

Exploratory and confirmatory analysis to identify airports and airlines characteristics as factors influencing domestic passenger traffic in Nigeria

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Abstract: Passenger traffic at airports is characterised by fluctuations resulting from the influence of several factors. The influence of each factor is different, leading to unpredictable passenger traffic patterns that make planning difficult. Previous studies used geographic, demographic, and economic variables as exploratory factors to examine air travel demand. The study explores several variables to confirm airports and airlines' characteristics as demand factors for domestic air travel in Nigeria. Data for the study were collected by administering a questionnaire to respondents at major domestic airports in Nigeria. The variables were presented in the 5-point Likert Scale for respondents to rank in order of significance. Exploratory and confirmatory factor analyses (EFA and CFA) were employed to identify the significant factors affecting passenger traffic at domestic airports in Nigeria. EFA reduced fifteen variables to four orthogonal factors influencing passenger traffic at domestic airports. CFA validates airport and airline services, demographics, economic factors, and airport size and facilities as significant factors affecting passenger traffic at domestic airports in Nigeria. The model fit test shows $CMIN/DF = 2.263$; $CFI = 0.940$; $GFI = 0.929$; $NFI = 0.901$; and $RMSEA = 0.078$. The result identifies airport and airline characteristics as factors influencing passenger traffic at the domestic airport in any country. It implies that airport and airline characteristics significantly influence domestic air traffic and needs to be included in modelling. Identifying airport and airline characteristics as air travel determinants make this study unique for policy decisions to forecast domestic passenger traffic in a country.

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Keywords: domestic airports, airport characteristics, airline services, passenger traffic.

1. Introduction

Passenger traffic at airports is essential to successful airport managers and airline operations. It is because airports are established to guarantee the movement of passengers, while airlines operate to carry revenue passengers from one airport to another. It implies that both airports and airlines' operations exist for passengers. But it is characteristic that passenger traffic fluctuates at an airport and records different volumes in different airports within a country. Several studies, such as Boonekamp, Zuidberg and Burghouwt (2018), and Inan and Gokmen (2021), have examined the factors responsible for passenger traffic at airports. Other issues that are affecting passenger traffic at airports include urbanisation (Demirsoy, 2012), income distribution (Airbus, 2011), and globalisation of production and consumption markets (Brorsson, 2016). The impact of the factors creates variability in the volume of traffic at airports. Yet, the fluctuation pattern in passenger traffic at airports remains a source of difficulty experienced by airlines and airport planners.

Likewise, operations at each domestic airport require a predictable traffic pattern for planning purposes. However, the pattern of passenger traffic is often influenced by several factors such as GDP, population, and tourism (Boonekamp, Zuidberg & Burghouwt, 2018). Other significant factors include ethnic ties, aviation-related employment, domestic transport, low-cost carrier activities, and public service obligations (Boonekamp, Zuidberg & Burghouwt, 2018). Passengers' traffic at the domestic airports of a country is also motivated by several reasons, including medical, business, tourist, and personal purposes (Tiwari et al., 2019).

Aside from the economic, demographic, and geographical factors already examined by researchers, there is concern that the characteristics of airports and airlines also affect passenger traffic at domestic airports. Airport and airline-related factors need to be examined in countries with multiple domestic airports like Nigeria. The influence of airport characteristics is reflected in the choice of passengers flying at a particular airport. Airports with supposedly improved facilities for accessibility, safety, and security may be in greater demand than others with fewer facilities. Likewise, airlines with perceived better service quality will receive more passengers than others with a lower perception of service quality. Nevertheless, it is logical that passengers tend to fly airlines whose service quality is less perceived but operate at an airport with a higher level of facilities for safety and security. As a result, the perception of airline service delivery is related to the level of airport infrastructure and facilities to improve safe flight operations. So, this study answers the question, do airport and airline characteristics significantly affect domestic air travel alongside the common factors from economic, demographic, and geographic indicators?

This paper aims to identify airline and airport characteristics as significant domestic air travel factors using Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA). Identifying these factors will inform future studies to include them in modelling air travel demand, especially in a country with multiple airports different ethnic backgrounds, cultural values, and regional economic prosperity.

The paper has five (5) sections after this. Section 2 presents the literature reviewed for the study. Section 3 of the article shows the study area, while Section 4 contains the data and methods used for the analysis. Section 5 contains the detailed results and a discussion of the study's statistical results. The last section summarises the study with policy implications and a conclusion.

2. Literature review

Several studies have been conducted on passenger traffic at domestic airports in different countries. It implies that domestic air travel has aroused great interest among researchers. Wang and Ga (2021) reviewed 87 articles published on air travel demand from 2010 to 2020. Wang and Song (2010) reviewed 115 articles published from 1950 to 2008 on air travel. However, the factors considered in domestic air passenger travel studies varied from researcher to researcher. Iyer and Thomas (2021) examined the determinants of domestic air traffic at regional airports in India. They

found that distance and airport accessibility are significant factors influencing passenger traffic at airports. Inan and Gokmen (2021) used population, human development index (HDI), and GDP to examine the air passenger numbers on America – Europe and Asia – Africa air routes.

Cook, Kluge, Paul and Cristobal (2017) conducted a study on air passenger traffic in Europe using regression analysis and found that the gross domestic product (GDP) per capita, the country's geographic location, and the level of education are statistically significant factors. Other factors such as per capita income, ticket prices, industrial production index, inflation rate, and exchange rate were found by Secilmis and Koc (2016) as the main factors influencing the demand for air transport in Turkey and the countries of the European Union. Endrizaloo and Vladimir (2014) explained the elasticity of air traffic using an algorithm of demand modelling and found ticket price and income as factors influencing passenger traffic at airports. The International Civil Aviation Organization - ICAO (2016) reported a 6.3 per cent growth rate for global air travel in 2016, influenced by social, demographic, and economic factors. In addition, Addepalli, Pagalday, Salonitis, and Roy (2018) specifically examined the socio-economic and demographic factors that contribute to the growth of civil aviation and noted the influence of social, demographic, and economic factors on the development of the aviation industry.

Different government policies and regulations also influence the passenger traffic at domestic airports in a country. For example, the Nigerian government embarked on airport rehabilitation, provision of facilities, personnel training to enhance passenger facilitation, and encouragement of customer-oriented service (Eze, 2020) to improve airport operations. However, improved air transport operations policies require additional costs for airlines with less return on investment (Daramola & Fagbemi, 2019). The implementation of the policies implies the imposition of various charges and taxes on airlines with an adverse impact on traffic as airlines disproportionately increase the total price of tickets (IATA, 2013). Daramola and Fagbemi (2019) examined the market potentials and challenges for air travel and found airfares resulting from the cost of airline service provision as a significant factor influencing traffic at airports in Nigeria.

Aderamo (2010) examined the demand for domestic air transportation utilising airport data of passenger, aircraft, and cargo traffic from 1975 to 2006 in a regression model to understand the need for air transport in Nigeria. Okafor, Buraimoh, Uhuegho and Soladoye (2019) forecasted domestic air passenger traffic flow at selected airports in Nigeria to ascertain the tendency to fly and recommended a greater investment volume in Owerri, Abuja and Kano airports. Adenigbo's (2016) airport choice study focussed on the agents' choice factors influencing cargo traffic at Abuja airport in Nigeria.

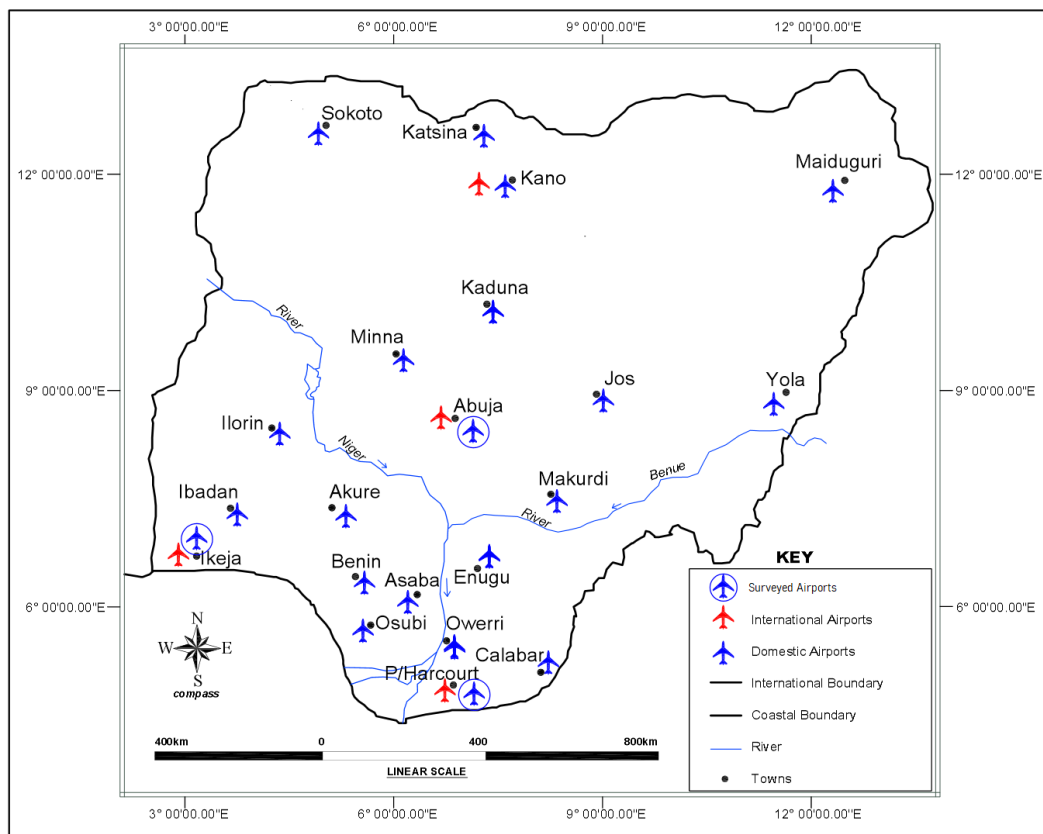
A careful note from the literature is that various publications on air cargo traffic did not include airport and airline-related variables in modelling air traffic. The literature shows that passenger traffic at domestic airports is influenced primarily by economic, demographic, and geographic variables. The knowledge gap that motivates this study is that researchers have yet to include airline and airport characteristics as factors in travel demand models. Therefore, this paper explores airline and airport variables to identify airline and airport characteristics as significant factors influencing passenger traffic at domestic airports. Its essence is to study a broader range of variables that affect domestic air traffic at airports. Therefore, this empirical study combined factors previously studied by researchers and unique factors related to airlines and airports in exploratory and confirmatory factor analysis.

3. Study area

The study explores the factors influencing passenger traffic at domestic airports in Nigeria. Nigeria has four major international airports with other domestic airports in different geopolitical zones. It should be noted that each of the major international airports also has a domestic wing. The airports serve the six (6) geopolitical zones in the country. Figure 1 shows the location of airports in Nigeria.

A survey was conducted to identify the factors determining passenger traffic at domestic airports in Nigeria. The survey was conducted by administering a questionnaire to respondents at the selected airports highlighted in Figure 1. The selected airports are the largest, with the highest passenger traffic from 2011 to 2017 in Nigeria (see Table 1). The domestic airports chosen for the study are Ikeja Airport with 37.5% of total traffic, Abuja Airport with 31.4%, and Port Harcourt with 10.7% of total domestic passenger traffic (see Table 1). The traffic of the three airports accounts for 79.6% of the total traffic at all domestic airports in Nigeria from 2011 to 2017.

Figure 1: Map of airports location in Nigeria



Source: Adapted from Google Earth Map, 2021

Table 1: Passenger traffic at domestic airports in Nigeria from 2011 to 2017

Airport	2011	2012	2013	2014	2015	2016	2017	Total	%
Abuja	3,624,862	2,804,128	3,015,803	3,274,986	3,375,823	3,296,940	2,788,869	22,181,411	31.4
Benin	323,554	208,181	217,254	227,896	227,896	189,917	224,404	1,619,102	2.3
Calabar	152,930	212,088	172,810	203,844	192,229	184,682	145,928	1,264,511	1.8
Enugu	301,744	220,031	225,915	291,023	310,558	241,622	272,814	1,863,707	2.6
Ibadan	38,979	43,864	56,959	64,743	65,586	67,631	44,337	382,099	0.5
Ilorin	46,990	52,142	52,938	66,205	67,439	66,365	50,156	402,235	0.6
Jos	47,794	36,152	47,910	48,938	48,199	39,675	42,040	310,708	0.4
Kaduna	109,622	125,290	144,583	174,216	123,737	115,801	274,780	1,068,029	1.5
Sokoto	69,805	64,191	78,377	100,078	84,338	43,198	20,608	460,595	0.7
Kano	272,911	214,606	202,934	257,927	227,038	237,738	237,443	1,650,597	2.3
Maiduguri	74,825	76,518	72,301	11,103	43,181	58,909	49,605	386,442	0.5
Makurdi	1,924	1,839	1,117	1,757	876	400	2,132	10,045	0.0
Ikeja	4,127,100	4,275,660	3,454,250	4,007,740	3,778,145	3,455,913	3,432,041	26,530,849	37.5
PHC	1,129,549	1,163,482	1,113,183	1,225,135	1,116,885	952,038	863,413	7,563,685	10.7
Yola	91,659	85,470	123,421	145,588	148,412	127,067	102,877	824,494	1.2
Minna	10,711	3,627	8,900	111,873	5,777	8,992	13,383	163,263	0.2
Katsina	5,937	1,840	2,456	1,828	7,354	974	1,042	21,431	0.0
Owerri	384,016	309,063	279,609	338,943	376,149	402,791	417,900	2,508,471	3.5
Osubi	365,875	287,453	246,560	221,250	187,630	173,781	-	1,482,549	2.1
Total	11,180,787	10,185,625	9,517,280	10,775,073	10,387,252	9,664,434	8,983,772	70,694,223	

Source: Headquarters, Federal Airport Authority of Nigeria
Selected Airports (Abuja, Ikeja, and PHC - Port Harcourt)

4. Data and method

The data required for the study include the total passenger traffic at domestic airports in Nigeria from 1987 to 2017 and primary data collected through a questionnaire that was administered randomly to potential passengers and staff of different organisations at the selected airports. This study assumes an infinite population of potential passengers at the designated airports. As a result, this study

determines its sample size using the formula of Cochran (1977) when there is an infinite population as follows;

$$n_0 = \frac{z^2 pq}{e^2} \quad (1)$$

where:

e is the desired level of precision at 0.05

p is the proportion of the population variability taken as 0.5

q is $1 - p$

z is the Z score of 1.96

n_0 is the sample size for the study

Therefore, the sample size for the study is 385, as presented below.

$$n_0 = \frac{1.96^2(0.5)(0.5)}{(0.05)^2} = 385 \text{ (Number of samples to be surveyed)}$$

A total of three hundred and thirty-six (336) participants were surveyed in this study, including staff from the Nigerian Airspace Management Agency (NAMA), the Nigeria Civil Aviation Authority (NCAA), the Federal Airport Authority of Nigeria (FAAN), airlines, and passengers as shown in Table 2. The survey had a success rate of 87.3 per cent. The distribution of the respondents shows that passengers dominate the respondents in the study (see Table 2). It corresponds to 75.9% of the total respondents surveyed for the study. The distribution suggests that their responses will be reliable in examining the factors influencing passenger traffic at domestic airports in Nigeria.

Table 2: Distribution of respondents

Category	Number	Per cent
NAMA	12	3.6
NCAA	15	4.5
FAAN	27	8.0
Airlines	27	8.0
Passengers	255	75.9
Total	336	100

Source: Authors' Field Survey, 2021

The distribution of respondents by airport shown in Table 3 indicates that the majority of respondents, 46.4%, were interviewed at Ikeja Airport. It was followed by the number of respondents interviewed at the domestic wing of Abuja Airport, which was 36% of the total. The domestic wing of Port Harcourt Airport has 17.6% of the total respondents. The distribution follows proportionately the data pattern shown in Table 1.

Table 3: Distribution of respondents by airports

Airport	Respondents	Per cent
Ikeja	156	46.4
Port Harcourt	59	17.6
Abuja	121	36.0
Total	336	100

Source: Authors' Field Survey, 2021

The respondents were sampled using the simple random technique to give the respondents an equal chance to be interviewed. The questionnaire for the study was designed so that respondents were asked to assess the factors that influence passenger traffic at domestic airports in Nigeria. The questionnaire contains fifteen (15) variables presented on a 5-point Likert scale. It is intended to allow respondents to choose from a wide range of measures to reflect the impact of each variable on traffic at domestic airports in Nigeria. The variables extracted and modified from the literature include economic prosperity, passenger income, population size, level of education, age, work experience, occupation, airport location, airport security, flight operations, infrastructure provision, airport accessibility, flight frequency, accessibility of the parking lot and airport size.

The factors were presented in tabular form so that the respondents ranked their significance from 1 - Not significant to 5 - Highly significant. The study used exploratory and confirmatory factor analyses

(EFA and CFA) as data analytical techniques. The exploratory factor analysis aims to reduce the fifteen (15) factors to fewer ones representing all other variables as the main factors influencing passenger traffic at domestic airports in Nigeria. These common factors are needed to explain the correlations between the observed variables and the relationship of each observed variable by its factor loadings. According to Okoko (2001), EFA is a linear combination of the original variables to derive the common factors. The mathematical expression of the definition, according to Okoko (2001), is:

$$F = W_1X_1 + W_2X_2 + \dots + W_nX_n \quad (2)$$

where,

$W_1 - W_n$ = Factor weights

$X_1 - X_n$ = original variables

The calculation of W_1 and X_1 was performed to generate the correlation matrix. The factor weight is a value assigned to a variable to help determine the scores for a particular factor. The factor values are the number of cases in a given factor load. Factor loadings 0.400 and above are considered high (Laudau and Everitt, 2004), with factor loadings below this threshold being considered low and having a minor contribution to the common factors. The factor rotation for this study was carried out using the Varimax method so that individual variables can be described by a linear combination of a few functions in which all factors are not correlated.

Confirmatory Factor Analysis (CFA) was used to validate the results of EFA in examining the factors influencing passenger traffic at domestic airports in Nigeria. The CFA model assumes that the covariances among four latent factors are correlated with the observed variables. In the model fitting of the CFA, several indices were used to validate the EFA output about the factors influencing domestic passenger traffic at airports in Nigeria. This study used Relative Chi-Square (CMIN/DF), Comparative Adjustment Index (CFI), Adjustment Quality Index (GFI), Normalized Adjustment Index (NFI), and Root Mean Square Approximation (RMSEA) as indices to validate the model. The determination of the test fit model follows the presentation by Samah (2013), who provided the recommended model fit values from different authors. Therefore, a value less than five (5) is considered suitable for CMIN/DF, 0.900 as a fit for CFI, GFI, NFI, and values less than 0.08 as a fit for RMSEA were assumed to validate the model.

The reliability test of the data was carried out using the Cronbach Alpha technique. The purpose is to check the internal consistency of the variables. Table 4 shows the summary of the data with 99.7% valid cases. So, Table 5 shows the Cronbach Alpha reliability test result with a coefficient of 0.793, which is above the minimum threshold. It implies that the coefficient for the fifteen (15) variables is valid for analysis. It suggests that the variables have high internal consistency that is reliable for the analytical technique used in the study.

Table 4: Case processing summary

		N	%
Cases	Valid	335	99.7
	Excluded ^a	1	.3
	Total	336	100.0

a. Listwise deletion based on all variables in the procedure.

Source: SPSS Computation, 2021

Table 5: reliability statistics

Cronbach's Alpha	N of Items
.793	15

Source: SPSS Computation, 2021

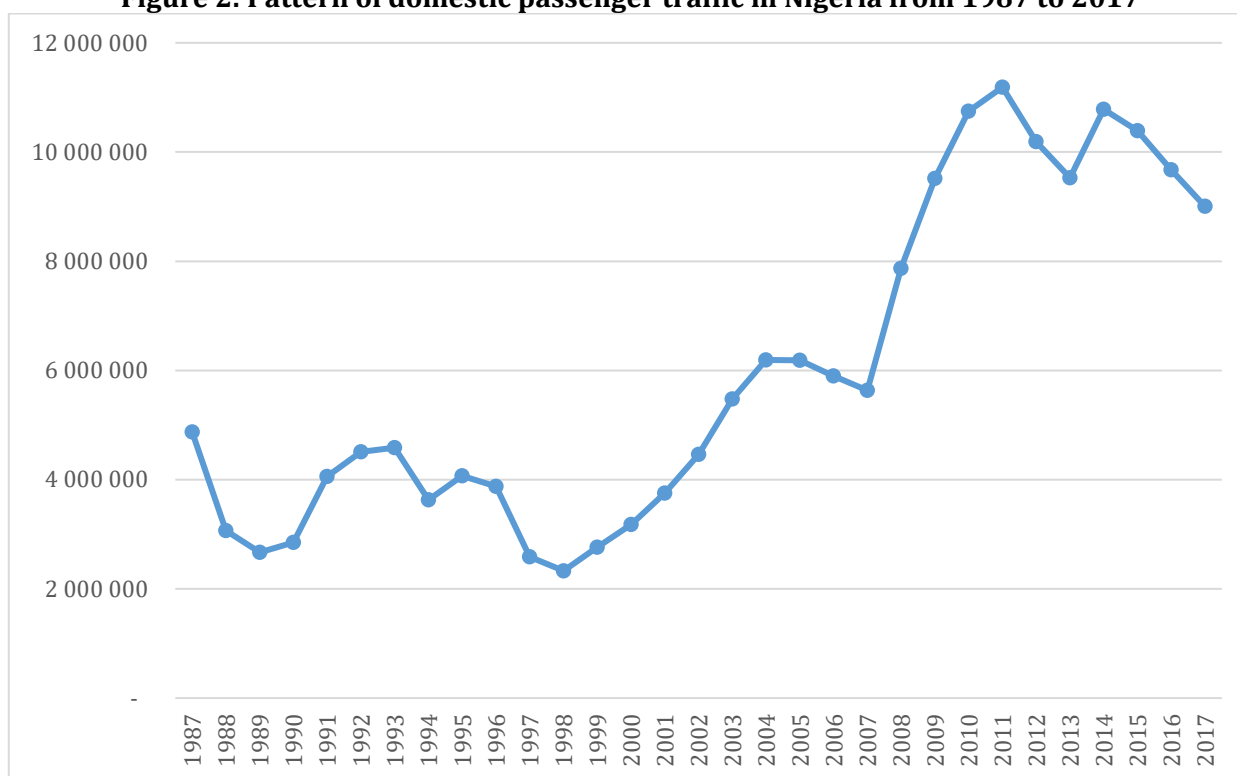
5. Results and discussion

Passenger traffic at domestic airports depends on many factors. These factors determine the volume of traffic and operations at domestic airports. Passenger traffic is invariably characterised by fluctuations, making it difficult for operators to make decisions. Hence, this study explores the factors

influencing domestic passenger traffic at airports in Nigeria, which is essential for airport management and airline decision-making.

The overview of domestic passenger traffic patterns in Nigeria shows an increasing trend from 4,890,906 passengers in 1987 to 9,007,451 in 2017. This is due to several factors, such as population and per capita income, which differ in content and scope. The growth pattern shows that fluctuations characterise passenger traffic at any airport. Domestic passenger traffic in Nigeria started with 4,890,906 passengers in 1987 and dropped to 2,847,677 passengers in 1990. The changes continued until 1998, after which the demand for domestic flights gradually increased from 2,759,543 passengers in 1999 to 6,189,262 passengers in 2004. Remarkably, the growth in passenger traffic at domestic airports in Nigeria increased from 5,633,689 passengers in 2007 to 11,186,860 passengers in 2011, which is the highlight of the pattern. The goal of Figure 2 is to show that passenger traffic at domestic airports in Nigeria fluctuates. This study explores factors responsible for the overall pattern of domestic air travel in Nigeria rather than analysing the time-based variability or predicting domestic passenger traffic.

Figure 2: Pattern of domestic passenger traffic in Nigeria from 1987 to 2017



Source: FAAN, 2019

The primary data collected were tested to determine their suitability for the analytical techniques. The results of the Kaiser-Meyer-Olkin (KMO) measurement of sample adequacy with 0.704 and Bartlett's test of sphericity with an approximate chi-square value of 638.064, which is significant at $p = 0.000$ (see Table 6), indicate an appropriate and suitable data for the chosen analytical techniques. On this basis, the results are reliable for discussion and policy implications.

Kaiser-Meyer-Olkin measure of sampling adequacy		
Kaiser-Meyer-Olkin measure of sampling adequacy		0.704
Bartlett's test of sphericity	Approx. Chi-square	638.064
	Df	105
	Sig.	0.000

Source: SPSS Computation, 2021

The correlation matrix in Table 7 shows the relationship between the variables considered for investigation in this study. The correlation value implies the extent of the corresponding influence

between the related variables. Fifteen variables examined in the study include economic prosperity, passenger income, population size, level of education, age, work experience, occupation, airport location, airport security, airline operation, infrastructure provision, accessibility of the airport, flight frequency, accessibility of parking lots, and airport size. The variables were presented in Table 5 as Ecopros, Pxinco, Popsiz, Edulev, Age, workexp, occup, airploc, airsase, airlops, infraspro, airpace, flifreq, capak, and airpse to facilitate they fit within the table.

Table 7 shows that the most strongly correlated variables are economic prosperity and passenger income with $r = 0.722$. The increase in a nation's economic prosperity will lead to a rise in the per-capital income of citizens, which will lead to increased demand for air travel. It is because air travel within a country is more expensive than other modes of transport. The level of education and the age of the passengers with $r = 0.579$ indicate that the higher the level of education, the older a passenger can be. The respondent's level of education with a high correlation ($r = 0.525$) with the type of occupation also implies that a higher level of education determines the kind of occupation of the respondents who are either skilled or unskilled workers. The age of the respondents also has a significant correlation with the degree of employment concerning the length of service in a particular occupation.

The importance of the infrastructure provided at an airport determines the scope of operations at the airport. The relationship between flight operations and infrastructure provision with $r = .522$ shows that airlines need basic infrastructure and facilities for safe flight operations at every airport. This will also affect the level of flight frequency of the airlines. It supports the relationship between flight operations and airport accessibility with $r = .582$, which means that flight operations increase with increasing accessibility at airports. It also suggests that the accessibility of airports with $r = .594$ is a function of the infrastructure provision. The relationship between infrastructure provision and flight frequency of airlines with $r = 0.530$ also shows that the airport infrastructure will increase the airlines' flight frequency because airlines will prefer to fly at airports with adequate infrastructure. The accessibility of an airport with a relationship ($r = .575$) to flight frequency implies that airlines tend to fly to an airport with a higher degree of accessibility. The relationship of $r = .561$ between airport parking space and airport size shows that the size of an airport determines the size of the land area for vehicle parking lots. This indicates that an airport with a large land area will provide car parking spaces, which enhances vehicles security.

Table 7: Correlation matrix of factors affecting passenger traffic at domestic airports

	Ecopros	Pxinco	Popsiz	Edulev	Age	Workexp	Occup	Airploc	Airsase	Airlops	Infraspro	Airspac	Flifreq	Capak	Airpsiz
Ecopro	1.000														
Popsiz	.722	1.000													
Edulev	.271	.304	1.000												
Edulev	.182	.278	.382	1.000											
Age	-.005	.023	.258	.579	1.000										
Workexp	-.076	.195	.274	.525	.513	1.000									
Occup	.019	.044	.165	.229	.239	.217	1.000								
Airploc	-.003	.082	.246	.314	.284	.295	.035	1.000							
Airsase	-.197	-.098	-.073	-.062	.103	.045	.065	.241	1.000						
Airlops	-.171	-.331	-.090	-.045	.103	.020	-.144	.316	.428	1.000					
Infraspro	-.084	-.152	.028	-.058	.147	.000	-.184	.285	.424	.522	1.000				
Airspac	-.171	-.194	-.059	.091	.193	.117	-.084	.315	.464	.582	.594	1.000			
Flifreq	-.278	-.313	-.150	-.002	.213	.161	-.113	.209	.290	.459	.530	.575	1.000		
Capak	-.190	-.132	.125	.121	.243	.042	-.042	.269	.203	.274	.298	.431	.429	1.000	
Airpsiz	.022	.107	.286	.326	.214	.197	.030	.405	.105	.132	.282	.242	.245	.561	1.000

Extraction Method: Principal Axis Factoring

Source: SPSS Computation, 2021

The communalities (Table 8) of the variables that influence the passenger traffic at domestic airports in Nigeria indicate the amount of each variable's contribution to the common factors. It is assumed that the variables with values less than 40% after extraction contribute little to the common factors. However, the other variables with extracted values greater than 50% have high percentage variances and suggest that the variables after extraction are due to the common factors.

Table 8: Communalities of factors influencing passenger traffic at domestic airports

	Initial	Extraction
Economic Prosperity	.648	.747
Passenger Income	.684	.709
Population Size	.311	.309
Education Level	.541	.643
Age	.498	.546
Work Experience	.512	.519
Occupation	.474	.441
Airport Location	.331	.328
Airport Safety and Security	.364	.302
Airline Operations	.509	.542
Infrastructural Provision	.535	.589
Airport Accessibility	.577	.670
Flight frequency	.514	.500
Car Parking Space	.508	.529
Airport Size	.478	.744

Extraction Method: Principal Axis Factoring

Source: SPSS Computation, 2021.

The total percentage variance of the factors influencing passenger traffic at domestic airports, shown in Table 9, indicates four (4) factors with an eigenvalue greater than 1. It shows that factor 1 has an eigenvalue of 3.919, which explains 26.125% of the total variance. Factor two gives an eigenvalue of 2.927 with a percentage variance of 19.515. Factor three provides an eigenvalue of 1.514 and thus makes up 10.094% of the total variance. Factor four also shows an eigenvalue of 1.141 with a 7.607% variance. It suggests that the factors have been reduced to four (4), which will affect passenger traffic at domestic airports in Nigeria.

The cumulative percentage of variance shows that the four factors alone account for 63.34% of the total variance, to give the portion of the variance explained by the common four factors. Identifying the factors that explain the fluctuations in passenger traffic at domestic airports in Nigeria requires factor rotation with the varimax method. It is necessary to maximise the variance of the quadratic changes to generate orthogonal factors that will be used to interpret the final output of the factor analysis. Laudau and Everit (2004) considered a threshold value of 0.400 as high for analysis.

Table 9: Total variance of factors influencing passenger traffic at the domestic airport

Factor	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3.919	26.125	26.125	3.472	23.149	23.149
2	2.927	19.515	45.641	2.486	16.572	39.721
3	1.514	10.094	55.735	1.127	7.513	47.234
4	1.141	7.607	63.342	.733	4.886	52.120
5	.918	6.121	69.464			
6	.771	5.142	74.605			
7	.675	4.503	79.108			
8	.595	3.967	83.075			
9	.549	3.658	86.733			
10	.469	3.124	89.857			
11	.427	2.846	92.703			
12	.387	2.577	95.280			
13	.323	2.155	97.435			
14	.232	1.545	98.981			
15	.153	1.019	100.000			

Extraction Method: Principal Axis Factoring

Source: Authors' SPSS Computation, 2021

The rotated factor matrix of the analysis presented in Table 8 shows the loadings of the variables on the extracted four factors. The analysis grouped the variables into four extracted factors. The highest

loading variable on each of the extracted factors is the accessibility of airports with 79.4% under factor 1, the level of education weighs 74.4% under factor 2, economic prosperity weighs 85.5% under factor 3, and the airport size weighs 82.2% under factor 4. These variables are essential in influencing passenger traffic at domestic airports in any developing country such as Nigeria. It is noteworthy that the accessibility of the airport and the size of the airport have a significant impact on passenger traffic, which is the main contribution of this study to knowledge.

In addition, it is crucial to consider the high-loaded variables for each factor in the final identification of factors affecting domestic air traffic in Nigeria. Factor 1 has, for example, the accessibility of the airport (79.4%), infrastructure (73.9%), flight operations (71.9%), flight frequency (61.8%), airport security (54.4%), and the airport location (4.56%) with factor loads greater than 0.400. These variables, considered a group, are named airport and airline services. It means that the characteristics of domestic airports and airlines alike will determine passenger traffic. The characteristics of an airport are taken into account about the accessibility of the airport, infrastructure provision, frequency of flights, and perceived level of security at the airport.

Factor 2 has five variables with high loadings. These are educational level (74.7%), occupation (71.3%), age 70.3%, population size with 46.4%, and work experience with 44.8%. These aggregated variables can be referred to as demographics. It implies that the level of education, type of employment, and the age of citizens near the domestic airport affect air travel, which previous studies confirm, as shown earlier.

The extracted factor 3 can be described as economic factors, with economic prosperity (85.5%) and passenger income (80.4%) having very high weights. Economic prosperity in this study refers to Nigeria's general economic well-being in terms of per-capita income and gross domestic product (GDP), ease of business growth, inflation rates, and other macroeconomic variables that measure a country's economic development. It is telling that the improved economic status of the citizens will increase the propensity for air travel within a country.

The final factor extracted from the study is airport size and facilities. Two variables, namely the airport size (82.2%) and the parking space (62.8%), load very high on factor 4. It justifies that the size of an airport determines the level of facilities to be provided for parking lots and other non-aviation-related services. It suggests that the type of facilities offered at a domestic airport to facilitate flights affects the volume of passenger traffic. This finding is also a contribution of this study to the literature.

The result in Table 10 shows that airport and airline services, demographics, economic factors, and airport facilities and structure are significant factors influencing passenger traffic at domestic airports in Nigeria.

Table 10: Rotated factor matrix of domestic air traffic in Nigeria

	Factor			
	1	2	3	4
Airport Accessibility	.794	.064	-.090	.167
Infrastructure Provision	.739	-.080	.017	.188
Airline Operations	.719	-.042	-.142	.054
Flight Frequency	.618	.047	-.267	.210
Airport Safety and Security	.544	.020	-.078	.015
Airport Location	.456	.316	.111	.299
Education Level	-.017	.747	.211	.200
Passenger Occupation	.087	.713	.020	.043
Age	.192	.703	-.021	.122
Population Size	-.085	.464	.320	.260
Work Experience	-.139	.448	-.011	-.031
Economic Prosperity	-.119	-.017	.855	-.042
Passenger Income	-.192	.160	.804	.028
Airport Size	.159	.179	.104	.822
Car Parking lots	.331	.060	-.147	.628

Extraction Method: Principal Axis Factoring.

Rotation Method: Varimax with Kaiser Normalization.

Source: SPSS Computation, 2021

The most important factors influencing the passenger traffic at a domestic airport in Nigeria are also relevant in other developing countries. Demographic factors are population distribution, measured by gender, race, marital status, age, education, occupational status, and family size, significantly affecting air traffic volume. These are variables with significant influence in previous studies. The economic factors include both macro and microeconomic variables. Macroeconomic variables found in previous studies that affect a country's domestic air travel include GDP, inflation rates, exchange rates, interest rates, foreign investment, income, etc. These variables strongly impact passenger traffic in every country because travel is not an end but a means to an end. The microeconomic variables most commonly used to describe the behavioural patterns of individuals and business units influence passenger traffic at domestic airports in any country.

It is noteworthy that two factors related to airport and airline characteristics are the main determinants of domestic air travel in Nigeria. These are airport and airline services and airport size and facilities. These factors comprise airport size, airport location, infrastructure and facilities, airport accessibility, airline operations, etc. It implies that airlines tend to operate at airports that offer more flexible aircraft handling with adequate facilities to ensure efficient operations. As a result, airports without adequate infrastructure and facilities tend to have lower aircraft traffic and a resulting reduction in passenger volume. The landside facilities also support airport quality of service to all users. The security and service delivery at airports, resulting from the level of equipment, are other important determinants of airport patronage by airlines and passengers.

This study further confirmed the Exploratory Factor Analysis (EFA) results by performing a Confirmatory Factor Analysis (CFA). The aim is to validate the measurement theory established by the EFA. The results of the CFA analysis, presented in Figure 3, show the model structure for the factors that determine domestic travel at airports in Nigeria. The Figure 3 shows that AAcc ($r = .780$) - airport accessibility, FFre ($r = .820$) - flight frequency and INFR ($r = .800$) - infrastructure are the main variables that make up the construct F1 - Airport and Airline Services. For construct F2 - Demographic characteristics, two variables, EL ($r = .990$) educational level and AGE ($r = .700$) age, are significant variables found to determine the demographic factors that influence passenger traffic at domestic airports in Nigeria. The third construct (F3 - Economic Factors) has two significant variables that make up the construct. PInc (Personal income) is the main determinant of the economic factors influencing passenger traffic at domestic airports in Nigeria. The fourth construct (F4 - Airport size and facilities) also has two significant variables that form the construct to show that airport size and facilities also influence passenger traffic at domestic airports in Nigeria. Table 9 shows the estimates of the model construct using the unobserved or latent variables, observed variables, and their correlation values to establish the relationship between the latent and observed variables.

The main impact of the CFA analysis compared to the EFA result in Table 10 is that not all the variables that weigh heavily on the extracted factors contribute significantly to the primary factors influencing domestic passenger traffic at airports in Nigeria. The variables were removed while building the CFA model. For example, the CFA has found that flight operations, airport security, and airport location do not significantly contribute to airport and airline services as a significant driver of passenger traffic at domestic airports in Nigeria. Likewise, the occupation, population size, and work experience did not significantly contribute to demographics influencing passenger traffic at domestic airports in Nigeria.

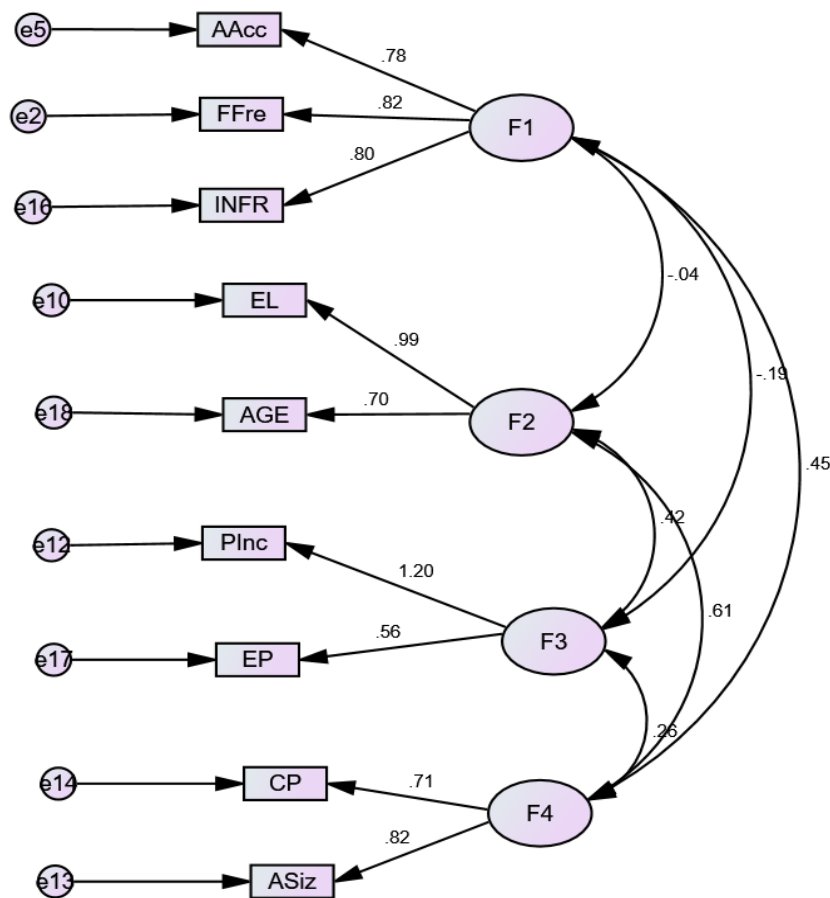
Indeed, it is logical that airports with good accessibility, high flight frequency, and adequate infrastructure will enhance flight operations, security, and ease of access despite the location of the airports. It implies that airport and airline services serve as a factor of domestic air traffic at airports due to the accessibility level of the airport, frequency of airlines flights, and adequacy of infrastructure provision for airport and airline operations. Also, the level of population, type of occupation, and years of work experience do not appear to form significant demographics that determine passenger traffic at domestic airports. However, the dominant age group and levels of education of citizens in a country determine the demographics influencing domestic air travel. Furthermore, personal income level determines the influence of economic factors on air travel demand. At the same time, the level of airport facilities at an airport is dependent on the size of the airport.

Table 11: Model Construct of factors influencing domestic air traffic

Latent Variables	Observed Variables	Correlation (r)
F1 - Airport and Airline Services	AAcc – Airport Accessibility	.780
	FFre – Flight Frequency	.820
	INFR – Infrastructure Provision	.800
F2 – Demographic Characteristics	EL - Educational Level	.990
	AGE – Age	.700
F3 - Economic Factors	PInc – Personal Income	1.200
	EP – Economic Prosperity	.560
F4 - Airport Size and Facilities	CP - Car Park space	.710
	ASiz – Airport Size	.820

Source: CFA using AMOS, 2021

Figure 3. Standardised estimates of the CFA Model of factors for domestic air travel at airports



Model Summary: CMIN/DF = 2.263 (< 5); CFI = 0.940 (> 0.90); GFI = 0.929 (> 0.90); NFI = 0.901 (> 0.90); RMSEA = 0.078 (< 0.080)

Factors Name: F1- (Airport and Airline Services); F2 - (Demographic Characteristics); F3 - (Economic Factors); F4 - (Airport Size and Facilities)

Source: AMOS Computation, 2021

The CFA's model fit indices show the second-order variables that influence domestic air traffic at airports in Nigeria. The indices validate the results of the exploratory factor analysis. The result of the indices has the relative chi-square (CMIN / DF) = 2.263, which is less than 5, the comparative adjustment index (CFI) = 0.940, the quality of adjustment index (GFI) = 0.929, normed fit index (NFI) = 0.901 and the root mean square approximation (RMSEA) = 0.078. The values of the fit indices agree with the recommended values of various authors. Bentler (1990) recommended using a relative chi-square less than 5 when the sample size exceeds 200 to test model fit. Chau (1997), Hatcher (1994), and Bentler

and Bonnet (1980) recommended 0.90 and above as a value suitable for GFI, CFI, and NFI, respectively. Byrne (2001) recommended a value less than 0.08 for RMSEA.

The CFA results presented in this study are within the recommended values. It implies that CFA validates the results of the EFA to determine that airport and airline services, demographics, economic factors, and airport size and facilities are the key factors influencing passenger traffic at domestic airports in Nigeria. It can be deduced from this that domestic air passengers consider the level of service satisfaction they receive from the airport and the airlines regarding the airport size and facilities. It underscores the importance of airline and airport characteristics as determinants of domestic air traffic in any country.

6. Policy implications and conclusion

Fluctuations characterise passenger traffic at domestic airports over time. The persistent volatility reflects in the passenger traffic at airports, which needs to be adequately studied for an appropriate policy decision. From this study, the government's economic policy should emerge from creating a sustainable environment to improve citizens' financial status. It should be done through strategic business opportunities and a targeted poverty reduction program that encourages domestic air travel. There is also a need on the part of the government to promote policies that involve the country's young population, who tend to travel frequently for productive activities. Airport managers must pay appropriate attention to the strategic location and size with adequate facilities and infrastructure arrangements. It should be done to provide easy access to airports and non-aeronautical services to increase passenger satisfaction. The provision of infrastructure at domestic airports should also enhance airline flights. The recommendations aim to guarantee a gradual and predictable increase in traffic for easy planning. For airlines, attention must be paid to improving the quality of service. A major recommendation from this study is that researchers should consider quantitative modelling of airport and airline characteristics in air travel demand analysis.

In summary, this study explored the factors influencing passenger traffic at domestic airports at airports in Nigeria to identify airport and airline characteristics as determinants of airport traffic. Fifteen (15) extraneous factors were selected and subjected to factor analysis which reduced them to only four (4) to serve as important factors influencing domestic air travel in Nigeria. These four factors are airport and airline services, economic factors, demographic factors, and airport size and facilities. A CFA model fit test validated the factors. Therefore, it is clear that the main factors in this paper may influence the air travel traffic at airports of other nations. It requires proactive action from airport managers to encourage predictable passenger traffic at domestic airports.

7. Limitations and suggestions for further study

This study is limited to factors affecting domestic air passenger traffic in Nigeria. Future studies should include airport characteristics and airlines in quantitative modelling of air travel demand factors.

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Conflicts of interest/Competing interests

The authors declare no conflict of interest arising from the study.

Authors' contribution

Adenigbo – supervision, data collection and analysis, discussion of results, and revision
Ofunwengbe – conceptualisation, literature review, data collection, and report writing
Kanyio – literature, data collection, and report writing

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