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Transport Infrastructure Improvement and Economic Growth in Nigeria

Dr. Akanbi Bosede[1], Bamidele Abalaba[2], Dunni Afolabi[3]
([1,2,3]Department of Economics, Osun State University, Osogbo, Nigeria)

ABSTRACT: *In this paper we presented an empirical evidence on the impact of transportation infrastructure improvement on economic growth in Nigeria for the period 1981 to 2011. Using the Ordinary Least Square Regression (OLS) technique, the paper made use of the generalized Cobb- Douglas production and extending the neoclassical growth model to include transport infrastructure stock (i.e output of transport sector) along with capital stock (i.e investment on transport infrastructure) as the input and gross domestic product. The study found that transport output and investment made on transport infrastructure in Nigeria has significant positive contribution to growth which shows that each impact is strong and statistically significant. The experience from Nigeria suggests that it is necessary to design an economic policy that will improve the transport infrastructure as well as to increase the investment made to the sector for sustainable economic growth in Nigeria. There is need to reduce pressure on the existing road networks by opening up the waterways and railways.*

KEYWORDS: *Transportation, Infrastructure, Economic growth, Investment, Nigeria.*

I. INTRODUCTION

Many economists have shown keen interest in factors which can accelerate the growth of their economies, one of such major factor is transportation. A well-functioning and integrated transport system among other things in the economy stimulates national growth and development which enhances the quality of life for all enabling the seamless movement of goods and services and people. The provision of vital linkages between spatially separated facilities enables social contact and interaction possible and also providing access to employment, health, education, and other services which brings about civilization (Boopen, 2006)[1].

Studies on transportation Sector in Nigeria have become so important due to various views of researchers with an efforts to formulate better policy that will affect the sector positively thereby bringing about an efficient, effective and standard transport system. Thus the demand for transport services in the country over the years have increased tremendously, while the supply of transport services have declined due to lesser infrastructure in place in the system. Zou, Zhang, Zhuang, and Song (2008) [2], defined transportation infrastructure as the arteries for the flow of people, goods and information which are necessary in an economy. For instance, Agricultural products generated in the rural areas needs to be carried/taken to the urban centres for further distribution which can take place or be achieved only through means of transporting those goods from that place to another, here transportation provides the means by which product are circulated around the country.

Given the fact that transportation Infrastructure is very crucial to the growth of the economy, the situation of Nigeria transportation infrastructure is in a poor state. Recent studies by Adeniji (2000) [3] and Obi (2009) [4] showed that less than 50% of the national road network are in fair or good condition causing an average death of 50 people per day; less than 300,000 tonnes of freight and less than 2.3 million passenger are been transported by rail; more occurrences of air crashes in the Aviation sector; high rate of congestion in the sea port and more vandalization of pipelines. When all this losses are added up to economic cost for loss of productive man-hour, it becomes clear that the need to give the sector an urgent attention becomes highly imperative. Therefore, the objective of this paper therefore, is to evaluate the empirical linkage between transportation infrastructure and economic growth in Nigeria. The rest of the study is structured as follows: section 2 presents a review of literature. In section 3 the theoretical model is presented, while section 4 analyzed the empirical result. Section 5 concludes the paper.

II. LITERATURE REVIEW

The studies on infrastructure, particularly, the move to measure quantitative relationship between growth in transportation infrastructure and total economic growth using microeconomic model started with Antle (1983) [5] when he estimated a Cobb Douglas production function for 47 developing countries and 19

developed countries. Infrastructure was specified as the gross national output from the transportation and communication industries per square kilometre of land area. Antle found a strong and positive relationship between the level of infrastructure and aggregate productivity. Mera (1973) [6], Ratner (1983) [7], Biehi (1986) [8], Aschauer (1989) [9], Binswanger et al (1987) [10], Binswanger et al (1989) [11], Easterly and Rebelo (1993) [12], and Baffes and Shah (1993) [13] also found transportation infrastructure as an effective factor of production.
Thus, Aschauer (1989), investigated the role of infrastructure in development process based on the United states, he argued that non-military public investment is far more important in increasing aggregate productivity than military spending. He conclude that core infrastructure such as street lights, highways, airports etc., contribute more to productivity than other form of infrastructure, and that the slowdown of U.S productivity was related to the decrease in public infrastructure investment. Subsequently Munnell (1990) [14], Garcia-milla and Guire (1992) [15] found high elasticity of public infrastructure investment through comparatively lower than Aschauers.

Calderon (2009) [16], provided a comprehensive assessment of the impact of infrastructure development on growth in African countries based on econometric estimates for a sample of 136 countries from 1960-2005. He evaluated the impact on per capita growth of faster accumulation of infrastructure stocks and enhancement in the quality of infrastructure services for 39 Africa countries in 3-key infrastructure sectors: telecommunications, electricity, and transportation (i.e road). Using an econometric technique suitable for dynamic panel models and likely endogenous regressors, the authors find that infrastructure stocks and services quality boost economic growth. The findings show that growth is positively affected by the volume of infrastructure stocks and quality of infrastructure services simulations show that our empirical findings are significant statistically and economically.

Boopen (2006) analyzed the contribution of transport capital to growth for a sample of Sub Saharan African (SSA) and a sample of Small Island Developing States (SIDS), using both cross sectional and panel data analysis. In both cases, the analysis concluded that transport capital has been a contributor to the economic progress of these countries. Analysis further revealed that in SSA case, the productivity of transport capital stock is superior as compared to that of over all capital while such is not the case for the SIDS where transport capital is seen to have the average productivity level of over all capital stock.

Pravakar, Ranjau, and Geethanjali (2010) [17], investigated the role of infrastructure in promoting economic growth in china for the period of1975 to 2007, using GMM(Generalized Methods of Moment) and ARDL(Autoregressive distributed lag model) techniques the result reveals that infrastructure and investment have played an important role in economic growth in China.

National Institute of Economics and Industry Research (NIERI),2002[18], proved the link between transport infrastructure investment and economic growth using a Cobb Douglas production function. In which to achieve the efficient of transport infrastructure, a link should be forged between information technology and management and transport infrastructure.

In Nigeria we have limited numbers of studies that estimated the contribution of investment in transportation infrastructure on economic growth. However, Loto (2006) [19] also found that infrastructure, when measured in physical sense, impacts positively on economic growth. In addition, Nwakeze and Mulikat (2010) [20] estimated the contribution of transportation investment, congestion and traffic related accident to economic growth in Nigeria between 1975 and 2006, using the extended Cobb Douglas production function model, they found that transport investment positively contributes to economic growth and traffic accidents contributes negatively. The estimated model used was the error correction mechanism with the real Gross Domestic Product as the dependent variable and the explanatory variables include physical capital, labour force, total road network, automobile density and traffic related accident.

Jerome and Ariyo (2004) [21] explore the impact of infrastructural reforms (that is, implementation of privatization and liberalization in telecommunications and private investment in infrastructure) on poverty reduction. The study noted that infrastructure reforms and privatization in Africa have been carried out without considering the needs of the poor and without meeting the policy preconditions that are indispensable for their effectiveness. The consequence of this is that infrastructure privatization, rather than having a positive impact, has negatively affected the poor in Africa. The authors argue that the goals of infrastructure reforms can only be achieved if such reforms are undertaken in the context of appropriate market and regulatory frameworks.

Ogun (2010) [22], investigated the impact of infrastructural development on poverty reduction in Nigeria. Specifically, the relative effects of physical and social infrastructure on living standards or poverty indicators are examined, with a view to providing empirical evidence on the implications of increased urban

infrastructure for the urban poor. The paper employs secondary data for the period 1970 to 2005 and the structural vector autoregressive (SVAR) technique is adopted in the analysis. The study unequivocally finds that infrastructural development leads to poverty reduction which leads to increase in economic growth. Results also show that though infrastructure in general reduces poverty and increase economic growth, social infrastructure explains a higher proportion of the forecast error in poverty indicators relative to physical infrastructure. This suggests that massive investment in social infrastructure in cities would drastically reduce poverty and increase growth in the urban areas.

From the above overview, there is a substantial body of literature that found that infrastructure investment is largely positively correlated with aggregate economic growth and also with social indicators. However, with over a decade of public sector reforms in Nigeria, it becomes necessary to anlyse the impact of transportation improvement on economic growth in Nigeria.

III. METHODOLOGY

The data was sourced through secondary sources. The data consisting of time series data were sourced from publications of Central Bank of Nigeria (CBN) statistical bulletin, 2010 and 2011 edition, for the period of 1981 to 2011. These data were analysed using Ordinary Least Square (OLS) technique with tjhe aid Eviews 3.1 Statistical package.

Model Specification

An analytical framework in the form of extended Cobb-Douglas production function, in which we are assuming a generalised Cobb-Douglas production and extending the Neo-classical growth model to include transport infrastructure stock (i.e output of the transport sector) along with capital stock (i.e investment on transport infrastructure) as the input of the production function and the gross domestic product as the output. This paper adapted Pravakar, Ranjau and Gentanjali (2010) as well as Nwakeze and Mulikat (2010).
The model can be specified as:

GDP = f (TRANSCON, INTRAN)……..(1)

Where

GDP = Real Gross Domestic Product implies that the GDP is measured using a constant price, i.e. the value of the GDP for different year is measured, using the price of a base year.
TRANSCON = Output of the transport sector. It is derived by summing the output from the various transportation modes that is (road, rail, water and air). The value of the TRANSCON is the contribution the sector and the infrastructure make to the economy and its growth.
INTRAN = Investments made in transport infrastructure. It is derived by summing the investment made on the various transportation modes. The values of expenditure made in the transport sector by the government.
Taking the natural logarithm of both side of the model produces a linear equation of the form:
Log GDP = f (Log TRANSCON, Log INTRAN)…….....…(2)

Thus the empirical model to be estimated in the study is given as:
$LogGDP = LogB_0 + B_1LogTRANSCON + B_2LogINTRAN + U$……(3)

Where
B_1 and B_2 = Slope coefficients and it shows the rate of change in the value of the GDP, when there is a unit change in the value TRANSCON and INTRAN.
B_0 = Intercept coefficient and it shows the rate at which GDP will change independent of TRANSCON and

INTRAN.
'U' = Error term which shows that other external factors that might affect the magnitude of the GDP that are not stated in the model
The model is expressed in log form for the purpose of linearizing it. It is also necessary to remove variation in the data and also to minimise bias in the data collected. (Gujarati: basic econometrics).

IV. ANALYSIS AND RESULTS

Analyses of results are discussed in three sub-sections: (1) unit roots test analysis, (2) co-integration test analysis, and (3) regression analysis.

Unit Root Tests

Table 1: ADF Test Result for Unit Root of the Variables

Variables	Level	1st difference	2nd difference	5% Critical value	Order of Integration
LOGGDP	0.928746	-3.437554	-4.690903	-3.6752	1(2)
LOGTRANSCON	1.188955	-3.6903399	-5.738393	-2.9665	1(1)
LOGINTRAN	-1.083480	-4.263132	-6.116035	-2.6220	1(1)

Prior to the estimation of the equation (3) the characteristics of the data was examine to determine whether the data is stationary (i.e whether it has unit roots) and the order of integration. In this regard, the Augmented Dickey-Fuller (ADF) was used. The result of the stationarity test with intercept term is presented in Table 1. It is clear from the table that all the variables are stationary in their first differences except for GDP that is stationary at the second difference. Note that the ADF-test statistic of each is greater in absolute value than the 95 percent critical value. Thus, these variables can affect the long-run determination of Nigeria's real GDP and hence, economic growth.

Co-integration Test

Table II: Co-integration Test

Eigenvalue	*Likelihood Ratio*	*5 Percent Critical Value*	*1 Percent Critical Value*	*Hypothesized No. of CE(s)*
0.476770	25.72959	29.68	35.65	None
0.209221	6.945323	15.41	20.04	At most 1
0.004746	0.137957	3.76	6.65	At most 2

Given that all the variables are non-stationary, we then decided to find out whether these variables are co-integrated. In doing this we adopted the Johansen procedure. The result of the test is presented in table 2. The result of the co-integration test shows that there is no co-integrating equation. This means that equation (3) has to be estimated using first difference of variables.

Regression results

Table III: Regression Results

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	2.696717	0.161166	16.73257	0.0000
LOGTRANSCON	0.675580	0.047117	14.33838	0.0000
LOGINTRAN	0.057906	0.009020	6.419595	0.0000

R-squared	0.979799	Mean dependent var	5.531867
Adjusted R-squared	0.977468	S.D. dependent var	0.202718
S.E. of regression	0.030429	Akaike info criterion	-4.023261
Sum squared resid	0.024074	Schwarz criterion	-3.836435
Log likelihood	64.34892	F-statistic	420.3553
Durbin-Watson stat	1.809757	Prob(F-statistic)	0.000000

From the regression result in table 3, the value of the constant term (intercept) is 2.696717. This signifies that if the explanatory variable is held constant, the GDP is 2.696717. In the context of the computed elasticity (i.e coefficient of the explanatory variables), the result suggested that, a unit change in transportation sector output (TRANSCON) will cause a 0.675580 unit rise in Gross Domestic Product (GDP). This means that there is low output and for this to develop, more output from this sector will enhance economic growth. A unit change in the transportation infrastructure investment will cause a 0.057906 unit change in Gross Domestic Product (GDP). This means that there is low investment and for this to develop, more capital will be mobilized and this will eventually affect the GDP positively.

The coefficient of determination (R^2) is 0.979799 for the model, this indicates that there is a very strong positive linear relationship between the dependent variables (GDP) and explanatory variables (TRANSCON and INTRANS) and that the explanatory variable accounted for 97.97% of the variations in the

GDP in Nigeria from 1981 to 2011, While the remaining 2.03% variation in the real GDP is explained by other exogenous variables that are excluded in the models (error term). This implies that the coefficients are high as 98%. Therefore the models are good fit as only less than 3% of systematic variation is left unaccounted for by the model.

Also, a brief look at the adjusted R-squared value of 97.7% indicates that after removing the effect of insignificant repressor' (explanatory variable), about 2.3% variation in the real GDP is still accounted for by the independence variables. Therefore, the model is a good fit.

The Durbin-Watson statistic is a test statistic used detect the presence of autocorrelation (a relationship between values separated from each other by a given time lag) from a regression analysis that is, it test the independence of error in the least square regression. As a rule of thumb, if D-W is less than 2.0, there is an indication that the successive error terms are on average, close in value to one another and positively correlation, it therefore means there is presence of auto correlation and if greater than 2.0, there is no autocorrelation. The Durbin- Watson statistics for the models is 1.809757 which shows that there is presence of auto correlation because it is less than 2.

The standard error test and the mean of the dependent variable test is carried out to ascertain the correctness, statistical significance and the reliability of the parameters estimated. The standard error of estimate or C is computed to be 0.161166, which is small compared to the mean of the dependent variable (GDP) which is 5.531867. This is a statistical significance between TRANSCON, INTRAN and GDP.

The standard error test is carried out to ascertain the correctness, statistical significance and the reliability of the parameters estimated. The test is done by comparing half of the value of the coefficient (½β) of each parameters with its corresponding standard error (S(β)) that is the estimates of the parameters (B_0, B_1 and B_2) are termed significant if half of the value of the coefficient is been greater than their standard error
With respect to TRANSCON (B_1): ½ (β) = ½ (0.675580) = 0.33779 and S (β) = 0.047117. Since, 0.33779 > 0.047117, we will accept the alternative hypothesis (H_1), this shows that the output in transport sector has a significant relationship with economic growth within the period of the study.

With respect to INTRAN (B_2): ½ (β) = ½ (0.057906) = 0.028953 and S (β) = 0.009020. Since 0.028953 > 0.009020, we will accept the alternative hypothesis (H_1), this shows that the investment made in transport infrastructure has significant relationship with economic growth within the period of study.
The student t-test is a more reliable test of significance which is carried out to confirm the validity of the standard error test. The student t-test statistic determines the strength of the relationship that exists between the dependent and independent variables in this model. The condition for the significant parameter estimate is that it is statistically significant if the t calculated is greater than the tabulated value (Tcal > Ttab) of t at 5% level of significance.

With respect to TRANSCON ($B_{1)}$ in the model, T_{cal} = 14.33838 and T_{tab} = 1.96. Since 14.33838 > 1.96, then we reject the null hypothesis and accept the alternative hypothesis. This decision signifies that output in transport sector (TRANSCON) is statistically significant at 5% level. Hence it is a good explanatory variable of the dependent variable (Gross Domestic Product (GDP).

With respect to INTRANS (B_2) in the model, T_{cal} = 6.419595 and T_{tab} = 1.96. Since 6.419595 > 1.96, then we reject the null hypothesis and accept the alternative hypothesis. This decision signifies that investment in transport infrastructure (INTRAN) is not statistically significant at 5% level. Hence it is not a good explanatory variable of the dependent variable (Gross Domestic Product (GDP).
The F statistics is used to ascertain the overall significance of the model, it is used to decide whether to accept or reject the Null hypothesis. This decision is made based on the comparism of the calculated F statistics (F_{cal}) and the tabulated F (F_{tab}).

From the regression result, the value of our calculated f-statistic is 420.3553. Thus F_c = 420.3553; k (the parameters) = 3; N (No of observations) = 31; Ft = $F\alpha_{,V1,V2}$; where V_1= k-1 (that is 3-1=2) and V_2= N-k (that is 31-3=28), where α = Level of Significance.

Thus, $F_{1\%,\ 2,\ 28}$= 5.45 and $F_{5\%,\ 2,\ 28}$= 3.34. Since $F_{cal} > F_{tab}$ (420.3553 > 5.54 and 3.34) at both 1% and 5% level of significance, we reject the null hypothesis (H_0) and conclude that there is a significant positive relationship between TRANSCON, INTRAN and GDP (economic growth) in Nigeria.
In conclusion, the linear regression model for Nigeria has a reasonable fit and therefore it can be concluded that relational expression exist between GDP, TRANSCON and INTRAN. The Null hypothesis is therefore rejected on this basis.

V. CONCLUSION AND RECOMMENDATION

This paper has provided an empirical explanation for the contribution of transportation on economic growth in Nigeria from 1981-2011. In line with existing literature, this study finds that the transportation infrastructure has a positive and statistically significant relationship with economic growth in Nigeria. This implies that increasing transportation infrastructure would increase economic growth. We therefore, recommend that the Federal government budget allocation to transport sector should be increased because this will increase the funds directed to improve the available infrastructure and to add to the existing infrastructure. Also, there should be full implementation of public private partnership (PPP) in transport sector project as recommend in the National draft on transport policy for the Federal Republic of Nigeria (2010). In addition, the Federal Ministry of Transport should balance the federal government effort through transportation regulations, strict monitoring of implementation of the allocation, improving the quality of human resources and the involvement of the private sector. They should provide adequate transportation facilities in terms of road signs, traffic lights, street lights, medians, drainages, and functional mass transit vehicles by government and private individuals is necessary so as to minimize traffic congestion and accidents.

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