2009. The empirical analysis was carried out by employing the Ordinary Least Square (OLS) estimation technique.

The findings provide evidence of the insignificance of transportation with respect to economic growth in Nigeria. However, because of the positive relationship between transport and economic growth, complete overhauling of the transportation system in additions to greater funding of the transport sector is hereby recommended. This would ensure the resuscitation of the degrading status of the transportation system and enhance its role in the process of economic growth.

The conclusion of this paper seems inevitable going by the low level of investment of transport infrastructure within the nation’s economy. This trend is not unconnected with the challenges of transport development in the country. In the first instance, there is no discernible transport policy for the country even though there has been recommendations for the various modes based on various studies but where not implemented. Indeed, there were whitepaper recommendations on national transport policy documents of 1993 and 2004, both explaining the crisis in the Nigerian transport sector and the inability of the transport system in the country to meet the transport demands of Nigerian economy. The need to have remarkable increase in the investment on transport infrastructure is therefore not unconnected with the state of the transport modes. Specifically, in respect of the five major modes of transport in the country, the pipeline transportation is plagued by old and corroded pipes and frequent fire outbreaks arising from illegal tapping of pipelines products. For railway infrastructure, the composite of the railway system is outdated, obsolete and indeed, no longer functional. The network does not connect to major resources and activity centres of the country. In addition, the speed is slow and the operational schedule extremely unreliable. The old substandard gauge is still pervasive across the country, with the concomitant sharp curves and step gradients. Perhaps, more importantly, there is poor connectivity of the railways with roads, seaports and waterways, which therefore makes integration with other modes virtually nonexistent.

Inland waterways and the ports also have their challenges as most rivers have excessive falls and rapids, and are seasonal. The seaports have witnessed stagnated development for several years due in-part to various previous economic strategies, particularly the structural adjustment programme that ensured that import dependency option persisted for so long. This existed during this period and up till 2006 when the national government embraced best practices of port reforms and improved their administration and management by concession to private investors to ensure development of the Nigerian seaports system is consistent with increasing investment.

Airways and aviation transportation for some time, as well, had limited investment despite increasing air travel demand, enhanced standard of living and improved economy. There was heavy investment of air transportation up till the late 1980s, which witnessed physical infrastructural development of airports in virtually every of the then twenty-one states of the federation. However, most of these airports are not functional and the capacity utilization of most of them extremely low [40]. The main reason for this low capacity utilization was simply because the investments in air transportation, particularly the development of airports was basically political rather than being utilization demand driven. The road transport has been over used and misused given the fact that it has received the greatest attention of the government at all levels since the early 1970s to the mere neglect of other modes and to the detriment of intermodal connectivity and transportation systems. Despite the investment favouring road transport system, the network is still beleaguered by poor quality of road construction, faulty and inappropriate designs, poor supervision of construction work, and inadequate administrative capacity for maintenance. The over-burdened road transport system is also characterized by proportionally high road traffic accidents.

In the light of these undoubting challenges, it is expected that investment in transport infrastructure would be
ommensurate with the desire to redress them, because of the implications for commodity flow, regional trade, and economic development of the country. The policy outlook perhaps is to have greater public investment in transport sector so as to contribute significantly to the economic development and growth of the country. The major areas of the directional policy shift should be the rehabilitation and a fresh reconstruction of railway infrastructure that could link various parts of the country and greater investment on transport infrastructure generally. Going by the extent of decay of road transport infrastructure (poor quality roads and lack of effective traffic management and enforcement), greater investment in road sector is imperative to improve maintenance, repairs and rehabilitation of the roads to reduce further deterioration of the road network. Increasing funding of the sector will also enhance capacity building to enforce existing regulations, traffic management measures, improve vehicle inspection and general improvement of service quality of the transport mode in the country. Furthermore, there must be a greater private sector participation, particularly in the air transport and seaport development. The support of public capital investment to compliment the private sector participation in modern transport system of the country cannot be over emphasized. The notable development of the maritime sector through concession of the seaport and strengthening public-private partnership must be encouraged. The air transportation subsector must be further deregulated to accomplish the incredible increase in the activities of the private airlines in the operation in the country.

There is need for effective policy harmonization and fiscal coordination amongst the tiers of government on transport projects. Indeed, the several many development and investment in transport projects needs to be properly quantified, planned and executed. Without doubt, transport investment would not only generate accessibility and other transport benefits - it will enhance overall regional economic development.

Acknowledgements

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References


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Professor Emeritus Andrew Onokerhoraye, at Precious PalmRoyal Hotel, Benin City, Nigeria, 26th – 28th March, 2012.


