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Econometric Modeling of Passenger Demand for International Air Transport in Nigeria Airports

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Abstract: The paper is aimed at examining the econometric modeling of passenger demand for international air transport in Nigeria Airports with the objective of examining the relationship between the international passenger demand in Nigeria airports and economic variables. 91.2% of the dependent variable can be well explained by the independent variables and the unexplained variables or the error term is 8.8%. The fact that the coefficient of explanation (R Square) is very high, this is a sign that there is a problem of multicolinearity and the Durbin Watson value (3.443) which is greater than 2 also signifies there is a problem of autocorrelation or serial correlation. The significance level of the computed test statistics is 1.29 which is more than the significance level (0.05), hence we cannot reject the null hypothesis which states that there is no statistical significant relationship between % change in international Passenger Traffic (Annual) and % change in economic indicators (Consumer Inflation Price (CPI), Naira value to Dollar and Gross Domestic Product). It is therefore concluded that the economic indicators cannot give a good forecast of international air transport demand because the model suffers from serial correlation, multicolinearity and insignificance of the test.

Keywords: Air Transport, Demand, Trend Analysis, Transportation

1. Introduction

1.1. Background to the Study

Transport is a service rarely in demand for its own characteristics. Demand for public transport, road freight facilities or airline services are usually derived from some other functions. [1] Transportation is demanded to execute the objectives of every other sectors in the economy. Not only does transportation provides mobility for people and goods, it helps shape an area's economic health and quality of life. Because of the high pertinence of transportation, it is expedient for a country or nation to embark on integrating man, material, money and machinery towards the realization of diversified modes of transport before such country will boast to have achieved a diversified economy and a sustainable development. [2] No transport organization can operate profitably unless there is a demand for its services and the estimation of expected future demands is a key element in planning transport operations. [1] The demand level for transport is related directly to the demand level for the product or service. It is therefore essential for a transport organization to establish a demand pattern for its services. [3]

Mobility is fundamental to economic and social activities, including commuting, manufacturing or supplying energy. Movements of people, goods and information have always been fundamental components of human societies. Contemporary economic processes have been accompanied by a significant increase in mobility and higher levels of accessibility. [4]

Air Transportation is the transportation of passengers and cargo by aircraft and helicopters. It is a transport system that involves the movement or carriage by air of persons or goods using airplanes and helicopters. [5] It has become the primary means of common carrier traveling. Greatest efficiency and value are obtained when long distances are involved and high value payloads are moved, although, the time and cost

efficiencies obtained decreases as distances traveled is reduced, air transport is often worthwhile even for relatively short distances. It also provides a communication link, which is sometimes vital, between the different groups of people involved. [5]

Airports are terminal that acts as the interchange or interface between road and other transport modes. [8] An airport (or aerodrome) is an area on land or water (including any buildings, installations and equipment) intended to be used either wholly or in part for the arrival, departure and surface movement of aircraft. Airports are vital national resources which serve a key role in transportation of people and goods and in regional, national, and international commerce. They are where the nation's aviation system connects with other modes of transportation and where federal responsibility for managing and regulating air traffic operations intersects with the role of state and local governments that own and operate most airports. [5]

Airports are an essential part of the air transport system. They provide the entire infrastructures needed to enable passengers and freight to transfer from surface to air modes of transport and to allow airlines to take off and land. The basic airport infrastructure consists of runways, taxiways, apron space, gates, passenger and freight terminals, and ground transport interchanges. Airports bring together a wide range of facilities and services in order to be able to fulfill their role within the air transport industry. These services include air traffic control, security, fire and rescue in the airfield. Handling facilities are provided so that passengers, their baggage, and freight can be successfully transferred between aircraft and terminals, and processed within the terminal. [6]

An airport is a meeting ground and exchange point for people and goods arriving and departing on a variety of air and surface vehicles having differing spatial and other requirements. With the view of operational control, airport is divided into two zones:

1. Air side and
2. Land side

Also, on the assumption of international context, all airports can be divided into three categories:

1. Gateway airports;
2. Regional international airports; and
3. Domestic airports. [7]

Airport terminal is defined as a building that serves as an interface between air and land of an airport. It operates mainly for air travelers and air load. Based on their function, terminals are divided into two types: each airport has the following: passenger terminal; and cargo terminal. [7]

In Nigeria, the demand for air transport services has been on the increase within the past three decades. There has been growth in passenger, aircraft and freight traffic as a result of physical and economic development of cities in different parts of the country. The creation of states and the need to develop state capitals for them to perform their socio-economic responsibilities has fuelled the tempo of physical development in the country. Fast connections between the diverse economic spaces of Nigeria are better achieved through air transportation. [4] It is therefore considerable to scientifically examine the relationship between the contributions of international passenger demand in Nigeria airports and economic variables. The economic variables to be involved are real Gross Domestic Product (GDP), Consumer Price Index (CPI), and exchange rate in so far as they are inextricably linked to the performance of aviation sector and enhance additional international passenger flows

It was stated that the long run success of any organization is closely related to how well management is able to foresee the future and develop appropriate strategies. [4] It is therefore noted that planning for future demand of air transport is quite very important in accommodating future demand for air transport services.

Furthermore, each location has its own natural resources and different peculiarities which the tapping will directly or indirectly result into increasing demand of air transportation. "The diversity in the resource endowment between the North and the South is an important factor in the increasing growth of air transport in Nigeria." [10] Also, the new civilian administration regards the air transport subsector as a critical focal point in the effort to open up the country to foreign investors and thereby narrow the gap between available and required levels of domestic investment capital. [11]

Recently, the significance of air transport mode in Nigeria is quite obvious most especially in socio-political development when compared with the road and railway modes. Therefore, the contribution of air transport mode is very significant. It is expedient to note that the situation of economic buoyancy of the country will positively affect the increasing demand of air transport in any country.

1.2. Aim of the Study

The aim of this paper is to examine the relationship between the international passenger demand in Nigeria airports and economic variables.

1.3. Hypothesis of the Study

H_0: There is no statistical significant relationship between the international passenger demand in Nigeria airports and economic variables.

2. Methodology

This study is a combination of both descriptive and inferential statistics and it relied on information and data obtained from secondary sources especially published materials, journal articles, and other documents of relevant government institutions and agencies in Nigeria. The hypothesis will be tested using inferential statistics.

2.1. Study Area

Nigeria is located in the West Africa sub-region. It is bounded in the north by Niger Republic, south by Atlantic Ocean, east by Cameroon and Chad and west by Benin Republic. She is the most populous country in Africa. With respect to NPC, 2006, Nigeria accounted for more than 140

million and by August, 2011 estimated to be about 167 million. Nigeria is located within the longitude 30E and 150E and latitude 40N and 140N of the equator. [12]

As at now, Nigeria has about eight (8) major International and the most functional among them are Murtala Muhammed Airport, Lagos, Nnamdi Azikwe International Airport, Abuja and Mallam Aminu Kano International Airport, Kano. MMA is the busiest international Airports in Nigeria that always account for more than 80% of the international airport service operation in Nigeria follow by MAKIA. Five of the International Airports were located in the northern part of the country while the rest were in the southern. Those in the north mostly perform even not up to the standard during the Islamic pilgrimage. [12]

The table below illustrates the spatial and geographical location of International Airports in Nigeria.

Table 1. *Location Map of International Airports in Nigeria.*

Airport	State	Geopolitical Zone
Murtala Muhammed International Airport	Lagos	South West
Nnamidi Azikwe International Airport	Abuja	North Central
Ilorin International Airport	Kwara	North Central
Maiduguri International Airport	Bornu	North East
Sadiq Abubakar International Airport	Sokoto	North West
Mallam Aminu Kano International Airport	Kano	North West
Port Harcourt International Airport	River	South South
Margaret Ekpo International Airport	Cross River	South East

Source: [12]

2.2. Trend Analysis of International Air Passenger Demand in Nigerian Airports

Air traffic in Nigeria comprises, of passenger traffic, aircraft movements, freight traffic and mail traffic. This study examines passenger traffic. Table 2 shows the international passenger traffic and percentage change in Nigeria Airports for the period 2011 –2016.

Table 2. *Total International Air Passenger Movement in Nigeria.*

YEAR	NUMBER OF PASSENGERS	% CHANGE
2011	3,586,742	11.46
2012	4,440,930	23.82
2013	4,600,698	3.60
2014	4,654,941	1.18
2015	4,233,844	-9.05
2016	4,260,989	0.64

Source: [13], [15], Authors' computation

From table 2 above, the percentage increase between the year 2010 and 2011 is very high at 11.46% but the international movement in year 2014 seems higher than all other years as shown on the table. There was dropping in the passenger demand during the year 2015 by -9.05 and little difference in the movement between the year 2015 and 2016. Can this be attributable to the economic recession that was declared in the year 2016?

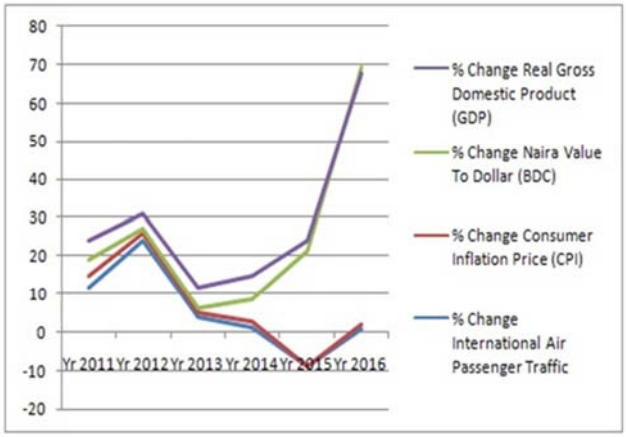
2.3. Descriptive Statistical Analysis Showing the Relationship Between International Air Transport Passenger Demand and Economic Indicators

Table 3. *Depict of % change in international Air Passenger Traffic, % change in Consumer Inflation Price (CPI) and % change in Naira Value to Dollar (BDC).*

YEAR	% Change International Air Passenger Traffic	% Change Consumer Inflation Price (CPI)	% Change Naira Value To Dollar (BDC)	% Change Real Gross Domestic Product (GDP)
2011	11.46	3.2	4.1	5.31
2012	23.82	2.1	1.0	4.21
2013	3.60	1.5	1.0	5.49
2014	1.18	1.6	5.5	6.22
2015	-9.05	0.1	30.0	2.79
2016	0.64	1.3	67.4	-1.51

Source: [15], Authors' computation

Figure 1. shown below is the further analysis of Table 3 shown above.



Source: Microsoft Excel, 2007 Version

Figure 1. *Line graph of % change of International Air Passenger Traffic, % change of Nigeria Consumer Inflation Price (CPI), % change of Naira Value to Dollar (BDC), and % change of Real Gross Domestic Product (GDP).*

From figure 1, CPI and international air passenger traffic seems tending towards the same direction while GDP and exchange rate also tend towards the same direction. It can be deduced that the four variables almost have the same trend in the year 2011, 2012, and 2013. CPI and international air passenger traffic became apart from GDP and exchange rate in the year 2014, 2015 and became too obvious in the year 2016. In end of year 2015 and throughout the year 2016, the exchange rate and real GDP went high resulting into little or low CPI and low demand of international air travel.

2.4. Inferential Statistical Analysis Showing the Relationship Between International Air Transport Passenger Demand and Economic Indicators

The secondary data are analyzed in-line with the aim and hypothesis earlier formulated in the study. In examining the relationship between the economic indices and international air passenger, regression analysis will be adopted.

Demand is the number of units of a particular product or service that customers are willing to purchase in a specified time period under specified conditions. The demand function is a statement of the relationship between the quantity demanded and the factors which affect this quantity. The function is usually expressed in the form:

$$Y = b_0 + b_1(X_1) + b_2(X_2) + b_3(X_3) + e$$

This is a regression equation where Y = quantity demanded for international air passengers in Nigeria, x_1, x_2, and x_3 are independent variables (% change of Nigeria Consumer Inflation Price (CPI), % change of Naira Value to Dollar (BDC), and % change of Real Gross Domestic Product (GDP)), and e captures other conditions influencing the demand, b_0 is the intercept while b_1, b_2 are parameters. This is a linear function which depicts very well demand relationships, and which can easily be solved using the method of Ordinary Least Squares (OLS). [16]. The following issues of model estimation will be determined:

Test for multicollinearity: For a model that has more than one qualitative variable, as in this study, problems of multicollinearity can arise. [17] Also, since data are non-experimental, many explanatory variables tend to move together meaning that they may be collinear. When two variables are highly or near perfectly correlated, their variances tend to infinity and as a result, hypothesis testing becomes weak so that diverse hypothesis parameter values cannot be rejected. [18]

Standard errors and overall coefficient of determination may be used for testing for multicollinearity. If the coefficient of determination (R2) is greater than 0.8, that is, there is a high correlation among variables, then multicollinearity is suspected. [17]

Testing for the goodness of fit: This is the summary of statistics that indicate the precision with which a model approximates the observed data.

Table 4. *Model Summary(b).*

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
	R Square Change	F Change	df1	df2	Sig. F Change	R Square Change	F Change	df1	df2	Sig. F Change
1	.955(a)	.912	.780	5.25451	.912	6.920	3	2	.129	3.443

a Predictors: (Constant), % Change Gross Domestic Product, % Change Consumer Price Index, % Change Exchange rate
b Dependent Variable: % Change International Air Passenger

Table 5. *ANOVA(b).*

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	573.215	3	191.072	6.920	.129(a)
	Residual	55.220	2	27.610		
	Total	628.435	5			

a Predictors: (Constant), % Change Gross Domestic Product, % Change Consumer Price Index, % Change Exchange rate
b Dependent Variable: % Change International Air Passenger

Table 6. *Coefficients(a).*

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta	B	Std. Error
1	(Constant)	44.921	19.024		2.361	.142
	% Change Consumer Price Index	5.617	2.674	.509	2.101	.170
	% Change Exchange rate	-.965	.336	-2.281	-2.869	.103
	% Change Gross Domestic Product	-8.341	3.020	-2.114	-2.762	.110

a Dependent Variable: % Change International Air Passenger

3. Discussion of Findings

From table 4 above, the regression between % change in international air passenger traffic as dependent variable and % change in consumer price inflation and % change in Naira value to Dollar and % change in Gross Domestic Product as independent variables is 0.912. This means that 91.2% of the dependent variable can be well explained by the independent variables and the unexplained variables or the error term is 8.8%. The fact that the coefficient of explanation (R Square) is very high, this is a sign that there is a problem of multicolinearity and the Durbin Watson value (3.443) which is greater than 2 also signifies there is a problem of autocorrelation or serial correlation.

Also from table 5, the significance level of the computed test statistics is 1.29. When compared with the set significance level of 0.05, it can be shown that the significance level of the computed test statistics (1.29) is more than the significance level (0.05), hence we cannot reject the null hypothesis which states that there is no statistical significant relationship between % change in international Passenger Traffic (Annual) and % change in economic indicators (Consumer Inflation Price (CPI), Naira value to Dollar and Gross Domestic Product). This means that the effect of downturn economic variables may not really cause and effect relationship or significance difference in the demand of international passenger air travel.

From table 6 above, the coefficients are as given below:

$$Y= 44.921+ 5.617X_1+ (-0.965)X_2+ (-8.341)X_3.$$

Given all the predictor variables constant at zero (0), the demand of international air passenger in Nigeria will be 44.921. The regression coefficient for international air passenger demand based on consumer price index is 5.617. This means that the relationship between the international air passenger demand and consumer price index is positive which indicates that effective regulation of consumer price in the country will result to the increasing demand of international air travel and vice versa. The regression coefficient for international air passenger demand based on exchange rate is -0.965. This means that the relationship between the international air passenger demand and exchange rate (dollar) is negative which indicates that the increasing rate of exchange in the country will result to decreasing demand of international air travel and vice versa. The regression coefficient for international air passenger demand based on gross domestic product -8.341. This means that the relationship between the international air passenger demand and gross domestic product is negative which indicates that the increasing gross domestic product in the country will result to decreasing demand of international air travel and vice versa.

4. Conclusion

It should therefore be noted that the economic indicators cannot give a good forecast of international air transport demand because the model suffers from serial correlation, multicolinearity and insignificance of the test. It is therefore concluded that the effective regulation of consumer price in the country will result to the increasing demand of international air travel and vice versa, also, the increasing rate of exchange in the country will result to decreasing demand of international air travel and vice versa, and the increasing gross domestic product in the country will result to decreasing demand of international air travel and vice versa.

References

[1] Cole S. (1998). Applied Transport Economics. London: Kegan Page Ltd.

[2] Adeniran A. O. and S. Ayinde O. (2017). Efficiency of Nigerian Transport System: Lessons Derived from the Developed Nations. Developing Country Studies www.iiste.orgISSN 2224-607X (Paper) ISSN 2225-0565 (Online) Vol. 7, No. 2, 2017. Pp. 87-93.

[3] Jean-Paul Rodrigue, Claude Comtois and Brian Slack (2006). Geography of Transport Systems. First published 2006 by Routledge.

[4] Aderamo A. J. (2010). Demand for Air Transport in Nigeria. Journal of Economics, 1 (1): 23-31 (2010).

[5] Windows Internet Explorer (2011). Air Transportation System- definition of air transport.

[6] International Civil Aviation Organization (ICAO).

[7] Airport Cooperative Research Program (ACRP) Synthesis 48. How Airports Measure Customer Service Performance. A Synthesis of Airport Practice. Transportation Research Board of the National Academics, 2013.

[8] Anne Graham (2003). Managing Airports. Butterworth-Heinemann Publications. ISBN: 0 7506 5917 3.

[9] ENO Foundation for Transportation, 1986.

[10] Ogunbodede E. F. (2006). Air Transportation in Nigeria: Past, Present Lessons and Challenges for the Aviation Industry. Journal of Geography and Planning Sciences, 1(1): 145-164.

[11] Adeyemi O. (2001). Moving Nigeria Forward: The Development Planning Approach. Ibadan: Ibadan University Press.

[12] Afolayan, O. S., Asaju, A. J. & Malik, N. A. (2012). Variation in Spatial Trend of Passengers and Aircrafts Movement in Nigerian International Airports. International Journal of Humanities and Social Science Vol. 2 No. 10 (Special Issue) May, 2012. Pp. 126-133.

[13] Federal Airports Authority of Nigeria.

[14] Nirametrics (2016). Nigeria Air Passenger Traffic [Online, Accessed, 2017].

[15] National Bureau of Statistics, 2017.

[16] Draper N. R., Smith H. (1981). Applied Regression Analysis. New York: John Wiley & Sons.

[17] Gujarati Damodar N. (2003). Basic Econometrics. Fourth Edition. Tata McGraw-Hill Publishing Company Limited, New Delhi, India The McGraw-Hill Companies, Inc.

[18] Greene W. (1993). Econometric Analysis. Second edition. Macmillan, New York, p. 791. Greene W. H. (2004). Econometric Analysis. Fourth edition, Prentice Hall International Upper Saddle River, USA.