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The Impact of Rail Freight and Passengers Volume on Economic Growth in Nigeria: 1970 -2017

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Abstract

The study investigated the impact of rail freight and passengers volume on economic growth in Nigeria (1970 – 2017). Annual time series data were sourced from Nigerian Railway Corporation, Federal Ministry of Transport, Central Bank of Nigeria and National Bureau of Statistics. The data were tested for stationarity using Augmented Dickey Fuller (ADF) test while the co-integration was conducted using Johansen's test. The estimation technique employed for the time series data was Error Correction Model (ECM). The results show that, there is long-run equilibrium relationship between the key variables, Gross Domestic Product (GDP), Volume of Freight (VOF) and Volume of Passengers (VOP). ECM also has the expected negative sign and is between the accepted region of less than unity. The result showed VOP has a positive relationship with GDP but does not have significant impact on GDP. VOF has a negative relationship but has significant impact on GDP. The negative impact of VOF on economic growth can be attributed to total neglect of railway sub-sector in Nigeria by successive government. The study therefore recommends that government should continue to increase capital expenditure in the rail sub-sector in order to rehabilitate old and provide modern rail tracks, purchase modern coaches and locomotives will aid movement of passengers and goods across cities and the hinterland which will boost economic activities, increase output, facilitate trade and generate employment across the country.

Keywords: Freight, Passages, Rail Transportation, Economic Growth
JEL Codes: O18, R41, O47.

1. Introduction

Transportation is a derived demand. The demand from a given location depends on the existence of demand of passengers and goods in the distant location. Transportation plays an important role in helping to bridge the demand and supply gap inherent in production approach between the geo-political zones of the economy. Transportation affects every individual directly or indirectly. The place we go to, the goods we consume and the entertainment are impacted by transportation. The growth of the Nigerian economy is attributable in part to the transportation system of the economy (Siyan, 2017).

Transportation infrastructure investment is critical to the economic well-being of Nigeria. These investments enhance mobility and provide our people with increased business and work opportunities. Advancing integrated, multi-modal networks provide travel options that improve connectivity, affect the health and well-being of urban and rural communities, and contribute to creating "smart" cities through the 21st century. Also, continuous re-investment is important to sustaining and advancing the Nigerian's competitive advantage in the worldwide

marketplace. It allows companies to establish lean supply chains and deliver competitively priced products and services, while at the same time achieving healthy profit margins.

The role of public infrastructure in the process of economic growth has received a wide attention since the contributions of Aschauer (1989) and the theoretical model of Barro (1990). These works showed that public capital generates spillover effects for the private sector. This view has been questioned in subsequent studies. It has been argued that while public investment may be considered as a factor input that contributes to economic growth, the way it is financed may crowd out private investment (Mittnik & Neumann, 2001). The main criticism of government intervention is that it is not as effective as market forces in allocating resources.

In many countries, rail transportation has and continues to play a catalytic role in bringing about socioeconomic development. It contributes substantially to the movement of passengers and freight. Indeed, railways can provide the most cost-effective, affordable, energy saving and environmentally friendly form of transport, when traffic densities are high. When properly integrated with other modes of transport, economic levels of traffic can be consolidated to enable the railway provide efficient services for high density flows of homogenous traffic carried over relatively long distances, including high volumes of containerized cargo or bulk freight such as oil, coal, steel or agricultural produce. Rail transport could be energy flexible and energy efficient, when electric traction is used.

The Nigerian railway network consists of 3,505 kilometers of single track route of 1,067mm (narrow) gauge and 479 km of the standard gauge construction of 1,435mm (Ajaokuta - Warri line). It traverses from the South-West (Lagos) to the North-East (Maiduguri) and from the South-South (Port Harcourt) to the North-West (Kaura - Namoda). Equally, new railway lines are being constructed in standard guage (1,435mm). These include: Ajaokuta - Warri of 277km; Kaduna - Abuja line of 186km while the scope of work for Lagos – Ibadan segment is under review together with its cost implications. The primary reason for constructing the railways was partly administrative: to provide a link between the northern and southern parts of Nigeria and partly economic: to enhance the evacuation of mineral resources and agricultural products from the hinterland to the seaports, for onward shipment to overseas markets in Europe (Nigerian Railway Corporation, 2017).

Several years after independence, Nigerian rail transport infrastructures investment still remains primary in Nigeria's transport system. While the maritime sector has been developed in terms of capacity and fair country-wide spread, the rail sector continues to be bogged down by systemic neglect (Akwara, Udaw & Ezirim, 2014).

The railway well suited for the movement by large numbers of inter-city passengers and high volumes of containerized cargo or bulk freight such as oil, coal, steel or agricultural produce. Since the fall in the price of oil in the international market, it has been difficult for the nation to finance her rail transport infrastructures because Nigerian economy is mono-economy that depends only on one source of foreign exchange earnings. The railway is well suited for the movement by large numbers of inter-city passengers and high volumes of containerized cargo or bulk freight such as oil, coal, steel or agricultural produce. The effects of the poor performance of the Nigerian railway subsector is already being felt seriously in the form of the undue pressure being mounted on the road transport across the country and the attendant huge damage to roads and loss of lives among other things. Many rail and road projects have been stopped due to the fall in oil revenue. This has led to low economic activities, decrease in productivity, increase in unemployment, low income, and high price level among others.

At the moment, the NRC operates just one freight service from Lagos to Kano each week. Years of neglect of both the rolling stock and the right-of-way have seriously reduced the capacity and utility of the system. Couplings of the chopper kind, vacuum brakes and non-roller bearing plain axles are also obsolete. By early 2013, the only operational segment of Nigeria's rail network was between Lagos and Kano. Passenger trains took 31 hours to complete the journey at an average speed of 45 km/h. With Nigeria's increasing population rate and the majority of the population involved in intra and interstate trade, Nigerian rail transport can no longer provide effective and efficient means of transporting passengers and goods **(**Ataguba, 2014).

From the foregoing, this study seeks plausible answers to the following research questions:

i. Is there any significant impact of volume of freight from rail transportation on economic growth in Nigeria?
ii. Does volume of passengers from rail transportation have positive impact on economic growth in Nigeria?

2. Literature Review and Theoretical Framework

The relationship between transport and economic development is a matter of much theoretical interest and practical importance and one that has received considerable attention over many years in both the developed and less developed countries. It is also an extremely topical and controversial area of study. Economists seek to explain how transportation infrastructure development can improve economic growth and also standard of living of the citizens. On the other hand, Geographers are more concerned with the spatial implications of transportation infrastructure development which would help in the general allocation of government expenditure in the economy (Ojekunle, 1999).

Yoshino and Abidhadjaev (2015) examined the nature and magnitude of the impact of railway infrastructure provision on regional economic performance in Uzbekistan. They employed difference-in-difference methodology linking the changes in the growth rate of regional-level economic outcomes in affected regions to the newly built railway connection in the southern part of Uzbekistan. The empirical results suggest that the Tashguzar–Boysun–Kumkurgon railway line in Uzbekistan encouraged an increase of around 2% in growth rate of the region due to connectivity effects by increasing the industry value added and services to approximately 5% and 7%, respectively. Positive and significant changes in the industrial output of the directly affected and neighboring regions mostly took place during the design and construction period in anticipation of the railway connection. The impact on agricultural output has been moderate in comparison to the other sectors, constituting around 1%. They suggested that the nature of effects of the infrastructure provision might be mirrored throughout the transition economies of Central Asia, as well as in other developing countries of Asia that might share a commonality of processes accompanying emerging markets.

Ojekunle (2015) assessed the commercial viability of rail transport operations in Nigeria. The data collected were analyzed using both descriptive statistics and regression analysis (SPSS Version 20). The results of data analysis showed that rail transport operations presently are not commercially viable. The variables used were volume of passenger, freight carried, Operating cost, Number of trips, Number of locomotives/wagons and coaches available. The result of the regression analysis shows that operating cost, number of trips made the capacity of train service and volume of freight carried were major determinants of estimating revenue generated from passenger operation. The variables account for 90.2% of the factors that determine the amount of revenue generated from freight operations of rail transportation in Nigeria. The NRC ran its operation at an average annual loss of 58.3% for passenger operation and 32.8% for

freight operation. However, it is revealed that increase in the operational capacity of NRC will enhance the commercial viability of rail services in the country. It is therefore suggested that rail operational capacity should be increased by providing more locomotives, wagons, coaches and improving its operational efficiency.

Mitwallyova and Jankovic (2015) examined the influence of railway infrastructure on the lives in selected European countries. Descriptive statistics were used to analyze the data. It was discovered that in the freight transportation area that all states are predominantly surpassed by Estonia who successfully exploits its position on the Baltic Sea coast. Germany and the Czech Republic reach mean values, while Serbia exceeds Italy as well as Switzerland and Great Britain. The differences are not very significant though. Comparing the indicators of transported gross-ton-kilometres per 1 employee, a huge dispersion is striking which shows in analysis outcomes in many European countries. The average value is 1.52 million gtkm per 1 employee, the most efficient Estonia having the indicator of 14 million gtkm per 1 employee, while the lowest being held by Great Britain with a mere 29.8 gtkm/1 employee. The study noted that EU states are capable of far more efficient utilization of their workforce than post-communist states with the exception of Estonia in the area of freight transportation.

Lingaitisa and Sinkevičiusb (2014) studied the relations between the passenger transport by railway and macroeconomic processes of a country (region), the correlation and regression statistical analysis of people's income, consumption, motorization, change in population, unemployment and passenger circulation were used. The 2001–2012 statistical research indicators for Lithuania were used. The result shown that, due to the increased motorization as a result of the growing standard of living, the amount of railway passengers is decreasing, negative – reverse correlation coefficients between the passenger transport and the indicators of GDP, average wage, final consumption expenditures were found. Also close correlation of the passenger transport and the change in population were recorded.

Apanisile and Akinlo (2013) examined the link between rail transport and economic growth in Nigeria over the period 1970-2011 using Error Correction modeling approach. The economic variables used were; GDP, capital, government expenditure on rail, rail and pipeline output and inflation. 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. There is negative relationship between inflation and economic growth in Nigeria over the period under review. This explains the decadence in the sector due to the neglect of the sector by the government. The study therefore concluded 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 neutralize the decadence that is evident in the sector.

Furthermore, Herranz-Loncán (2011) examined the role of railways in export-led growth of Uruguayan economy between 1970 and 2010 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 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.

Robinson and Mortimer (2004) studied the state of the art in urban rail freight distribution on the basis of some relevant European examples. They discovered that rail has, in many areas, been displaced in whole, or in part, from a dominant position as road transport services have grown and developed in capability and levels of sophistication that have not, regrettably, been matched by rail service providers. Rail's generic weaknesses, particularly in door-to-door capability, cost - compared to road transport alternatives, which largely exclude consideration of external costs - and service availability have been the principal causes of the decline in rail's share of the urban freight market. The development of city planning, zoning and rebuilding practice has also created problems by effectively sterilizing operational and commercial options that were formerly open to rail. They therefore, concluded that there is no doubt that rail no longer commands a prominent place in urban freight activities. There are some grounds for believing that rail can rebuild market presence, but this will need to be done with a much greater recognition of the market's needs and requirements and how these continue to evolve. Shippers are now accustomed to slick; sophisticated, road-based logistics services and are very unlikely to be prepared to sacrifice these for a less capable and costlier alternative.

In addition, Ramirez (2001) studied the impact of rail transport on the Colombia'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.

3. Methodology

This section presents macroeconomic models that permit the simulation of influence of macroeconomic variables on the Nigerian economic growth. The models consist of one behavioural equation and four explanatory variables. The methodology to be employed in estimation of the time series data is Error Correction Model (ECM). Following the link between rail transportation infrastructure and economic growth reviewed earlier, as well as the work of Pooloo (2009), hence we adapt the model of Ojekule (2015) with the functional relationship specified as follows:

$$GDP_t = f(VOF_t, VOP_t, INF_t, INT_t) \quad ...3.1$$

In order to capture the responsiveness of the dependent variable (GDP) to the explanatory variables (VOF, VOP, INF, INT), we take the log of equation (3.1)

$$\ln GDP_t = \beta_0 + \beta_1 \ln VOF_t + \beta_2 \ln VOP_t + \beta_3 INF_t + \beta_4 INT_t + \mu_t \quad ...3.2$$

In the model represented by equation (3.2), GDP is the Gross Domestic Product. Other variables in the model are defined as follows: VOF represents Volume of Freight in rail transport while VOP is the Volume of Passengers in rail transport. INF and INT are inflation rate and interest rate. $\beta_1 - \beta_4$ represent the coefficients of the explanatory variables, while μ is the error term. The a priori expectation posed that β_1 & $\beta_2 > 0$ while β_3 & $\beta_4 < 0$.

4. Estimation and Interpretation of Result

Unit Root / Stationarity Test

Stationarity is defined as a quality in which the statistical parameters (mean and standard deviation) of the process do not change with time (Challis & Kitney, 1991). The assumption of the classical regression model necessitates that both the dependent and independent variables be stationary and the errors have a zero mean and finite variance. According to Granger and Newbold (1974), the effects of non-stationarity include spurious regression, high R^2 and low Durbin-Watson (DW) statistic. The Augmented

Dickey Fuller test modifies the work done by (Dickey & Fuller, 1979) was used to test the Stationarity of the data.

Table 4.1: Unit Root Test for Stationarity Result

Variable	ADF Statistics	Critical Value	Stationary Status
GDP	-7.610362	-4.26274(1%) -3.55297(5%) -3.20964(10%)	I(1)
VOP	-8.625674	-4.26274(1%) -3.55297 (5%) -3.20964(10%)	I(1)
VOF	-5.166726	-4.26274(1%) -3.55297 (5%) -3.20964(10%)	I(1)
INF	-4.484296	-4.26274(1%) -3.55297 (5%) -3.20964(10%)	I(0)
INT	-5.860210	-4.5743 (1%) -3.6920 (5%) -3.2856 (10%)	I(1)

The critical values for rejection of hypothesis of unit root were from MacKinnon (1990) as reported in e-views 9.0.; Source: E-Views Output, Version 9.0

The table above shows the result of the unit root test for stationarity. The five variables (GDP, VOP, VOF, INF and INT) underwent unit root test using the Augmented Dickey-Fuller (ADF) test. As is the case most times, only INF was stationary at levels I(0) while other variables (GDP, VOP, VOF and INT) were found to be stationary after first difference I(1).

Table 4.2: Johansen Co-integration Test
Series: GDP VOP VOF INF INT

Unrestricted Cointegration Rank Test (Trace)				
Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.825231	236.9292	150.5585	0.0000
At most 2 *	0.573807	113.3767	88.80380	0.0003
At most 3 *	0.524298	76.70361	63.87610	0.0029
At most 4 *	0.402146	44.75621	42.91525	0.0323
At most 5	0.205504	9.892040	12.51798	0.1321
At most 6	0.256499	22.63661	25.87211	0.1200

*Trace test indicates 4 cointegrating eqn(s) at the 0.05 level; * denotes rejection of the hypothesis at the 0.05 level; **MacKinnon-Haug-Michelis (1999) p-values; Source: E-Views Output, Version 9.0*

The table 4.2 above shows there is long run relationship among three keys variables which are GDP, VOF and VOP. The result shows the three variables (GDP, VOF and VOP) converge in the long run thereby depicting the existence of long run relationship among them. The long run relationship exists at 5% level of significance according to the trace test statistics. However INF and INT were not co-integrated with the rest of the variables, this implies there exists

three (3) co-integrating relationships among the variables.

Table 4.3: Error Correction Mechanism
Dependent Variable: ΔGDP_t

Independent Variables	Coefficient	Standard Error	t-Statistic	Pr Value
Constant Intercept	-51672.43	17761.16	-3.44554	0.0456
ΔVOF_t	11824.59	895.6475	10.04561	0.0000
ΔVOP_t	0.002521	0.001290	1.954225	0.0639
ΔINF_t	-13552.67	547.4567	-1.221881	0.0531
ΔINT_t	1.024911	0.012171	3.104332	0.0021
ECM (μ_{t-1})	-0.246324	0.035809	-3.125736	0.0000
R^2	0.503576	F Statistic	33.46217	(00000)
Adjusted R^2	0.541721	D-W Statistic	1.947939	

Source: E-Views Output, Version 9.0

Since the key variables were found to be co-integrated implying that they have long run equilibrium relationship, it is necessary to test for short run relationship. From table 4.3, the ECM parameter is negative (-) and significant which is -0.246324, this shows that 25 per cent disequilibrium in the previous period is being corrected to restore equilibrium in the current period. It has been established the variables are co-integrated and also have short run relationship established from the ECM. Hence, the OLS technique will be used to derive the long-run impact of the independent variables (VOP, VOF, INF and INT) on the dependent variables (GDP).

Table 4.4: Least Square Regression Result
Dependent Variable: GDP

Independent Variables	Coefficient	Standard Error	t-Statistic	P-Values
C	6.945064	2.181561	3.183530	0.0028
VOP	0.003153	0.102328	0.030817	0.9756
VOF	-0.283406	0.102705	-2.759409	0.0087
INF	0.020343	0.008187	2.484810	0.0172
INF	0.020343	0.008187	2.484810	0.0172
R^2	0.583594	F Statistic	74.98254	0.00000
Adjusted R^2	0.541543	D-W Statistic	1.947939	

Source: E-Views Output, Version 9.0

Table 4.4 is the result of the least square estimate for the model. Volume of Passengers (VOP) has a positive impact on Gross Domestic Product. This result fulfils a priori expectation and consistent with previous literature including the study of Dowden (2013); Mitwallyova and Jankovic (2015); and the study of Ojekunle (2015). Volume of Freight (VOF) has a negative impact on Gross Domestic Product. This result does not fulfil a priori expectation. This result supports the study of Robinson and Mortimer (2004) on the impact of urban rail freight in some European countries but not consistent with empirical study of Dowden (2013); and Mitwallyova and Jankovic (2015). Interest Rate (INT) has a positive impact on Gross Domestic Product. This result also fails a priori expectation and is not in line with the study of Maiga (2015) and Obamuyi (2009). The result from Inflation Rate (INF) shows that INF has a positive impact on Gross Domestic Product. This result does not fulfil a priori expectation and is not consistent with the study of Apanisile and Akinlo (2013) and Marbuah (2010). But the study of Umaru and Zubairu (2012) show that there is positive relationship between inflation and economic growth which is in line with our result.

5. Conclusion and Recommendations

Transportation plays a pivotal role in the economic, political and social development of every nation. No two locations will interact effectively without a viable means of movement. Rail transportation can therefore provide substantially to the movement of passengers and freight (goods). Indeed, railways can provide the most cost-effective, affordable, energy saving and environmentally friendly form of transport in Nigeria if adequate attention can be given to it by the government. Rail transportation has capacity to link producers and consumers together, making it easy to move raw materials, commodities and other finished products. An efficient and effective rail transportation system in Nigeria is essential in supporting economic growth and in fact serves as a corner stone to economic development.

Also, increase in volume of freight and passengers have the capacity and potential to increase economic growth and employment in Nigeria if government can continue to increase its investment in the rail transportation sub-sector. Increase in the number of locomotives, coaches and cargoes will improve movement of passengers and goods will boost trade and business activities, increase output, generate employment either directly or indirectly and generate more revenue for the government.

Rail transportation infrastructure investment in Nigeria has only been in the exclusive list of the government. This has hampered the development of rail transportation sub-sector. As a matter of fact, the Nigerian Railway Corporation has operated as a monopoly since its establishment. Deregulation of the activities of NRC like what obtains in the telecommunication sector will improve the rail infrastructural provision and services delivery of the corporation. Involvement of the private sector in the provision of rail transportation facilities and services will indeed improve the sub-sector and overall economic performance in Nigeria.

Based on the findings, of this study, the following recommendations are proffered in order to improve the quality and quantity of rail transportation infrastructure in Nigeria:

The government remains the major financier of infrastructure in every economy. Nigerian government must continue to increase capital expenditure in the rail sub-sector in order to rehabilitate abandoned rail tracks and construct new rail tracks across the country. This will improve the contribution of rail transportation in contributing to economic growth and employment generation in Nigeria. In order to improve economic activities, the government should provide modern rail tracks, purchase modern coaches and locomotives, which will aid the movement of passengers and goods across cities and the hinterland. This will improve trading and mobility in the country. The Nigerian Railway Corporation functions as a monopoly. There is need for government to decentralize the sub-sector in order to allow other levels of governments (states and local governments) participate in the establishment and provision of rail transportation infrastructure which has been in the exclusive list of the federal government.

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