

A Multivariate Analysis of the Transportation Sector and Economic Growth in Nigeria

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Abstract

It is widely acknowledged that an efficient transportation sector promotes economic growth in a country. This study empirically examines the relationship between the transportation sector and economic growth in Nigeria. Focussing on the road, air, water and rail/pipeline transport subsectors and employing Eagle-Granger Co-integration and Error Correction Model (ECM) on time series data from 1981 to 2020; the results show that in the long run, road and air transport sub-sectors positively and significantly impact Gross Domestic Product in Nigeria while water and rail/pipeline transport sub-sectors have a negative but significant impact on growth. Although the water and rail/pipeline transport sectors do not meet apriori expectations, the results are consistent with earlier studies done in Nigeria. Furthermore, the findings show that the road transport sector has the greatest impact on Gross Domestic Product. To maximize the potential of the transportation sector, the paper suggests that the government should address the challenges in the road and air sectors and revamp the water and rail sectors for better productivity.

Keywords: Transportation, Road Transport, Water Transport, Air Transport, Rail/Pipeline Transport, Economic Growth, ECM.

Introduction

The economic growth of any country depends on the efficacy of different sectors of the economy of which the transportation sector is one. In any country, transportation provides and improves the access people, businesses and organizations have to different locations as well as facilitates a large range of social and economic interactions that would otherwise not be possible. That is, businesses can connect with other businesses and people can connect to social, educational, recreational, personal, leisure and other activities. As stated by many studies, an efficient transportation sector promotes people's well-being; businesses development and contributes to economic growth (Adeyi, 2018; Braham, 2017; Filip & Popa, 2016; Ministry of Transport, 2016; Hong et. al., 2011; Rudra & Tapan, 2013; Samir et., al. 2018).

The transportation sector in Nigeria is divided into five subsectors: road transport, rail/pipeline transport, air transport, water transport, post/courier services and other transport services (CBN, 2022) with the main modes of transportation as road, rail, water and air. In Nigeria, of the entire transportation modes, road transport is the most

commonly used (Chi & Udo, 2020; Faajir, 2016) followed by water, rail and air (Ayantoyinbo & Ekundayo, 2015) and these four modes as identified in literature will be used in this study. For many years, road transport has contributed the most to the output of the transportation sector in Nigeria. As of 2020, it was responsible for about 88 percent of the subsector's contribution to the Gross Domestic Product (GDP) while the other four subsectors accounted for about 12 percent. This is quite different from the 90 percent contribution of the road sector and 10 percent by others as stated in Ayantoyinbo and Ekundayo (2015). The decline in performances can be attributed to problems in the sector such as bad roads, inadequate trains and airplanes; congested ports (NBS, n.d.); insecurity, banditry, vandalization of pipelines and other factors of which Ayantoyinbo and Ekundayo (2015) rightly stated are responsible for restraining the Nigerian economy from maximizing the benefits from the sector. Furthermore, Akanbi et al. (2013) and Gmbh (2016) describe the transportation infrastructure as being in a poor state. As usual with past and current governments of Nigeria, attempts have been made to improve the performances of the different transportation modes.

It is in light of the spate of challenges and the different policy initiatives established in the transportation sector that the need to investigate the relationship between the transportation sector and economic growth in Nigeria is justified. In this regard, the basic objective of this study is to determine the impacts of the road, water, rail/pipeline, and air transport subsectors on the Gross Domestic Product in Nigeria for a period of 39 years (1981-2020). This paper adds to the existing literature by focussing on just four transport modes within a timeframe that is different from previous studies. It will provide an additional stance to policymakers, government and academia, on the effect of the transport subsectors' contributions to economic growth in Nigeria. Consequently, the paper is divided into five sections wherein the second addresses the literature review, third methodology, fourth is, the presentation and discussion of results and the last conclusion and recommendations.

Literature Review

Conceptual Review

Economic growth is simply an increase in the productive capacity of an economy (Isere & Ehighebo, 2023). It is the increase in the quantity of goods and services produced in a country within a specified period. On the other hand, Merriam-Webster dictionary (n.d.) defined transportation as an act, process or instance of transporting or being transported while Chi and Udo (2020) defined transportation as the medium through which goods are moved from the manufacturers to the final consumers. Summarily, it is the movement of people and goods from one place to another, using different modes of transport such as road, air, water, pipeline or rail.

Relationship between Transportation and Economic growth

As observed by Samil et. al. (2018), the transport-economic growth nexus is among the most important issues being addressed in recent economics literature. Keeling and Mooney (2011) (as cited in Ayantoyinbo & Ekundayo, 2015) argued that a transport system adds directly to economic growth and development through rail, road, air and maritime services. Succinctly put, the Eddington Transport Study (2006, as cited in Ministry of Transport, 2016) stated that history is full of how transport networks played a critical role in driving phases of rapid economic growth through inter-urban and international connections which eventually led to the introduction of new production processes and specialization in the production of goods and services. According to NBS (n.d.), a good transport system or sector (road, rail, air and water transport) is essential to support economic growth and development because they provide economic and social opportunities that result in positive multiplier effects such as better accessibility to the markets, employment and more investments. On the other hand, a weak transport sector results in a lot of missed opportunities. Establishing therefore an efficient transportation sector in Nigeria can stimulate rapid economic growth

The transportation sector in Nigeria is categorized into five subsectors: road transport; rail transport and pipelines; post and courier services; air transport; water transport and other transport services (CBN, 2022) with the key modes of transportation as road, rail, water and air. Adeyi (2018) observed that there is rapid growth in the demand for public transport services due to population growth, urbanization and an increase in economic activities. Of all services, road transport is the most commonly used (Chi & Udo, 2020; Faajir, 2016) followed by water, rail and air (Ayantoyinbo & Ekundayo, 2015). Studies have shown that road transport has contributed the most to the output of the transportation sector in Nigeria and other developing countries (Chi & Udo, 2020; Ghosh & Dinda, 2022). As of 2020, about 88 percent of the subsector's contribution to the Gross Domestic Product (GDP) was from road transport while the other subsectors accounted for about 12 percent. This is quite different from the 90 percent road sector contribution and 10 percent by others, between 1981 and 2012 mentioned in Ayantoyinbo and Ekundayo (2015). Generally, the dominant use of road transport in Nigeria has been ascribed to the poor state of alternative means of transportation.

Over the years, Nigeria's transportation sector has been bedeviled with many challenges which include bad roads, inadequate trains and airplanes; congested ports, policies ineffective traffic regulations (NBS, n.d.); insecurity, banditry, vandalization of pipelines, inordinate policies and other factors. These problems and more have restrained the Nigerian economy from maximizing the benefits of the sector (Ayantoyinbo & Ekundayo, 2015). In addition, Akanbi et al. (2013) and Gmbh (2016) described the transportation infrastructure as being in a poor state. To change the narrative, past and current governments of Nigeria, have enacted new policies, tried to rejig the rail sector and constructed new roads and bridges amongst others. Have these efforts improved the outcomes from the sub-sectors?

Empirical Review

Studies using various variable specifications, models, different periods and countries have shown broad support for the theory that the transport sector contributes to the economic growth of nations especially developing ones like Nigeria. Khadaroo and Seetanah (2008) used a vector error correction model (VECM) and time series analysis for the period 1950–2000 to study the association between transport capital and economic growth for Mauritius. Transport infrastructure is shown to have significantly contributed to the economic performance of the small island state of Mauritius. Hong et. al. (2011) examined the linkage between transport infrastructure and regional economic growth using a panel data sample from 31 Chinese provinces from 1998 to 2007. The results revealed that land and water transport infrastructure had strong and significant impacts on economic growth while air transport had a weak impact. In the same vein, Ghosh and Dinda (2022) examined the relationship between transport infrastructure and economic growth in India for the period 1990–2017. Applying the vector error correction model to estimate the relationship between economic growth and different modes of transport infrastructure namely road, rail and air transports, the results revealed that road and air transports have significant positive contributions to economic growth in the long-run while rail transport is insignificant. Rudra and Bagchi (2013) examined the effect of transportation (road and rail) infrastructure on economic growth in India over the period 1970–2010. Using Vector Error Correction Model (VECM), the paper found bidirectional causality between road transportation and economic growth; unidirectional causality from rail transportation to economic growth and unidirectional causality from rail transportation to gross capital formation.

Investigating the impact of transportation infrastructure improvement on economic growth in Nigeria for the period 1981 to 2011, Akanbi et al. (2013) used the Ordinary Least Square Regression (OLS) technique and found that transport output and investment in transport infrastructure positively and significantly contributed to growth. It was suggested that an economic policy that will improve transport infrastructure and increase investment in the sector should be designed to achieve sustainable economic growth in Nigeria. Chi & Udo (2020) examined the contributions of the transport sector to Economic Growth. Using annual time series data from 1981 to 2019, the results revealed that Road transport, Air transport and Post and courier services had direct and significant contributions to real gross domestic product in Nigeria while Water transport and Transport services had an inverse relationship with Real GDP. The study recommended that the regulatory authorities of the Ministry of Transportation should strengthen policy on the maintenance and renovation of transport facilities, as well as overhaul the entire transport infrastructural development in Nigeria amongst others. Also, Anfofum et al. (2015) evaluated the influence of air transport sector development on economic growth in Nigeria. The result showed a positive influence of air transport on economic growth. The study recommended a proactive and dynamic cohesive transport policy that benefits all stakeholders. Apanisile & Taiwo (2013) examined the link between rail transport and economic growth in Nigeria over the period 1970–2011.

Using the Error Correction model, the results identified a long-run relationship among the variables. In addition, there was an inverse relationship between rail transport and economic growth in Nigeria. It was the suggestion of the study that government should embark on development policies that will aim at strengthening the sub-sector of the economy. Siyan et al. (2015) examined the impact of road transportation on economic growth in Nigeria. A probit model was used to analyze the primary data while a multivariate model was used for analyzing the secondary data to determine the long-run relationship between economic growth and road transportation in Nigeria. The result showed that the road sub-sector had a positive impact on the economic growth in Nigeria. It was suggested that the government should come up with sustainable and implementable road development and maintenance policies that will ensure good access and flow in Nigeria.

Theoretical Framework

This paper is anchored on the Neoclassical Growth Theory that maintains that a steady economic growth rate occurs when three economic forces of labour, capital and technology are well adjusted. Based on the theory, when an economy invests in capital, skilled workers and adapts a new technology for production, then productivity will be more effective. This implies that technology is endogenous to the production system. Assuming a generalized Cobb-Douglas production function and extending it to include the activities of the transportation sector as the inputs of the production function and the real gross domestic product as the output, this study is in line with existing similar empirical studies such as (Chi & Udo, 2020; Gmbh, 2016) that examined the contribution of transportation infrastructure on economic growth.

Methodology

To investigate the impact of the transport sector on the economic growth of Nigeria, time series data from 1981 to 2020 for Real GDP, road transport, air transport, railway/ pipeline transport and water transport were obtained from the Central Bank of Nigeria's website (CBN).

Model Specification

Modifying the regression model obtained from (Chi & Udo, 2020), the baseline equation for this study is expressed as

$$RGDP_t = f(RDT_t, ART_t, WRT_t, RPT_t, \epsilon_t) \dots\dots\dots 1$$

Where

RGDP = Real Gross Domestic Product

RDT = Road transport

ART = Air transport

WRT = Water transport

RPT = Rail/pipeline transport

Equation 1 is transformed to natural logarithms as follows:

$$\text{LRGDP}_t = \alpha_0 + \beta_1 \text{LRDT}_t + \beta_2 \text{LART}_t + \beta_3 \text{LWRT}_t + \beta_4 \text{LRPT}_t + \varepsilon_t \dots\dots\dots 2$$

$\beta_1, \beta_2, \beta_3$ and $\beta_4 > 0$

The econometric analysis used in this study consists of three steps; the first being the unit root test which examines the stationarity of the series; the Engle and Granger residual based co-integration technique that tests the residuals of the model for unit roots test and the Error correction model that determines the speed of adjustment at which the dependent variable returns to equilibrium after some possible shocks in the system. The following sections present and discuss the results obtained from the analyses.

Results and Discussion

Table 1: Augmented Dickey-Fuller Unit root tests

Variables	ADF computed value at level	5% Critical value	ADF computed value at 1 st difference	5% Critical value	Conclusion
LRGDP	-1.041159	-2.943427	-3.783079	-2.941145	I(1)
LRDT	-0.100319	-2.938987	-5.424744	-2.941145	I(1)
LART	-0.226980	-0.938987	-3.980121	-2.941145	I(1)
LWRT	-2.259268	-2.938987	-7.802936	-2.941145	I(1)
LRPT	-1.719785	-2.938987	-5.010581	-2.941145	I(1)

Source: Authors' extraction from Eviews12

Using Augmented Dickey-Fuller (ADF), the stationarity test results in Table 1 show that all the variables; LRGDP, LRDT, LART, LWRT and LRPT were not stationary at levels I(0) but at first differencing I(1). In this model, since the five variables are non-stationary at levels there is a need to test for co-integration. The Engel–Granger residual-based co-integration technique which tests residuals of the model for unit roots is adopted in this study. With this technique, co-integration exists among the variables if all the variables in the model are integrated at the same order I(1) and the residuals are I(0).

Table 2: Abridged Co-integration Result

Engel-Granger Co-integration test result		
Null Hypothesis: ECM has a unit root		
Exogenous: Constant		
	t-statistic	Prob*

Augmented Dickey-Fuller test Statistic		-4.229707	0.0019
Test critical values	1% level	-3.610453	
	5% level	-2.938987	
	10% level	-2.607932	

Source: Authors' extraction from Eviews12

The null hypothesis that residuals of this model have unit roots is rejected at a 5% level of significance since ADF statistic 4.229707 is greater than the critical value. The conditions that all variables must be 1(1) and the error term be I(0) are met hence there is co-integration between LR GDP and LRDT, LART, LWRT and LRPT. This implies that the linear combination of RGDP with other independent variables is stationary, consequently, the long-run model specified below is not spurious. A long-run relationship exists between the variables in the model.

Table 3: Long and short-run estimation of the model

Long Run Result				
Dependent Variable is LR GDP				
Variable	Coefficient	Std error	t-stat	prob
LRDT	0.502424	0.055262	9.091727	0.0000
LART	0.351214	0.054659	6.425564	0.0000
LWRT	-0.193677	0.060707	3.190356	0.0030
LRPT	-0.041560	0.010433	3.983713	0.0003
C	6.584112	0.152059	43.29981	0.0000
R.SQ	0.986794	ADJ. R-SQ	0.985285	
Short Run Result				
Dependent Variable is D(LR GDP)				
Variable	Coefficient	Std error	t-stat	prob
D(LRDT)	0.276739	0.052074	5.314387	0.0000
D(LART)	0.057259	0.052353	1.093706	0.2820
D(LWRT)	-0.40712	0.043799	0.929503	0.3594
D(LRPT)	0.010337	0.012532	0.824859	0.4154
C	0.023363	0.006302	3.706926	0.0008
ECM(-1)	-0.220953			0.0587
R.SQ	0.531512	ADJ. R-SQ	0.460529	

Source: Authors' extraction from Eviews12

The long-run result in Table 3, shows that the LRDT and LART are positive and statistically significant at the 5% level of significance. This is in line with apriori expectations and the studies of (Anfofum et al., 2015; Chi & Udo, 2020; Ghosh & Dinda, 2022; Siyan et al., 2015). A 1% change in LRDT will positively change RGDP by about 50%. In the same vein, a 1% change in LART positively influences LR GDP by 35%. LWRT and LRPT are however negative and significant at 0.05 level. These results negate the apriori expectation but are in order with the studies of Chi & Udo, (2020) and Apanisile & Taiwo (2013). Furthermore, the overall result shows that about 99% of the variation in the dependent variable was explained by the independent variables.

In the short-run analysis, all the explanatory variables except LRDT are insignificant. LRDT is positive and statistically significant at the 5% level of significance. A 1% change in short-run LRDT impacts LR GDP by 28%. The value of the error correction term is also negative and statistically significant at the 10% level of significance. This means that after any shocks, the dependent variable returns to equilibrium at a speed of adjustment of 22.1%. The overall result also revealed that the explanatory variables were able to explain about 46.1% of the variation in the dependent variable in the short run.

Conclusion

This study examines the relationship between the transportation sector and economic growth in Nigeria by exploring the extent of the sub-sectors' impacts on Real Gross Domestic Product from 1981 to 2020. The findings show that in the long run, road and air transport subsectors are strong and significant drivers of economic growth in Nigeria while water and rail/pipeline subsectors have an inverse relationship with economic growth. In addition, of all the sectors, the road subsector has the greatest impact on GDP and remains the major determinant of the growth experienced in the transportation sector in Nigeria.

Recommendations

- a) Government should address the challenges in the road and air subsectors and conscientiously revamp the water and rail/pipelines sub-sectors.
- b) Ministry of Transportation should conduct regular diagnostic checks on the sub-sectors to ascertain the progress made when different policies are implemented.

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