Demand Analysis for Air Travels In Nigeria -An Expository Study[1]

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Introduction

The aviation industry in Nigeria has been deregulated since mid-1990's following the commercialization of state-owned airports and the licencing of private airlines to participate in the aviation industry. The air transport has operated largely in a deregulated environment in the country, although many of the airports owned by the federal and state govrnments shifted someaspects of their operations to the private sector through concession.This globalization, liberalization and deregulations of airports and air transporthave led the sector to a competitive environment. These will lead them into having some significant organizational changes within the air transport sector. Some airports in the country have been publicly owned for the past decades, but for the past eight years some airports have been partially or fully privatized due the deregulation process. While all the airlines or air carriers are privately owned since the bankrupt of the national carrier of the nation (Nigerian airways). Although efforts have been made to revive the national carrier by the present administration, but all effort made did not work out. Furthermore, the emergence of hub airport for the intercontinental and domestic passenger traffic can offer Nigerian resident business men a better offer in terms of access to their various destinations, at a higher frequency and at a lower price in terms of fare charges within the West African sub-region (Nwaogbe, 2018).

All these triggers the federal government to make much effort from year 2005 to rebuild the infrastructure base of the airports and to improve air transport management following best global practices.It has been the aspiration of Nigeria to develop into a viable market that will help them become the hub of the aviation industry in Africa. This is possible if and only if, the airports in the country are able to handle growing traffic demands in the aviation industry effectively (passenger throughput, aircraft movement and cargo throughput). Furthermore, the remodeling and the transformation agenda of the government has gone far in developing many air transport systems to world standard, although almost the airports in the country are still operating under airport model 2. More so, experts acknowledged that liberalization of air transport and airport operation within the regions and the country at large promotes flexibility, competence and professionalism (Nwaogbe, 2018; Barros, Nwaogbe, Ogwude and Omoke, 2015 &Nwaogbe, Ogwude and Barros, 2015).

Global economic investment in the African continent has led Nigeria to work towards the development of its transport infrastructure especially the aviation industry in order to accommodate the growing traffic at the nation's airports. The development is focused on both the international and domestic airports as Nigeria aspires towards becoming the hub of economic activity and air transport business in the West African sub-region and Africa at large. As a result, the Nigerian government and heraviation industry professionals and other stakeholdersare interested in assessing the overall performance especially in the areas of airtravel demand analysis, productivity and efficiency of aviation industry. The role of air transportation in Nigeria is highly significant due to the fact that it does not have any competitor in terms of speed, reliable and safety of services.(Nwaogbe, Wokili, Omoke and Asiegbu, 2013; Nwaogbe et. al, 2015; Nwaogbe, Ogwude and Ibe, 2017; Nwaogbe, Wanke, Ogwude, Barros, and Azad, 2018).

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Demand is the charge at which customers want to purchase a product. Itis a price and quantity relationship the quantity of a product that will be demanded at different price levels, the Economic concept is of the view that demand is made up of these elements: taste and ability to purchase. Taste is the choice for a good or service, it determines the willingness to purchase the good or service at a particular price. Ability to buy means that to pay for a good or product at a specific price, however, there is a need for an individual to possess sufficient wealth or income so that he can complies with the payment. The derived character of transport is self-evident. A lessening of similar parameters will bring about a diminishing interest in transport (Blauwens, De Baere, and Van de Voorde, 2008).

Air travel demand is so touchy to changes in price and income, Air travel demand can be antagonistically influenced with more extensive changes in the financial subsidence can disposable income, GDP, and consumer confidence, which can likewise thusly, chill demand for air travel, due to the economic development of the country the increasing growth-rate in Nigeria population and high traffic growth of domestic and international demand has a great impact on the air transport sector. In an erratic world comes an eccentric air travel demand. Even as few markets keep on shining brilliant, others have blurred the back of a cloud. because a vital part of a demand investigation is to anticipate travel demand, regardless of whether or not in infrastructure usage, volume or fleet usage, a proper forecast of demand permits the organization to invest in only staffing, equipment, infrastructure, and facilities as needed.

The analysis of air travel demand market is an essential part of the corporate planning of air transport that displays the manpower requirements, capacity utilization and operational capital of projects in terms of monetary cost, and so on. However, cost pressures continue, from the record of excessive gasoline costs, high inflation, poverty rate, increasing prices of spare parts, economic recession and so forth. This variables have unavoidably prompt to changes in prices for airline services and passenger demand for travel by air, of which it is sotouchy to adjustments in air travel charges or fares, disposable income, flight plan, quality of service, purpose of trip and the economic downturn, most of the airline industries are faced with issue of not meeting their load factor since void seat can't be saved, delay in holding up time of passengers in airports, change in frequency of services, changes in arrival and departure time, change in the level of service etc.

These challenges have been faced by the airline has result to so many unintentional cancellations of some trip by the airline companies, high operating cost and loss of revenuethat is supposed to be generated by the airline, laying off of some employeescompeting for modes of transport, declining rate of the number of air tickets sold and over-investment in facilities and infrastructures.A proper and adequate management of the air transport industry is a necessity to the enhancement to decision making about the present and the destined improvement developing the industry. These consist of activities such as airport investment decisions development planning and etc. there can't be a proper planning without knowing the demand level for the service provided and the factors of determinants related to it. The key elements for the operational planning of air transport are the process of analyzing and forecasting the current and future demand for air travel (ATAG, 2007, Wells, 2005). The aim of this study is to analysze domestic air travel demand in Nigeria. Airlines need to understand the need of the customers and make provision for the right quantity and quality service for the customers. The study contributes to the improvement of air transport economics in the country through the provisional of air travel demand of passengers and adapting it to the Nigeria domestic air travel market.

Hypotheses
H1: There is no statistically significant relationship between National disposable income and domestic air travel demand in Nigeria.
H2: There is no statistically significant relationship between air fare and domestic air travel demand in Nigeria.

Study area

West Africa is the region where Nigeria is located with the longitude 30E and 1500 E and latitude 40^0N and 140^0N Nigeria occupies a place of 923.768 sq.km, with the distance of 1,127 km East to West and 1,046km North to South. It shares a border with Chad on the North-East, with Atlantic Ocean (Gulf Guinea) on the South, with Cameroon by the East, with Niger on the North-west and North and with Benin on the West. Nigeria is the country with the highest population in Africa, according to National Population Commission (NPC, 2006), Nigeria accounted for the population of over 140 million, the country comprises of the Thirty-six States and one Federal Capital Territory. The capital of the Country is Abuja.

Figure 1.1 map of Nigeria showing some major airports in the country
Source: Google

Literature

Many research studies by various researcher on air travel demand have analyzed various factors that influence air travel demand. Graham (2000) opined that the determinant for air travel demand is expressed quickly as "the element of determinant makes individual movements to be feasible". Despite the fact that the definition is right, it is not whole. The reason is that determinants are not most effective elements empowering or making traveling feasible. However, they also increase traveling desire (penchant to fly), insinuating that the number of travels taken by each individual will increase (Çağlar, 2012). Demand is said to be the degree at which consumers are willing to buy a good/product.

Chieh-Yu Hsiao (2008) study on Passenger Demand for Air Transportation in a Hub-and Spoke Network, he tries to develop an air passenger city-pair demand model of analysis so that these objectives can be attained: predictions of average link movement from movement in particular city-pair markets. This bottom-up analysis enables the impacts of the flow in a wide range system adjustment which involves the airports, fares, flight frequencies, and economic growth of the region to be investigated, assuming that demand generation and demand assignment will be treated as a single model. The precipitated air travel was calibrated by the use of a model which allows the entire air demand to have variation in order for potential travelers not be forced to select any alternatives for air transport. Due to changes in the causal factor it may influence both the entire air travel demand and market shares of other modes of transport, because different choices routes and airports are used for making journey within a city-pair there need for the model to handle time series and cross-sectional changes in air travel demand, so that variation in demand for travel by air in the future can be identified.

Chi and Baek (2012) studied quick and long-time period consequences of U.S determinants of the demand for air passengers travel, they employ the co-integration of Johansen evaluation incorporated with Vector Error-Correction (VEC) model, NASDAQ (National Association of Securities Dealers Automated Quotations) was utilized for the purpose of \ measuring travel made for business activities while disposable income of U.S was used to measure passengers traveling for leisure. Chi and Baek (2012) discovered that airfare, NASDAQ and disposable income had a substantial impact on air passenger demand for travel in the U.S in the long-run even as the blended quick-run dynamic outcomes of the populace, disposable profits, NASDAQ and airfare spread the changes in air passenger distance.

Dargay and Hanly (2001) made use of income, airfares, overseas change, trade prices, and domestic fee ranges to examine the factors which can be affecting/influencing air travel demand in and out of United Kingdom. Within the empirical factors, this research makes use of a pooled time-series cross-segment method (panel data) and constant effects version specification, which enables them to have some unique consequences. Panel data was used for business and leisure trips journeys to twenty (20) nations and non-United Kingdom resident leisure and business journeys in and out of the United Kingdom. The

researchers favor the use of pooled time-collection pass-section method due to a constrained variety of observations for the time-series version. Subsequently, the results make clear that the effect of fares on passenger demand is negative while the effect of income on it is positive within the United Kingdom air travel market. Moreover, the of UK income elasticity of air travelers on leisure is decided to be 0.43 in the brief-run and 1.05 within the long-run because a unit change in income/earning stimulate the number of air travel to increase by using 0.43 and 1.05 devices, respectively.

A study conducted by Brons, Pels, Nijkamp, and Rietveld (2002) on Price Elasticities of Demand for Passenger Air Travel in Aviation Sector, makes use of meta-regression analysis to look at the determinants of fare elasticity for inter-continental and globalairline services and to perceive each not unusual and contrasting factor that have an effect on price elasticity. Njegovan (2006) used the Almost Ideal Demand System (AIDS) model which do takes into consideration the feasible approaches wherein in expenditure on airfares pertains to expenditure on non-fare additives of travel overseas and with expenditure on domestic leisure, in a research that studied the outbound demand for leisure air travel in the United Kingdom.

Nelson, Dickey, and Smith (2011) used Estimating Time Series and Cross Section Tourism Demand model to study the analysis of factors affecting the volume of passengers from Hawaii to United State mainland, they used a double-log form for the airline-demand version and located out that cross-sectional airfare elasticities, on an annual foundation basis, were high and growing over time, however the outcomes envisioned from the time series analysis were much lower. So far different determinants were considered by different researchers to determine the factors that affect the demand for air transport for different countries. Some of the factors considered in their study were similar to the hypothetical factors included in this study.

Amanuel, (2016) looked at the determinants of Domestic air transport demand in Ethiopia during the period 2000/2001-2013/2014. He made use of Autoregressive Distributed Lag Approach to Co-integration and Error Correction Model to analyses the long-run and short run relationship between the domestic passengers and its determinants. The results of the Bounds test show that the relationship between the number of Domestic revenue passenger, income, airfare, the price of competing services (Buses), road length and population is stable in a long run. The empirical results show that income, the price of competing services and population were discovered to have a positive impact on the domestic air transport. And also has a negative impact on the domestic air transport. In his short run, the coefficient of error correction term is -0.62 which is about 62 percent annual adjustment towards long-run equilibrium. The estimated coefficients of the short-run model proofed that population, income, and airfare are the main contributors to the domestic air transport demand. Ejem, et al (2015) developed an air travel demand model for Nigeria domestic network. They used panel data from the period of 2009 to 2013, the model covered both time series and cross-sectional changes in air travel demand. The empirical analysis explicitly modeled service variables by a log-linear demand model using OLS estimation. The estimates yielded better demand elasticities than those of direct linear models. Empirical findings include: at market level, the fare elasticities from the estimations show the inelasticity of the market demand. Except for routes with connecting flights, which is highly elastic with fare elasticity value of -2.932.

Data
The statistical data used for the study was sourced from NCAA and FAAN were from 2002 to 2016 period. The sample of airports used in the study covers all the airports in the country's domestic services. The model for the study involved the use of eight variables. These variables include; Dependent variable: Number of passengers, Independent variables are National Disposable Income, Population, Average Airfare, Gross Domestic Product, Exchange Rate, Total Expenditure, and Crude oil price. The variables are denoted as NPAX (Passenger), NDI (National Disposable Income) POP (Population), AAF (Average

Air Fare), GDP (Gross Domestic Product), EX RT (Exchange Rate), TO EXP (Total Expenditure), CRUDE PRICE (Crude Oil Price).

Method of Data Analysis

Multiple linear regression was used to statistically analyze data and quantitatively assess air travel demand in Nigeria. Passenger throughput was used as dependent variable while National Disposable Income, Population, Average Airfare, Gross Domestic Product, Exchange Rate, Total Expenditure, and Crude oil price was used as independent variables. There are various statistical investigations in which the goals were to decide if any relationship existed between two or more variables. If those relationships are modelled into a mathematical equation, then the equation can be adopted for making predictions. The study used a stata-graphic software to carry out a multiple regression analysis. Secondary data sourced from both FAAN and NCAA were used for the data analysis. The general equation is given below: -

$$Y = K + \beta_1 (X1) + \beta_2 (X2) + \beta_3 (X3) + \beta_4 (X4) \ldots\ldots\ldots + \beta_n (Xn)$$

Where:

Y = dependent variable

X_n= independent variable

K = constant and

βn= coefficient of x.

Results and Discussion of findings

The output in Table 4.1 shows the results of fitting a multiple linear regression model to explain the relationship between NPAX and the 7 independent variables. From the analysis, the R-square statistic shows that the fitted model explains the variability in NPAX which is 96.8124%. The statistic R^2 adjusted is most suitable statistic used in comparing the models that have different numbers of independent variables, is 93.6248%. The standard error of the estimate indicates the standard deviation of the residuals to be 0.580721. The prediction limits for new observations can be constructed using these values. The mean absolute error (MAE) of 345960 is the average residual values. The significant correlation based on the order in which they occur in the data file is determined by testing the residuals with the Durbin-Watson (DW) statistic.

Table 4.1: Model Fit for Multiple Regression Analysis

Parameter	Estimate	Standard Error	T Statistic	P-Value
CONSTANT	-1.92267E6	7.01113E6	-0.274232	0.7918
NDI	0.170287	0.0330478	5.15274	0.0013
POP	0.0777248	0.0672339	1.15604	0.2856
AAF	-690.814	140.624	-4.91247	0.0017
GDP	-0.0321241	0.0205773	-1.56114	0.1625
EX RT	13142.7	11967.4	1.09821	0.3084
TO EXP	1700.9	748.291	2.27305	0.0572
CRUDE PRICE	-308.208	126.112	-2.44392	0.0445

Source: Author,2018

Table 4.2   Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	P-Value
Model	7.16974E13	7	1.02425E13	30.37	0.0001

Residual	2.36066E12	7	3.37237E11
Total (Corr.)	7.4058E13	14	

Source: Author,2018

R-squared = 96.8124 %
R-squared (for d.f. adjusted) = 93.6248%
Standard Error of Est. = 580721.
Mean absolute error = 345960.
Durbin-Watson statistic = 2.26939 (P=0.2175)
Lag 1 residual autocorrelation = -0.185593

The equation of the fitted model is
NPAX = -1.92267E6 + 0.170287 *NDI + 0.0777248 *POP   -690.814*AAF-0.0321241*GDP + 13142.7*EX RT + 1700.9 *TO EXP - 308.208*CRUDE PRICE

The ANOVA table (**Table 4.2)** shows that the P-value < 0.05, this mean that the relationship between the variables is significant at a confidence level of 95.0%. Since the P-value > 0.05, there is no indication of serial autocorrelation in the residuals at the 95.0% confidence level. To determine if the model can be simplified, the highest P-value on the independent variables is 0.3084, belonging to EX-RT. Since the P-value is greater or equal to 0.05, that term is not statistically significant at the 95.0% or higher confidence level.

Table 4.3 Correlation matrix for coefficient estimates

	CONSTANT	**NDI**	**POP**	**AAF**	**GDP**	**EX RT**	**TO EXP**	**CRUDE PRICE**
CONSTANT	1.0000	-0.1450	-0.9807	0.5425	0.4259	-0.0613	0.8152	-0.1086
NDI	-0.1450	1.0000	0.2166	-0.6772	-0.5354	-0.0503	0.1335	-0.5760
POP	-0.9807	0.2166	1.0000	-0.5900	-0.4197	-0.0970	-0.7630	-0.0194
AAF	0.5425	-0.6772	-0.5900	1.0000	0.1708	-0.1979	0.3449	0.1779
GDP	0.4259	-0.5354	-0.4197	0.1708	1.0000	0.1300	0.0044	0.4739
EX RT	-0.0613	-0.0503	-0.0970	-0.1979	0.1300	1.0000	-0.2738	0.5825
TO EXP	0.8152	0.1335	-0.7630	0.3449	0.0044	-0.2738	1.0000	-0.5768
CRUDE PRICE	-0.1086	-0.5760	-0.0194	0.1779	0.4739	0.5825	-0.5768	1.0000

Source: Author, 2018

Table 4.3 shows estimated correlations that exist between the coefficients in the fitted model. The presence of serious multi-collinearity can be detected with the use of correlations, i.e., correlation amongst the predictor variables. From the output, there are 7 correlations with absolute values > 0.5 (not including the constant term).

Hypothesis Testing:
H$_{1:}$ There is no statistically significant relationship between National Disposable Income and domestic air travel demand in Nigeria.

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Table 4.1 shows that P-value calculated is 0.0013 which is less than P-value 0.05, thus, implying the existence of a statistically significant relationship between National Disposable Income and domestic air travel demand in Nigeria. Also, there is a positive significant relationship between National Disposable Income and perceived domestic air travel demand since $P < 0.05$. This implies that the higher the National Disposable Income, the higher the perceived Demand for domestic air travel.

H$_2$: There is no statistically significant relationship between air fare and domestic air travel demand in Nigeria.

Table 4.1 shows that the P-value calculated is 0.0017 which is less than P-value 0.05, thus this means that there is a statistically significant relationship between air fare and domestic air travel demand in Nigeria. Also, there is a positive significant relationship between air fare and perceived domestic air travel demand since $P<0.05$. This implies that the higher the air fare, the higher it affects the Demand for domestic air travel.

Conclusion

This study analyzed domestic air travel demand of passengers in Nigeria and focused on the period 2002-2016. The study evaluated the various determinants of domestic air travel demand in the country using Multiple Regression and the results show that the independent variables have a great impact in the domestic air travel demand of passengers in Nigeria. The study finding show that the independent variable accounted for 93.624% relationship with demand for domestic air travel of passenger. The Hypothesis testing shows that 2 of the independent variables have a highly significant relationship with the demand for domestic air travel, the independent variables are National Disposable Income which has the P-value of 0.0013 and Average Airfare which has the P-value of 0.0017, the P-value of the variables were less than P-value 0.05, so the null hypothesis was accepted. The results showed a significant relationship between the independent variables and demand for domestics' air travel of passengers in Nigeria. Based on the results of the findings, the study recommends that stakeholders in the air transport sector should improve the infrastructures in the nation's air transport operations, in order to adequately accommodate the growth of air travel demand for domestic air travels in Nigeria.

REFERENCE

AmanuelSofany (2016), *The Determinants of Domestic air transport demand in Ethiopia*, Addis Ababa University, Ethiopia.

ATAG. (2007), The Economic and Social Benefits of Air Transport. *Air Transport Action Group.* Geneva Switzerland.

Barros, C. P., Wanke, P., Nwaogbe, O. R**.** and Azad, A.K. (2017). Efficiency in   Nigerian Airports, Case *Studies on Transport Policy (Science Direct) 5,* 573-579. https://doi.org/10.1016/j.cstp.2017.10.003.

Barros, C.P., Nwaogbe, O. R., and Ogwude, I.C. (2015). Performance and Heterogeneity of Nigeria Airports, *Proceeding of the 19th Air Transport Research Society (ATRS) World Conference, Singapore*, July 2 - 5, 2015.

Blauwens, G., De Baere, P. and Van de Voorde, E. (2008). *Transport Economics* (Third Revised Edition), De Boeck Ltd., Antwerp.

Boeing. (2011). *Boeing current market outlook 2011-2030.* Seattle

Brons, M, Pels, E., Nijkamp, P. and Rietveld, P, (2002), "Price elasticities of demand for passenger air travel", *Journal of Air Transport Management,* 8, 165-175.

Çağlar, D. (2012). *Analysis of Stimulated Domestic Air Transport Demand in Turkey. What are the drivers?* Masters Research Thesis. School of Economics. Erasmus University. Rotterdam.

Chi, J. and J. Baek, (2012). A Dynamic Demand Analysis of the United State Air Passenger Service, *Transportation Research Part E 48*:755-761

Chieh-Yu Hsiao, (2008). Pas*senger Demand for Air Transportation in a Hub-and-Spoke Network,* University of California, Berkeley.

Dargay, J., and Hanly, M. (2001), The determinants of the demand for international air travel to and from the UK. *Paper presented at the 9th World Conference on Transport Research,* Edinburgh, Scotland, May, 2001.

Ejem, E. A., Ogwude, I. C., Ibe, C. C., Nzotta, S.M. and Ikeogu, C.C. (2015). Estimation of Route Based Air Travel Demand Elasticities in Nigeria*, Proceedings of the 19th Air Transport Research Society (ATRS) World Conference,* Singapore, July 2 -5, 2015.

Graham, A. (2000), Demand for leisure air travel and limits to growth. *Journal of Air Transport Management,* 6, 109-118.

Nelson, L., Dickey, V., and Smith, J. (2011). Estimating Time Series and Cross Section Tourism Demand Models: Mainland United State to Hawaii Data, *Tourism Management 32,*28-38.

Njegovan, N. (2006), 'Elasticities of Demand for Leisure Air Travel: A System Modelling Approach' *Journal of Air Transport Management* 12 (1), 33-39

Nwaogbe, O. R., Wokili, H., Omoke, V., Asiegbu, B., (2013). An Analysis of the impact of air transport sector to economic development in Nigeria, IOSR *Journal of Business Management, 1(5),* 41-48. Doi: http://dx.doi.org/10.9790/487X-1454148

Nwaogbe, O. R., Ogwude, I.C., and Barros, C.P. (2015). An Assessment of Productivity and Efficiency in Nigerian Airports Using Data Envelopment Analysis, *Proceedings of the19th Air Transport Research Society (ATRS) World Conference,* Singapore, July 2 -5, 2015.

Nwaogbe, O. R., Ogwude, I. C. and Ibe, C. C. (2017). Efficiency Analysis of the Nigeria Airports:An Application of DEA-BCC Model. *International Scientific Journal of Air Transport Industry(AERO-Journal)*, 2ed. 28-39. Zinlinska University,Czech Republic.

Nwaogbe, O. R., Wanke, P., Ogwude, I. C., Barros, C.P and Azad, A.K. (2018). Efficiency Driver in Nigerian Airports: A Bootstrapp DEA-Censored Quantile Regression Approach. *Journal of Aviation Technology and Engineering*, 7 (2), 15-31.

Nwaogbe, O. R. (2018). *Assessment of Airport Productivity and Efficiency in Nigeria*, Unpublished Ph.D Thesis Dissertation, Federal University of Technology Owerri.

Wells, A.T. (2005), *Air Transportation. A Management Perspective*. 2nd edition. Wadsworth. USA.