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Rail Transport and Economic Growth in Nigeria (1970 – 2011).

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ABSTRACT

The study examined the link between rail transport and economic growth in Nigeria over the period 1970-2011 using Error Correction modelling approach. The results show that there is long run relationship among the variables. In addition, the EC models show that the error correction term is correctly signed and significant while there is inverse relationship between rail transport and economic growth in Nigeria. This explains the decadence in the sector due to the neglect of the sector by the government. The study therefore concludes that government should embark on development policies that will aim at strengthening the sub-sector of the economy so that it can operate in its full capacity and neutralise the decadence that is evident in the sector.

Keywords: *Rail Transport, Economic Growth, Error Correction Model.*

1.0 INTRODUCTION

Railway system plays a significant role in the development and overall growth of any economy. It is often regarded as the wheels of economic activity because of the crucial role it play in providing the bulwark upon which production and distribution stand. It opens up regions, hinterlands and rural areas by facilitating agricultural development as well as the growth of cottage and large scale industries. It also attracts residential, commercial, educational and recreational settlements and developments around its corridor. Due to the role it performs in growth and development process, rail transport is seen as the mainframe around which an integrated national transport system is built. Its capacity, which is further accentuated by its safety and security factors, coupled with its ability to travel longer distance with ease and lower unit costs, places it in good stead to serve as the hub of a transport system of a nation (Nwanze, 2002).

Rail transport has made varying degrees of impact on the development of the countries where they exist (Kolars and Malin,1970). Rowstow (1960) described rail transport as historically the most powerful single initiators of economic take off, being a main force in the widening of markets and a prerequisite to expanding the export sector. Hilling (1996) also observed that rail transport provides the first alternative to human porterage and brought with them some economic advantage. Early rail lines were critical to the development of commerce, the expansion of commercial agriculture and the stimulation of settlement expansion. The rail lines became the zone of economic activity, and the rail heads were the focal points for the expansion of settlements and economic input and output (O'Connor, 1965).

There are handful of literatures about rail transport-economic growth nexus both in the developed and the developing countries. For instance, Atack *et. al.*(2009) investigated whether railroad induces or follows economic growth in the American Midwest in the period 1850-1860. The results showed that railroad improvement leads to economic growth in the region. Other studies that support this finding include: Herranz-Loncan (2011) in Latin America, Haines and Margo (2006) in US, Herranz-Loncan (2011) in Uruguay and Ramirez (2001) in Colombia. Following the above findings in the literature, this study therefore attempts to examine the impact of rail transport on economic growth in Nigeria so as to see whether the result will conform to what is obtainable in the literature. Apart from this introductory part, the study is divided into four sections. Section two presents an overview of rail transport and economic growth in Nigeria. Section three explains the literature review while section four provides methodology and variable measurement. Section five presents estimation and discussion of results while section six concludes.

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2. OVERVIEW OF RAIL TRANSPORT AND ECONOMIC GROWTH IN NIGERIA

Figure 1: Performance of Rail Transport and Economic Growth in Nigeria (1970-2011).

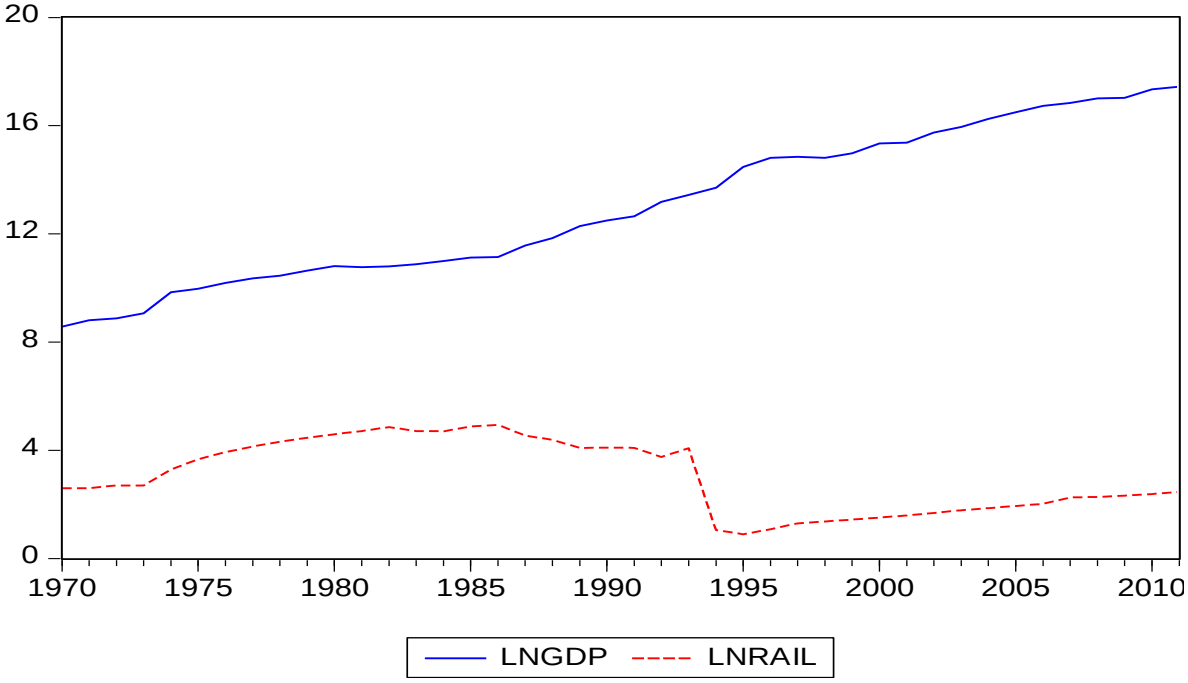

Figure 1 above shows the performance of rail transport and economic growth in Nigeria for the period 1970-2011. It can be deduced from the figure 1 above that the country experienced steady growth rate for the period under study. This could be attributed to increase in Agricultural produce that accounts for over 80% contribution to Gross Domestic Product in the early 70s and also the advent of crude oil which has now become the mainstay of the economy (CBN, 2011). However, the contribution of rail transport to economic growth is not stable over time. Figure 1 above shows an increase in rail output from 1970 to 1980 before the advent of crude oil. Thereafter, the country experiences a fall in rail output due to lack of sufficient budgetary provision by the Federal Government coupled with poor management by the Nigerian Railways Corporation (NRC) that is saddled with the responsibility of managing the subsector. Rail transport subsector hardly gets up to one-fifth of the allocation to the transport sector (CBN, 2011). Lack of necessary resources to keep tracks and maintain facilities in a good working condition is said to have produced a serious deterioration of the railway system. This decadence account for a sharp fall between 1990 and 1995 as depicted in figure 1 above.

Recent attempt to resuscitate the subsector by the government led to little success recorded as shown in figure 1 above from 1996 to 2011. The primary goal of the policy is to transform the railway system in Nigeria from its present condition to an efficient, flexible and competitive mode of transport so as to enable it plays its full part in the country's development.

3. LITERATURE REVIEW

Several authors have examined rail transport-growth nexus both in the developed and the developing countries. Herranz-Loncan (2011) examined the contribution of rail transport to economic growth in the Latin America before 1914. The paper used the growth accounting framework to provide estimates of the contribution of railways to the region's economic growth using four of the main Latin American economies (Argentina, Brazil, Mexico and Uruguay), in order to obtain the impact of the railway on those economies during the period of export-led growth. Results show that the contribution of railways to growth varied substantially across Latin American countries. More precisely, in the case of Uruguay, the growth impact of railways was very low, lower actually than in some European countries, such as Britain and Spain. This unexpected result may be explained by the features of the Uruguayan geography and economic structure, and provides a clear counterexample to the hypothesis that railways had higher benefits in Latin America than in the core industrialized countries.

Furthermore, Herranz-Loncán (2011) examined the role of railways in export-led growth of Uruguayan economy between 1870 and 1913 using OLS estimation. The results showed that Uruguayan railways did produce some positive effects. They helped to integrate the national market while also promoting the political and administrative unification of the country. However, their economic impact was much lower than in other

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countries of the region that experienced export-led growth. This indeed has affected the growth prospects of the Uruguayan economy. The results, therefore, provide reason for relative poor performance of the economy during the period under study. The study concluded that Uruguayan case provides a clear-cut example in which geography limited the potential of railway technology to generate significant levels of economic growth.

Atack *et. al.* (2009) investigated whether railroad induced or followed economic growth in the American Midwest for the period 1850-1860. Using a newly developed GIS transportation database, the study examined the subject matter, focusing on two indicators of broader economic change, population density and the fraction of population living in urban areas. The difference in differences estimates (supported by IV robustness checks) strongly suggest that the coming of the railroad had little or no impact upon population densities just as Albert Fishlow concluded some 40 years ago. However, the results also imply that the railroad was the reason for mid-western urbanization, accounting for more than half of the increase in the fraction of population living in urban areas during the 1850s.

Haines and Margo (2006) used panel data set of counties for 1850 and 1860 to examine the economic impact of gaining access to a railroad on local economic development in the US. Difference in Difference approach was adopted to compare outcomes from a treated group (counties that gain rail access in the 1850s) with a control group (those that gain rail access before and after 1850s). Results showed that rail access appears to have increased the percentage participation in the service sector, decreased agricultural yields, and reduced the share of improved acreage in total land area.

In addition, Ramirez (2001) studied the impact of rail transport on the Colombian's economic development using panel data set for the period 1914-1980. The study adopted fixed effect model and found out that railroads did not play an overwhelming role in the Colombian economy, in contrast to other Latin American countries with similar rail transportation system such as Brazil and Mexico. In addition, the study found out that railroads caused expansions in coffee exports, but the magnitude of these effects were lower than those suggested in the literature.

In order to verify the impact of rail transport on economic development, Bollinger and Ihlanfeldt (1997) used a simultaneous model of census tract population and employment to study the economic impacts of Atlanta's MARTA rail transit system for the period 1980-1990. The results indicated that MARTA has had no discernible impact on total population or employment in station areas, but it has altered the composition of employment in these areas in favor of the public sector.

In conclusion, the review reveals an inconclusive argument in the literature as to the contribution of rail transport to economic growth, both in the developed and developing countries. Therefore, this study intends to contribute to the existing literature by examining the impact of rail transport on economic growth in Nigerian as an example of a developing country.

4. METHODOLOGY

4.1 Model Specification

Following the work of Mankiw, Romer, and Weil (1992), the augmented Solow Model was put forward as:

$$Y_t = A_t \ K_t^{\alpha} \ H_t^{\beta} \ L_t^{1-\alpha-\beta} \qquad 3$$

By writing equation (3) above in intensive form, we have:

$$y_t = Ak_t{}^{\alpha} h_t{}^{\beta} \qquad 4$$

by taking logarithm of both sides, we have:

$$lny_t = lnA_t + \alpha \ lnk_t + \beta \ lnh_t \qquad 5$$

In order to introduce infrastructure components, human capital is decomposed following the work of Ijaiya and Akanbi (2009) and Esfahani and Ramırez (2003). Therefore:

$$lnh_t = lnGE_t + lnRA_t + lnINF_t \qquad 6$$

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Substituting equation (6) into (5), equation (5) becomes:

$$\Delta lny_t = \gamma_1 + \gamma_2 \Delta lnk_t + \gamma_3 \Delta lnGE_t + \gamma_4 \Delta lnRA_t + \gamma 5 \Delta lnINFt + \varepsilon_t \quad 7$$

where :
y_t = GDP
k_t = Capital
GE_t = Government expenditure on rail
RA_t = Rail and pipeline output
INF_t = Inflation
ε_t = Error term

4.2 Estimation Techniques

Equation (7) above is the final equation to be estimated in order to determine the contribution of rail transport to economic growth in Nigeria. To achieve this, the first step is to test for the stationarity level of the variables. This is because non-stationarity of variable is one of the properties of time series data that was used in this study. As a result of this, the study adopts both Augmented Dickey-Fuller (ADF) test proposed by Engle and Granger (1987) and Kwiatkowski-Philip-Schri-Shin (KPSS) 1992 test. The Augmented Dickey-Fuller (ADF) test for unit root involves the estimation of the following equation:

$$\Delta Y_t = \beta_0 + \delta Y_{t-1} + \gamma_1 \Delta Y_{t-1} + \gamma_2 \Delta Y_{t-2} + \ldots\ldots \gamma_p \Delta Y_{t-p} + \mu_t \quad 8$$

$$\Delta Y_t = \beta_0 + \delta Y_{t-1} + \sum_{i=1}^{p} \gamma_i \Delta Y_{t-t} + \varepsilon_t \quad 9$$

The ADF test for unit root test the null hypothesisH_0: δ=0 against the alternative H_1: δ<0. Thus, it tests the null hypothesis of a unit root against the alternative that the series is stationary. The use of KPSS is adopted to take care of the limitation of the ADF statistic in deciding weather e = 1 or e = 0.98, in a model like:

$$X_t = \boldsymbol{\mu} + eX_{t-1} + \Sigma_t \quad 10$$

The next step is to examine the possibility of long run relationship among the variables. Johansen proposes two different likelihood ratio test of significance of these canonical corrections and thereby reduced rank of the Π matrix: the trace test and maximum Eigen value test are shown respectively in equations (11) and (12):

$$J_{trace}(r) = -T\sum_{i=r=1}^{n} In(1-\lambda_i) \quad 11$$

$$J_{trace}(r, r+1) = -T \ln(1-\lambda_{r+1}) \quad 12$$

Where T is the sample size and $\lambda_i$is the i_{th} largest canonical correlation. The trace test tests the null hypothesis of r cointegrating vectors against the alternative hypothesis of n co-integrating vectors. The maximum Eigen value test on the other hand tests the null hypothesis of r co-integrating vectors against the alternative hypothesis of r + 1 co-integrating vectors. In general however, neither of these test statistics follows a chi square distribution; asymptotic critical values can be found in Johansen and Juselius (1990) and are also given by most econometric software packages. The critical values used for the maximum eigenvalue and trace test statistics are based on the pure unit-root assumption and thus, they will no longer hold when the variables under consideration are near-integrated of near-unit-root processes.

4.3. Variable Measurement

GDP is measured as the monetary value of all goods and services produced in the country. Capital is proxied by gross fixed capital formation as argued by Esfahani and Ramırez (2003). GE represents government expenditure/investment on rail transport in Nigeria. RA is the rail and pipeline output data and INF represents inflation level in the country which can affect the amount of money invested in the sector. Data on these variables are collected from Central Bank on Nigeria (CBN) statistical bulletin 2011 edition.

5. DISCUSSION OF RESULTS

The unit root test on all variables was carried out using the Augmented Dickey-Fuller(ADF) and KPSS tests with intercept only and the result is presented in Table 1 below. The result shows that all variables, except inflation, are integrated at order one, that is, they became stationary after first differencing. The KPSS unit root test results, as reported in the table, confirmed results from ADF test.

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Table 1: Unit Root Test for Stationarity

Series	ADF		Remarks	KPSS		Remarks
	Level	1^{st}Difference	1(1)	Level	1^{st}Difference	
lnCapital	- 1.5288	- 9.7233*	1(1)	-1.5288	-9.7235*	1(1)
lnGDP	-0.1872	-5.6727*	1(1)	-0.1872	-5.6726*	1(1)
lnexp	-1.0491	-8.0577*	1(1)	1.0491	-8.0577*	1(1)
lninflation	-3.8545*	-	1(0)	3.8545*	-	I(0)
lnrail output	-1.2141	-6.1192*	1(1)	1.2141	6.1192*	1(1)

*indicates significant 1% level of significance

The next step is to determine whether there is long run relationship among the variables. The study employs Johansen-Juselius (1990) multivariate co-integration methodology to determine the number of co-integrating variables due to its well documented superior properties over the Engle-Granger two-step procedure (Gonzales,1994). The result of trace test, as presented in table 2, indicates that there is one co-integrating vector at 5% significance level when the study assumed no linear trend in the data and allowed for an intercept in the co-integrating relationship. The Max-Eigen statistic indicates one co-integrating vector which is also at a 5% significance level with the same specifications. The co-integrating equation (normalized on the growth variable) is as shown in panel B of table 2. The results in panel A of table 2 show that the null hypothesis of no co-integration i.e. 0 can be rejected either using Max-Eigen or the trace tests statistics. Therefore, the study concluded that there is a co-integrating relationship between output and infrastructural facilities in Nigeria. The existence of co-integration means that, although each variable displayed a stochastic behaviour individually, together, they moved back into the equilibrium position by correcting any deviation in their equilibrium values (Saibu and Oladeji, 2008). The economic significance of this is that any one of the variables could be targeted as a policy variable for bringing about the desired long-term effect on others. The co-integrating equation (normalized on growth variable) shown in panel B of table 2 indicates that inflation and rail output have positive sign while capital and government expenditure have negative sign (the sign are reversed because of the normalization process). The t-ratio indicated in parenthesis showed that all coefficients except rail output are significant.

Table 2: Summary of Co-integrating Results (Panel A)

Null	Alternative r	λ-max	Prob	Trace	Prob
0	1	59.42133	0.0000	96.62047	0.0001
≤1	2	16.58275	0.6159	37.19914	0.3382
≤2	3	13.28977	0.4259	20.61639	0.3820
≤3	4	7.254368	0.4595	7.326621	0.5399
≤4	5	0.072253	0.7881	0.072253	0.7881

Panel (B): Estimates of co-integrating vector

lngdp	lninflation	lncapital	lnGovtExp	lnrail
- 1.00	-7.233 (10.7408)	1.950 (5.5643)	1.099 (3.0780)	-0.512 (1.3925)

Next we generate the error correction models that capture the short and long run behaviour of the output relationship. The changes in the relevant variables represents short-run elasticities while the coefficients of error correction term represents the speed of adjustment back to the long-run relationship among variables. Table 4 below provides the results for output growth relationship for the period 1970-2011. The results show that lagged value of the dependent variable is positive and significant. This implies past growth recorded in the economy has significant impact on the current growth. Government expenditure on rail transport and its lagged value have negative impact on economic growth. Although meaningful conclusion cannot be made based on this result because the coefficients are not significant. Lagged values of rail transport have negative impact on economic growth and their values are significant. This reveals the extent of decadence in rail transport in the economy.

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This is attributed to the development of oil sector that led to the neglect of other sectors in the economy. Lagged inflation has negative impact on the economic and it is significant. This implies high level of inflation in the past is inimical to economic growth.

The relative fit and efficiency of error correction regression is averagely alright, and as the theory predicts, the error correction terms are negative and significant in all the reported equations in table 4. Using regression formulation 1, the error correction shows that a deviation from long-run growth this period is corrected by about 252% in the next year which is almost immediately.

Table 4: Nigeria: Error Correction Model (dependent variable $\Delta \ln Y_t$)

	OLS Regressions			
Variables	1	2	3	4
Constant	-0.03(0.788)	-0.01(0.915)	-0.06(0.677)	-1.87(0.001)**
$\Delta \ln Y_{t-1}$	2.76(0.005)**	2.18(0.004)**	2.18(0.006)**	10.75(0.000)**
$\Delta \ln K_t$	-0.02(0.336)	-	-	-
$\Delta \ln K_{t-1}$	0.04(0.050)**	0.05(0.019)**	0.05(0.026)**	0.21(0.000)**
$\Delta \ln K_{t-2}$	-	-	-	0.01(0.352)
$\Delta \ln GE_t$	-0.04(0.155)	-	-	-
$\Delta \ln GE_{t-1}$	0.02(0.582)	0.04(0.173)	0.04(0.177)	0.12(0.021)**
$\Delta \ln GE_{t-2}$	-0.04(0.188)	-	-	-0.03(0.390)
$\Delta \ln GE_{t-3}$	-	-0.004(0.548)	0.002(0.934)	-
$\Delta \ln RA_t$	-0.06(0.253)	-	-	-0.07(0.174)
$\Delta \ln RA_{t-1}$	-0.18(0.003)**	-0.18(0.001)**	-0.17(0.002)**	-
$\Delta \ln RA_{t-2}$	-	-0.08(0.160)	-0.07(0.243)	-0.07(0.246)
$\ln INF_t$	-0.01(0.828)	-	-	-
$\ln INF_{t-1}$	-0.11(0.019)**	-0.08(0.048)**	-0.08(0.07)*	-0.52(0.000)**
$\ln INF_{t-2}$	-	-	-	0.40(0.001)**
ECM_{t-1}	-2.52(0.005)**	-2.23(0.003)**	-2.21(0.006)**	-10.75(0.000)**
R^2	0.56	0.50	0.50	0.54
D. W.	1.88	1.81	1.60	1.87

Note: probability value in parenthesis. All variables are as defined. *and** indicate level of significance at 1% and 5% respectively.

6. CONCLUSION

The study examined the contribution of rail transport to economic growth in Nigeria using time series data over the period 1970 - 2011. This is as a result of huge investment of resources by the government in order to resuscitate the sector. The results show that rail transport enhance economic growth and this is line with the theory. Also it an be deduced that the neglect of rail transport sub-sector over time is inimical to the growth of the economy. This is evident from the regression result in which there is inverse relationship between rail transport and economic growth. Also, the lagged value of rail transport is negative and statistically significant. This explains the extent of decadence in the sector since the advent of crude oil in the economy.

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Furthermore, the results show that there is long- run relationships among the variables in the model. This implies that any of the variables can be used to enhance economic growth in the future. Also, the error correction is correctly signed and significant. On the final note, government should raise development policies that will aim at strengthening the sub-sector of the economy so that it can operate in its full capacity and neutralise the decadence that is evident in the sub-sector.

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