

Econometric Analysis of Air Cargo Throughputs in Nigeria

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ABSTRACT

In the millennium era, there has been a huge increase in the number of air freight throughputs in Nigeria despite the increasing fare on freight shipment. In a situation whereby a region has vibrant airport, such region is opened to increase competitiveness. The concern for this study is the economic perspective. The study aimed at examining the econometric analysis of air cargo freight in Nigeria. The study adopted a combination of descriptive and inferential statistics, and it relied on information obtained from secondary sources especially published relevant government institutions and agencies in Nigeria. Econometric model was employed to estimate the contributions of air cargo throughputs on the economy. Observatory data were gathered on international and domestic air cargo throughputs between year 2009 and 2018 (10 years). Also, observatory data were collected on GDP and GNI between the same periods. The study found a strong and positive causal relationship between the air cargo throughputs and the economic indices. Air cargo throughputs contribute little to GNI and GDP by 31.5 percent. It is therefore recommended that there should be better policies that will encourage air cargo movement in Nigeria.

Keywords: econometric model; air cargo; throughputs; GNI; GDP

Background to the Study

In recent time, the economic and social impacts of air transportation on the region are well accepted throughout the world including Nigeria. In developing economies, transportation sector has played significant role to development. In the millennium era, there has been a huge increase in the number of air freight throughputs in Nigeria despite the increasing fare on freight shipment. In a situation whereby a region has vibrant airport, such region is opened to increase competitiveness. Air transportation can either or both become a factor and an index of economic development. Conversely, it is an attribute of progress as it enhances transportation within the extended countries that is deficient with adequate land transportation infrastructure, and it connects the country with the rest of the world. Conversely, it is an indicator of development as its volume clearly depends on the level of economic activity with the affluence of the population. Additionally, it can be an indicator to position economic development as is associated with outward oriented economy realized from intense passenger or freight air traffic. According to François and Pierre-Emmanuel (2016), oftentimes in economic study, it is difficult to

unscramble the importance of air transportation because a service whose demand increases with development are most likely to be inextricably linked with each other (development and air transportation). Nonetheless, the dynamic changes that occurred in the volume of air transportation is connected to the structure of the economic functionality which might provide significant information on development. According to Flash analysis (2016), the growth in GDP is said to be the major driving force of air freight throughput. As the major enabler in the forecast models, the nexus between the growth in GDP and air traffic development have attracted so many attentions and issues. It has been widely observed that the number of passengers at airports around the world grows at a rate of about 1.5 times that of worldwide GDP. Nonetheless, the truthfulness of this has great doubt overtime. It is pertinent to note that growth rates of air throughputs in the past remained stable despite a weakening world economy. In fact, there are differences in the world regions.

Air traffic in terms of cargo has been on the increase in Nigeria with the increase attributed to government's rigorous provision of navigational aid facilities, basic aeronautical

equipments and high level of security at the nations' airports (NCAA, 2003). However, in spite of the general increase in air transport system, there has been insignificant or minute contribution of air transport in the economy using the Gross Domestic Product (GDP). Can it be that the GDP is not a good indicator to measure the contribution of air transport demand? Hence, there is need to include Gross National Income (GNI).

There is a record of high insecurity in the country, this makes the road and air transportation to compete on selected route. Majority of the high income earner prefers air transport to road transport their goods because of the level of high insurgent and the assumption that air transportation is safer. In fact some middle income earner join the league of high income earners by patronizing the air transport service provider all because of insecurity. There is need to examine the percentage increase of throughputs during the perceived period of insecurity on the Nigerian roads and its effect on the economy.

There are some periods that were known for economic recession, there is need to examine the nature of fluctuations that occurred in the air transport demand in those eras. According to Howard (1974), there are several methods of time series techniques for analyzing air travel demand (Howard, 1974). Time series analysis is however handicapped by the inability to identify the impact of air travel demand on causative factors such as the reduction in fares, introduction of new aircraft, and economic recession, or the uncertainties with regard to future regulatory conditions. Hence, there is need to adopt a robust forecasting technique.

Among the related studies conducted are, the study of Fridström and Thune-Larsen (1989) focused on forecasting air traffic volumes in Norwegian domestic air transportation network. The study of Alperovich and Machnes (1994) increased the understanding of multiple dimensions of air travel. Also, Sai et.al. (2011) examined factors determining the choice of full service airlines and low cost carriers using the case of Malaysia. Ukpere et al. (2012) examined air travelers' decision choice of domestic airlines to fly within Nigeria using data collected from 15,802 air travelers with questionnaires on Likert scale ranking.

Nwaogbe et al. (2013) carried out a study on the analysis of the impact of air transport sector on economic development in Nigeria. Ayantoyinbo

(2015) evaluated Nigeria domestic airline services that are preferred by numerous airline passengers in Nigeria using data collected from 550 air travelers with questionnaires through random sampling technique. Ayantoyinbo (2015) further examined the factors that contribute to the occurrence of flight delay in Muritala Muhammed International Airport, Lagos Nigeria using thirty two airlines operators that were purposively selected. Aleksandra (2016) conducted a study on the factors influencing passengers' choice of transport mode to Warsaw Chopin Airport. Adeniran and Ben (2017) emphasized on the econometric modeling of domestic air travel demand in Nigeria.

Ayantoyinbo (2018) conducted a research to identify factors inhibiting aviation cargo logistics based on twenty four variables. Adenigbo (2016) conducted a study on the factors influencing cargo agents choice of operations in Abuja airport, Nigeria. Most of the earlier studies may not have captured the impact of air cargo throughputs on Gross National Income (GNI) and Gross Domestic Product (GDP). In view of these gaps, this study is set to examine the econometric analysis of air cargo throughputs in Nigeria. Econometric analysis is the quantitative application of statistical and mathematical models using data to develop theories or test existing hypotheses in economics and to forecast future trends from historical data. It usually relies on techniques such as regression models and null hypothesis testing (Hayes, 2019). Gross Domestic Product (GDP) is an internationally recognized measure of economy size and strength. It is the total monetary or market value of all the finished goods and services produced within a country's borders in a specific time period (Kramer, 2020). Gross National Income (GNI) is the total amount of money earned by a nation's people and businesses. It is used to measure and track a nation's wealth from year to year. It includes the nation's gross domestic product plus the income it receives from overseas sources (Chappelow, 2020).

Methodology

This design for this research is achieved through the combination of descriptive and inferential statistics, and it relied on information obtained from secondary sources especially published relevant government institutions and agencies in Nigeria. The hypotheses will be established with Ordinary Least Square (OLS) regression. The study adopts econometric model to estimate the

contributions of air passenger demand on the economy. The following steps of econometric model are:

Model Specification or Model Formulation

In the model specification or model formulation, mathematical model will be initially specified before the formulation of econometric model. Without the mathematical model, there cannot be an econometric model. The difference between the mathematical model and the econometric model is the inclusion of stochastic disturbance term, which is also referred to as unexplained variables or error term in the econometric model.

$$\text{AirCar} = t + D1(\text{GDP}) + D2(\text{GNI}) \dots \dots (\text{Equation 1})$$

Econometric Models

$$\text{AirCar} = t + D1(\text{GDP}) + D2(\text{GNI}) + U_i \dots (\text{Equation 2})$$

Where:

AirCar = Air Cargo Throughputs (international and domestic) (Dependent variable)

t = Intercept

D1 = Regression coefficient for GDP

GDP = Percentage change in Gross Domestic Product

D2 = Regression coefficient for GNI

GNI = Percentage change in Gross National Income

U_i = Stochastic disturbance term or unexplained variables or error term which captures other economic indicators influencing air cargo throughputs in Nigeria.

Collection of Appropriate Data Based On the Specified or Formulated Model

In this study, observatory data were collected on international and domestic air cargo throughputs that were imported and exported in Nigeria between year 2000 and 2019 (20 years). Also, observatory data were collected on GDP and GNI between the same periods from NBS and confirmed in the World Bank data.

Model Estimation

Econometric model is estimated to give model satisfaction and reliability. This was achieved with the use of Ordinary Least Square (OLS) regression to reveal the differences between the true line and the observed line (error or residual). Ordinary Least Square (OLS) regression, which is also referred to as regression, is a constructive parametric tool that is usually

adopted for examining the relationship between two or more variables if and only if the data types are interval scale or ratio scale of measurement. OLS regression assumes that there is a linear relationship between the two or more variables, if the relationship is not linear, OLS regression will not be the ideal tool for analysis, or modifications to the variables may be required. The basic idea of linear regression is that, if there is a linear relationship between two variables, one variable can be used to predict or forecast the values of the other variable.

Validity of the Model

Validity of the model is needed to find out if the model will give a true forecast. It can be achieved through the following:

Test of Significance

This is crucial in research analysis. Adeniran and Ben (2017) used a slimily approach in their study that as methodology is the heart of a research work, so also is significance test the heart of model estimation. It is usually assumed that the null hypothesis would be rejected and the alternate hypothesis would be affirmed if the computed probabilistic value (p value) is less than the chosen error probability. Otherwise, the null hypothesis will not be rejected and the alternate hypothesis will be rejected. If the null hypothesis is rejected, the model will give a good forecast. However, it is not only dependent on the test of significance, other tests are:

Tests for Homoscedasticity and Multicollinearity

Homoscedasticity usually occur when two variables are highly or near perfectly correlated, i.e. R more than 80 percent (Greene, 2003). Multicollinearity is suspected if the coefficient of determination (R-squared) is greater than 0.85. Standard errors, correlation coefficient, and overall coefficient of determination may be used for testing Homoscedasticity and Multicollinearity.

Goodness of Fit Test

The goodness of fit test can be referred to as the summary of statistics, which indicates the precision, and appropriateness of the estimated model. It is also referred to as the regression proper. It shows the ratio of explained and unexplained variables. In the situation whereby the explained is more than the unexplained, the model is good. If otherwise, the model is not suitable for forecast.

Results and Discussion

Trend Analysis of Air Travel Demand, GNI and GDP

From the Table 1, it can be deduced that there was a sharp fall in the inbound and outbound air

cargo in the year 2009. It was revealed that the inbound and outbound cargo traffic is fluctuating. The implication of this is that, the nations' economy is possible to be in a fluctuating pattern.

Table1. Airport Throughputs in terms of cargoes

Year	Total Cargo
Yr 2009	166,782,990.4
Yr 2010	180,836,476.0
Yr 2011	174,944,961.0
Yr 2012	229,624,617.0
Yr 2013	204,039,075.0
Yr 2014	189,754,412.0
Yr 2015	245,915,784.9
Yr 2016	177,256,846.0
Yr 2017	161,800,520.0
Yr 2018	164,938,399.4

Source: Federal Airports Authority of Nigeria (2008)

Table2. Percentage change of total cargoes, GNI and nominal GDP from 2010 to 2018

Year	% Change of Cargo Traffic	% Change of GNI	% Change of GDP
Yr 2010	7.7714	5.24	-2.02
Yr 2011	-3.368	-2.92	-1.84
Yr 2012	23.813	4.301	-1.36
Yr 2013	-12.54	2.105	-1.44
Yr 2014	-7.528	4.427	-0.94
Yr 2015	22.838	6.579	-1.65
Yr 2016	-38.73	-0.76	-2.63
Yr 2017	-9.553	-3.13	-3.17
Yr 2018	1.9025	-1.79	-2.84

Source: Authors' computation; World Bank (2020)

Impact of Air Cargo Throughputs on GNI and GDP

When examining the impact of air cargo throughputs on GNI and GDP, there is need to be conscious of the fact that the air cargo throughputs was captured with the summation of import and export that is concerned with air transportation. These throughputs were loaded, consolidated, and fragmented in the Nigerian airports.

H0: There is no statistical significant relationship between air cargo throughputs and Gross Domestic Product (GDP); and

H0: There is no statistical significant relationship between air cargo throughputs and Gross National Income (GNI).

As shown below in the econometric modeling equation, Ordinary Least Square (OLS) regression was adopted.

$$\text{AirCar} = t + D1(\text{GDP}) + D2(\text{GNI}) + U_i, \dots \dots \dots (\text{Equation 2})$$

In order to analyze this, the total air cargo throughput is the dependent variable, while the GDP and GNI are the independent variables or predictors. The secondary data has the occurrence or data scope of ten (10) years from 2009-2018, and was standardized, perfected and converted into percentage changes as shown in Table 2. The hypothetical analysis was shown in Table 3, Table 4 and Table 5. For the aggregate regression and correlation analysis that was shown in Table 3, correlation value (R) of 0.561 implies that there is a strong and positive causal relationship between the air cargo throughputs and the independent variables (GNI and GDP). From the same Table 3, the aggregated regression value of 0.315 implies that 31.5 percent of the air cargo throughputs is explained by GNI and GDP. In other words, air cargo throughputs little to GNI and GDP by 31.5 percent. This case is quite different from that of air passenger demand; this is because the correlation value and regression value are good. However, if the span of observatory data is extended, the correlation and regression values

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will be realistic. Hence, there is a clear indication that air cargo throughputs will contribute meaningfully to the nations' GNI and GDP. Hence, air cargo throughputs may be a good variable to determine how the economy is performing. The more import and export through the air transport, the better the economy. The level of significance that is P value of 0.321, when compared with the critical region 0.05, it was revealed that P value is more than critical region as shown in Table 4. Hence, there can be no rejection on the null hypothesis which states that there is no significant relationship between air cargo throughputs and the economic indices (GNI and GDP) in Nigeria. This non rejection is may be attributed to limited observatory data. Hence, for better predictions, there is need for a long span of observatory data.

Table 3. Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.561(a)	.315	.087	18.32681

a Predictors: (Constant), GDP, GNI

Source: SPSS Version 21

Table 4. ANOVA (b)

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	927.624	2	463.812	1.381	.321(a)
	Residual	2015.231	6	335.872		
	Total	2942.855	8			

a Predictors: (Constant), GDP, GNI

b Dependent Variable: Cargo

Source: SPSS Version 21

Table 5. Coefficients (a)

Model		Unstandardized Coefficients		Standardized Coefficients		t	Sig.
		B	Std. Error	Beta	B		
1	(Constant)	-9.514	27.722			-.343	.743
	GNI	3.064	2.420	.601		1.266	.253
	GDP	-1.520	12.199	-.059		-.125	.905

a Dependent Variable: Cargo

Source: SPSS Version 21

CONCLUSION

The study aimed at examining the econometric analysis of air cargo throughputs in Nigeria. The study adopted a combination of descriptive and inferential statistics, and it relied on information obtained from secondary sources especially published relevant government institutions and agencies in Nigeria. Econometric model was employed to estimate the contributions of air cargo throughputs on the economy. Observatory data were gathered on international and domestic air cargo throughputs between year 2009 and 2018 (10 years). Also, observatory

As shown in Table 5, given all the predictor variables constant at zero (0), air cargo throughputs will be -9.514. This negative value signifies that the predictors cannot give true estimate of the forecast. On the other side, the regression coefficient for GNI is 3.064. This means that the air cargo throughputs have positive contribution to GNI. In addition, the regression coefficient for GDP is -1.520. This means that air cargo throughputs has negative contribution to GDP.

In a nut shell, both GNI and GDP cannot be predicted with air cargo throughputs in Nigeria based on limited span of observatory data. If forecasted with such data, it will not give a true forecast. The econometric model that is unfit goes thus:

$$\text{AirPCar} = -9.051 - 0.463\text{GDP} - 0.950\text{GNI} + U_i$$

data were collected on GDP and GNI between the same periods. The study found a strong and positive causal relationship between the air cargo throughputs and the economic indices. Air cargo throughputs contribute little to GNI and GDP by 31.5 percent. It is therefore recommended that there should be better policies that will encourage air cargo movement in Nigeria.

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