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TRANSPORT INFRASTRUCTURE AND ECONOMIC GROWTH IN NIGERIA: CAUSALITY ANALYSIS

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ABSTRACT

The main aim of this study is to establish if there is a causal relationship between transport infrastructure and economic growth in Nigeria over the period 1970-2010. Granger causality test was adopted and it showed that both instantaneous and past values of transport infrastructure have explanatory power on economic growth in Nigeria while the opposite could not be established. The study therefore concluded that infrastructural led policy should be pursued to ensure economic growth in Nigeria.

INTRODUCTION

The link between economic development and infrastructure has received a widely recognized debate since the contribution of Aschauer (1989). The conventional wisdom is that investment in infrastructure, in particular those in transport, plays a crucial role in facilitating economic growth and international competitiveness. Without efficient and affordable transportation networks, markets become disconnected and therefore fail, agricultural products will perish at farm-gates. However the relationship between infrastructure and economic growth has been controversial. A number of empirical studies have found high returns to infrastructure investment (Aschauer, 1989). But, the robustness of the results has been questioned in other empirical studies and surveys (Munnell, 1992; Gramlich, 1994). In addition, the direction of causality between transport infrastructure and economic growth is theoretically unclear. Transport infrastructure can cause economic growth and economic growth can pave for increase in transport infrastructure. Also, the existing empirical evidence on the causal relationship is very inconclusive. It is therefore, of interest to investigate whether the part cause of growth can be attributed to change in transport infrastructure and vice versa.

The main aim of this study is to investigate the causal relationship between transport infrastructure and economic growth in Nigeria. The current state of transport Infrastructure in Nigeria is a major developmental challenge towards achieving the national vision of becoming one of the largest economies by 2020 (Sanusi 2012). In Nigeria, about 80% of the 194,200km of road in the country is in a poor condition while only 20% percent is paved. This is far below some other African countries like Algeria and Egypt who has more than 70% of their total road network paved (CIA World Fact Book 2009). This means that transport infrastructure services in Nigeria are remarkably weak for a country which is the world's sixth largest oil exporter (David, 2003). The rest of this study is structured as follow; Section 2 reviews the literature on the relationship between transport infrastructure and economic growth. Section 3 is concerned with the methodology. Section 4 presents and discusses the findings of the study while section 5 concludes and recommends.

REVIEW OF RELATED LITERATURE

The most cited explanation in relating transport infrastructure to economic growth in the literature are reduction in costs of transportation and increase in accessibility. This is usually referred to as transportation benefits. To empirically examine the trend of transportation investment and analyze the effect of transportation investment on regional economic development in China, Joyce (1998) used two stage least-squares (2SLS method). Result shows that transportation investment has positive and statistically significant effect on GDP and it also indicates that those provinces that have invested more in transportation infrastructure tend to have greater output. The impact of transport infrastructures on the economic growth for both regions and sectors, was also analyzed by Cantos et. al.(2005). An attempt was also made to capture the spillover effects associated with transport infrastructures. Two different methodologies were used: the first adopts an accounting approach based on a regression on indices of total factor productivity; the second uses econometric estimates of the production function. Very similar elasticities were obtained with both methodologies for the private sector of the economy, both for the aggregate capital stock of transport infrastructures and for the various types of infrastructure. However, the disaggregated results for sectors of production were not conclusive. The results confirm the existence of very substantial spillover effects associated with transport infrastructures.

Moreover, the contribution of transport capital to growth for two different data sets-namely for a sample of 38 sub-Saharan African (SSA) countries and also for developing states (SIDS) using both cross-sectional and panel data analysis was conducted by Boopen (2006). In both samples the analysis concluded that transport capital has been a contribution to the economic progress of these countries. Their analysis further revealed that in the SSA case, the productivity of transport capital stock is superior as compared to that of overall capital but such is not the case for SIDS where transport capital is seen to have the average productivity level of overall capital stock. In addition, the impact of infrastructure investment on East Asia economic growth was examined by Stephan, et. al. (2008) using both growth accounting framework and cross-country regressions for most of the variables used both the growth accounting exercise and cross country regression failed to find a significant link between infrastructure productivity and growth. Their conclusion contrast strongly with previous studies finding. They therefore concluded that results from studies using macro-level data should be considered with extreme caution.

Another study that estimates the effect of transportation networks on regional demographic and economic outcomes was the work of Banerjee, et.al, (2009) in China between 1986-2003.They addressed the problem of endogenous placement of network by exploiting the fact that these networks tend to connect historical cities. Their results show that proximity to transportation networks have a large positive causal effect on per capita GDP growth rate across sectors. Zou et.al (2008) conducted a research on transport infrastructure on economic growth and poverty alleviation, using panel data of 1994-2002, as well as time series data of 1978-2002 in China. They find out that the higher growth level in East and Central China comes, to a great extent, from better transport infrastructure and concludes by

Granger-test that transport investment especially that on roads constitutes a source of growth, but not vice versa. Not only that, Zuu et al (2009) also investigates empirically the relationship between transport infrastructure (focus on highways) and GDP growth based on a production function approach. The physical stocks of transport infrastructure were used instead of monetary data to measure public capital together with several other variables (labor and private capital) that were hypothesized to affect economic growth. Then they explore a number of subsequent studies that use panel data covering the period between 1992 and 2004.An investigation was also done to compare developed countries and developing countries. Results indicate that physical units are positively and significantly related to economic growth. Furthermore there was an interesting finding that the output elasticity with respect to physical units for developed countries is higher than developing countries. Keho andEchui(2011)examines the temporal relationship between transport infrastructure investment and output in Côted'Ivoire over the period 1970-2002. Using cointegration and causality tests within a multivariate framework, it was found that the public investment in transport infrastructure, private investment and economic output are cointegrated. The Granger causality tests reveal that public investment in transport does not have a causal impact on economic growth; conversely economic growth has a causal impact on transport investment.

In Nigeria the empirical assessment of transport infrastructure and economic growth in Nigeria was considered by Ighodaro (2009). Findings from the study show that in the three national development plans in Nigeria, road transportation system has been given more priority followed by water and air. The study shows that no causality was found between road development and economic growth in Nigeria. However, the long-run part of the VECM estimate shows that the lag value of road development variable is significant in the determination of economic growth in Nigeria

METHODOLOGY

The idea of causality is that the cause precedes the effect. That is, if an event y is the cause of another event x, causality exist, according to granger (1969), when lagged values of a variable y, have explanatory power on the variable x.

Therefore, in this study Granger Causality test will be used to test the hypothesis regarding the presence and the direction of causality between Infrastructure and Economic growth using the following models:

$$y_t = A_o D_t + \sum_{j=1}^{k} \beta_j y_{t-j} + \sum_{i=1}^{k} \gamma_j x_{t-j} + \varepsilon_{1t} \dots\dots\dots\dots (1a)$$

$$y_t = A_o D_t + \sum_{j=1}^{k} \beta_j y_{t-j} + \sum_{i=1}^{k} \gamma_j x_{t-j} + x_t + \varepsilon_{1t} \dots\dots\dots\dots (1b)$$

$$x_t = A_o D_t{}' + \sum_{j=1}^{k} \beta_j y_{t-j} + \sum_{i=1}^{k} \gamma_j x_{t-j} + \varepsilon_{2t} \dots\dots\dots\dots (2a)$$

$$x_t = A_o D_t^{'} + \sum_{j=1}^{k} \beta_j y_{t-j} + \sum_{i=1}^{k} \gamma_j x_{t-j} + y_t + \varepsilon_{2t} \ldots\ldots\ldots\ldots\ldots\ldots (2b)$$

Where: $A_o = vector\ of\ parameters$
$D_t = deterministic\ trend$
$y_t = growth\ of\ output$
$x_t = growth\ of\ infrastructure\ capital$
$u^{'}s = the\ stochastic\ error\ term$

Moreover, from equation 1a and 2a four different hypotheses about the relationship between infrastructure and economic growth can be formulated:

(i) Unidirectional Granger causality : transport infrastructure causes economic growth and not vice versa
(ii) Unidirectional Granger causality : economic growth causes transport infrastructure and not vice versa
(iii) Bidirectional or feedback causality : economic growth causes transport infrastructure and vice versa
(iv) Independence between infrastructure and economic growth: transport infrastructure does not cause economic growth and vice versa

In addition, equation 1b and 2b will be used to test instantaneous causation between transport infrastructure and economic growth.
These equations will be estimated using Granger two steps causality procedure and a simple F- test will be used as decision rule

$$F = \frac{RSS_R - RSS_{UR}/k-1}{RSS_{UR}/n-k} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (3.3)$$

Where:
RSS_R= restricted residual sum of squares
RSS_{UR}= unrestricted residual sum of squares
k =number of estimated parameters
n = total number of observation
Economic growth: is measured as gross domestic product((gdp)- (gdp(-1))/gdp
Transport infrastructure: road network density

All the time series data are obtained from Central Bank of Nigeria (CBN)statistical bulletin, various issues and CBN annual reports while transport infrastructure are obtained from canning (1999), the Nation Masters World Statistics and World Bank Development Indicators . All variables are expressed in logarithm form and estimations was carried out using E-view 7.0 software.

Analysis

To determine the causal relationship between economic growth and transport infrastructure Granger causality tests were computed and the results are presented in table 1 and 2:

Table 1 Past Values Causality Test

	RSS	URSS	F RATIO	F
Economic growth does not causes transport Infrastructure	65.53	56.03	2.38(3.11)	0.76
Transport Infrastructure does not causes Economic growth	326.96	114.52	53.11(8.81)	6.03

In the regression estimated to test the null hypothesis, economic growth causing transport infrastructure, the observed F-statistic was 0.76 which is less than the critical value $F_{0.05}$ (2.99).Thus the hypothesis is accepted, meaning that economic growth is not causing transport infrastructure. However, the hypothesis of transport infrastructure not causing economic growth is rejected because, the observed F-statistic (6.03) was greater than the critical F-Value of (2.99). This shows that growth in transport Infrastructure is causing economic growth while economic growth is not causing growth in transport infrastructure. It also means that there is a unidirectional relationship between economic growth and transport infrastructure. Thus it can be argued that past values of transport infrastructure contribute to the prediction of the present values of economic growth in Nigeria over the period of analysis.

Table 2 Instantaneous Causality Test Result

	RSS	URSS	F RATIO	F
Economic growth does not causes transport Infrastructure	65.53	45.12	5.10(2.37)	2.15
Transport Infrastructure does not causes economic growth	326.96	93.69	58.32(4.93)	11.83

The instantaneous causality test between infrastructure and economic growth is shown in table 2 Comparing the calculated F to F-statistic (2.92) it shows that transport infrastructure causes economic growth instantaneously.

CONCLUSION AND RECOMMENDATION

Therefore, this study concluded that transport infrastructure causes economic growth in Nigeria instantaneously and with lags meaning that both present and past values of transport infrastructure have explanatory power on economic growth in Nigeria. This reiterates the fact that economic growth cannot be achieved without a supportive transport infrastructure in Nigeria. This study will therefore recommends that the country should pursue transport infrastructural led policy by increasing the quantity and quality of total road network in the country.

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