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INVESTIGATING THE AIR TRAVEL-TOURISM RELATIONSHIP USING GRANGER CAUSALITY ANALYSIS: THE CASE OF TURKISH DESTINATIONS

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Abstract:

One of the main benefits of air transport is that it allows people to travel quickly from one place to another. This allows people to reach their destinations faster than other modes of transport for purposes such as tourism, business and education. The aim of this study is to investigate the causality relationships between air travel and tourism demand by each market segment. The causality relationship between the number of domestic passengers, international passengers and total number of passengers and the number of domestic tourists, international tourists and total number of tourists is analyzed on a monthly basis for the period 2017-2021 in Turkey with Granger causality analysis. The findings revealed a two-way causal relationship between the number of domestic travelers and the demand for domestic tourism, as well as a two-way relationship between the demand for total travelers and the demand for total tourism. There is a unidirectional causal connection between the demand for inbound tourists and the quantity of international travelers. The research is expected to add to the body of work on the outcomes. It will also have implications for those who make decisions about infrastructure and policy.

Key words: *airline, tourism, granger, causality, demand.*

1. Introduction

A destination's economy, especially the tourist industry, is significantly impacted by air travel, and the opposite is also true (Henderson, 2009; Lian and Denstadli, 2010). In other words, relatively few individuals travel just to fly; the majority of people fly to get somewhere and accomplish something. This implies that activities that are spatially fixed, such as pleasure, business, visiting friends and relatives (VFR), etc., have a significant role in the demand for air travel (Papatheodorou, 2021). Tourism and air travel are intimately intertwined and intricately interwoven (Duval, 2013), and their mutually beneficial relationship cannot be overemphasized (Debbage 1997; Forsyth, 2006; 2010; Bieger and Wittmer 2006). Both are extremely cyclical and highly responsive to shifting social, political, and economic circumstances (Papatheodorou, 2021).

Since the 1960s, technological advances in air transport (i.e. the rise of jet aircraft) and market developments (i.e. deregulation) have been largely responsible for the emergence of mass leisure and business travel (Papatheodorou, 2002). Tourism also

stimulated the growth of charter airlines (Bieger & Wittmer, 2006). At the same time, the introduction of charter airlines into the transport sector made air travel cheaper, creating mass tourism, and air travel brought the world closer together by shortening distances. With the development of regional aviation, local economies far from trade and tourism centers also had the opportunity to become a part of the global world (Sarılgan, 2011, p. 74). So many developing nations have looked to tourism as a potential alternate source of prosperity. The supply of aviation, local transportation, and hotel infrastructure for the global tourism sector has received the majority of funding. These supply-side changes are a result of the rising demand for "long-haul" travel. This has been driven by improvements in air transport technology and the accessibility of destinations in developing countries (Sinclair, 1998, p. 1). In 1970, when Pan Am began flying with the first Boeing 747 between New York and London route, 310 million passengers were carried by air. 25 years later, in 1995, this figure reached 1.3 billion (Worldbank, 2023).

When comparing the pre-pandemic period to 2018, it can be seen that more over half (58%) of foreign tourists traveled by flight. Air transport is also known to support 19.6 million direct and 44.8 million indirect jobs in tourism. The Air Transport Action Group (ATAG) states that tourism accounts for $1 trillion of the $3.5 trillion total economic benefit of air transport (ATAG, 2020, p. 10). The last COVID-19 outbreak is another element that emphasizes the connection between tourism and aviation. The tourist industry was significantly harmed by the COVID-related air travel disruption. There were 26.4 million fewer employments created as a result of the $630 billion reduction in GDP gain from air-related tourism. According to analyses, the outbreak may result in a loss of 850 million to 1.1 billion foreign travelers and $910 billion to $1.2 trillion in lost tourism export revenue (ATAG, 2020, p. 5).

Commercial air travel, which includes both scheduled and charter flights, is a crucial factor in determining regional and worldwide tourist flows, yet it is still a relatively new field of study for tourism geographies (Duval, 2013, p. 494). Studies examining the relationship between air transport and tourism have been identified in a review of the literature. In these studies, the effects of airline strategic alliances on tourism (Morley, 2003), the relationship between leisure travel and airline business model (Papatheodorou and Lei, 2006), the environmental impacts (carbon footprint, etc.) of passengers travelling by airline for tourism (Peeters and Schouten, 2006; Dickinson, et al, 2010), whether low-cost airlines can contribute to cultural heritage tourism (Smith, 2009) and coastal tourism (Whyte and Prideaux, 2008), the impact of economic regulations in air transport on tourism (Warnock-Smith and Morrell, 2008; Dobruszkes and Mondou, 2013), the importance of hub airports on tourism (Costa et al, 2010), the effects of airline strategies on tourism destination decisions (Liasidou, 2013), causality relationships between air transport and tourism (İlban and Güngör, 2020; Tsui et al., 2021), and causality between air transport, tourism and economic growth (Kılıç and Aslan, 2021; Law et al., 2022). Nevertheless, a review of the research reveals that the study of the connection between airlines and tourism is done at a macro level and ignores segments. It is recommended that the connections between domestic air travel and tourism, international air travel and the demand for inbound tourism be examined individually. It is highlighted that the body of literature on this issue is lacking in this situation. The direction of the relationship between

air travel and the demand for tourism in Turkey is therefore expected to be clarified by this study, which will also add to the body of knowledge in this area.

The remaining portion of this study, which analyzes the connection between air travel and tourism demand in Turkey, is organized as follows. The literature review is presented in section 2, the methodology and dataset are shown in section 3, the empirical findings are presented in section 4, and the study outcomes are presented in the last part.

2. Literature review

There are many studies in the literature that examine the relationship between air transport and tourism in different contexts. Some of them are the following:

In analyzing how international airline alliances affect tourism, Morley (2003) discovered some economic evidence suggesting lower ticket costs are a result of airline alliances. At the same time, it was discovered that partnerships between airlines that had previously competed on a route reduced competition, resulting in fewer flights and higher rates. In the form of reduced prices, faster connections, and shorter overall travel times, airline partnerships support tourism. Papatheodorou and Lei (2006) looked at how regional airports were affected by the airline business model. The results show that leisure and VFR passengers have a wider choice and can travel at lower fares than in the past thanks to low-cost carriers. It shows that regional airports play an important role in the development of tourism, but that airlines with business models other than LCC also contribute to the development of these airports. Peeters and Schouten (2006), in their study on reducing the ecological footprint of tourism and transport in the context of Amsterdam, found that long-haul tourism contributes 25% of all revenues, but its environmental impact is 70% of all options. It is emphasized that flying is a major driver in achieving this. In order to solve this problem, it is suggested to increase the tourist market coming to the city with short distance transport options.

Smith (2009) analyzed the effect of LCCs on heritage tourism development in Malta. The results show that LCCs helped to generate more arrivals to Malta in 2007. However, LCC travelers are still primarily motivated by climate rather than history and culture. Warnock-Smith and Morrell (2008) examine the economic regulation of air travel and the growth of air travel in economies that depend on tourism. The study found that air transport liberalization led to traffic increase coefficients ranging from 2.55% to 3.02% in the context of the US-Caribbean markets. It concludes that Caribbean countries wishing to develop tourism can do so by liberalizing air transport markets Whyte and Prideaux (2008) examined the impact of LCCs on regional tourism. They find that as airfares fall, consumers switch from private cars, intercity buses and railways to air travel. The impact of transit modes is illustrated by analyzing the impact of low schedule airlines on Cairns, a major coastal destination in northeastern Australia.

Liasidou (2013) examined how airline strategies affect travelers' preferences for travel destinations. Three basic kinds of tourists were found using a two-stage clustering analysis: "traditional," "demand/opportunistic," and "undecided." By examining how changes in airline industry strategies affect the tourism industry and its related consumption patterns and decision-making processes, the research emphasizes the

dynamic link between the two sectors. According to Dobruszkes and Mondou (2013), there have been observable changes in both air transportation services and leisure travel as a result of the liberalization of the air transport market between the EU and Morocco. Their findings indicate a significant rise in foreign leisure travel to Morocco, however the connection to the deregulation of air travel is less certain. Despite a sharp fall in the number of package holidays marketed by tour operators, air travel's market share grew. The growth has been especially pronounced among Moroccan expatriates, which is a sign that new long-distance travel habits are starting to form. Pisa (2018) used Granger causality and Johansen cointegration tests to investigate the link between air transport, tourism, and economic growth in South Africa between 1995 and 2015. Cointegration and causality studies revealed no evidence of causation or long-run correlations between GDP and tourism factors. However, the VAR model revealed that GDP explains part of the variation in tourism spending and tourism earnings.

Tsui et al. (2021) look at the relationship between scheduled airline capacity and tourist arrivals, which is an important link between the aviation industry and tourism development in Hong Kong. The findings make it very clear that there is a symbiotic relationship between scheduled airline capacity and incoming tourism. Law et al. (2022) examined the relationship between the growing use of air transportation, the expansion of the economy, and inbound tourism in South East Asian countries. They discovered a bidirectional causal link between passenger traffic and long-term economic growth. Although there is no apparent link between the two in the short term, inbound tourism has a considerable influence on the demand for air travel over the long term. Deregulation of air travel has had a beneficial and major impact on Cambodia in particular, although Myanmar needs more reforms. Noshab-Hussain (2023) used principal component analysis, fully modified ordinary least squares regression, and Granger causality analysis to investigate the influence of air transport, rail transport, and trade openness on incoming and outbound tourism in 140 BRI nations between 1996 and 2020. The findings revealed that air and rail transportation, as well as trade openness, had a long-term favorable impact on inbound and outgoing tourism. The Granger causality test demonstrated a bidirectional association between incoming tourism and air, rail, and travel services, as well as trade openness. Inbound tourism and transportation services, on the other hand, have a one-way interaction. Outbound tourism is linked to air transport, rail transport, travel services, transportation services, and trade openness in both directions.

Studies have been carried out to identify the relationship between airlines and tourism in the context of Turkey. İlban and Güngör (2020) analysed the impact of Milas-Bodrum and Balıkesir Koca Seyit airports on regional tourism demand. The study found a positive relationship between tourism demand and air transport systems. Kılıç and Aslan (2021) examined causality between aviation and tourism in Mediterranean countries. They found a significant relationship between passenger transport and tourism, with air passenger traffic having a positive impact on total tourist arrivals, tourism receipts and gross national product. An evaluation of the research shows that the relationships between tourism and air travel demand are realized at the macro level in different contexts. Unlike the previous studies, this study analyses the causality between tourism and air travel

demand at the micro level. Table 1 provides a summary of the focus of the studies and the methods used.

Table 1. Summary of related studies

Authors	Focus	Methodology
Morley (2003)	Airline alliances and tourism	Literature review
Papatheodorou and Lei (2006)	Linkage between regional airports and leisure travel in Great Britain	Panel regression
Peeters and Schouten (2006)	Inbound Tourism, ecological footprint and transportation in Amsterdam	Ecological footprint analysis
Smith (2009)	LCC effect on heritage tourism in Malta	Passenger survey
Warnock-Smith and Morrell (2008)	Regulation, air travel and tourism relationship in US-Caribbean markets	Regression analysis
Whyte and Prideaux (2008)	LCC and regional tourism linkage in Australia	Document examination
Liasidou (2013)	Impact of airline strategies on tourists' destination preferences	Cluster analysis
Dobruszkes and Mondou (2013)	Liberalization and international tourism relationship in EU-Morocco	Document examination
Giap (2016)	Examination of the factors driving international tourism in Malaysia	Geweke Causality Analysis
Küçükönal and Sedefoğlu (2017)	Causality between air Transport and socio-economic factors in OECD countries	Pesaran CDLM test and Friedman's test
Koo et al. (2017)	Direct air services and tourism demand in Australia	Panel data analysis
Pisa (2018)	Air transport, tourism and economic growth causality in South Africa	Joinpoint regression and Granger causality analysis
Tsui et al (2021)	Aviation and tourism growth in Hong Kong	Cointegration test
Madurapperuma (2020)	Interaction between air transportation, tourism and economic growth in Sri Lanka	Cointegration and causality analysis
İlban and Güngör (2020)	Impacts of Balıkesir Edremit and Milas-Bodrum airports on regional tourism	Zivot and Andrews test
Kılıç and Aslan (2021)	Aviation and tourism causality in Mediterranean countries	Granger causality and Regression
Fernandes et al. (2021)	Impact of air transportation on employment for tourism in Brazil	Granger causality
Law et al. (2022)	Air transport, economic growth and inbound tourism causality in South East Asia	ARDL Model
Noshab-Hussain (2023)	Effects of air and railway transportation on tourism in BRI countries	Principle Component Analysis, FMOLS, and DCCE tests

3. Methodology

Granger causality analysis was utilized in this study to determine the direction of the causal link between the quantity of airline passengers and the quantity of visitors. In several academic subjects, the Granger causality test is frequently employed in

empirical studies. It is defined as if the past of a random variable X is a stronger predictor of the future of another random variable Y, then variable X is the Granger cause of variable Y (Seth, 2007; Atukeren, 2011, pp. 137-138).

In a pioneering paper, Granger (1969) developed a methodology for analyzing causal relationships between time series. Suppose that x_t and y_t are two stationary series. It is tested with the following equation in order to reveal the existence of a relationship between the variables that are questioned whether there is a relationship between them and to determine the direction of the relationship in case of existence of a relationship (Lopez and Weber, 2017, p. 973). The model:

$$y_t = \alpha + \sum_{k=1}^{K} \gamma_k y_{t-k} + \sum_{k=1}^{K} \beta_k x_{t-k} + \varepsilon_t \qquad \text{with } t = 1, \ldots, T \qquad (1)$$

can then be used to test whether x is the cause of y. In essence, x influences y causally if the previous values of x are significant predictors of the current value of y, even after the past values of y have been taken into account in the model. It would be easy to perform an F-test using the following null hypothesis with the aid of equation (2):

$$H_0: \beta 1 = \cdots = \beta K = 0 \qquad (2)$$

It can be concluded that there is causation from x to y if, if H_0 is rejected. In order to test for causation in the opposite direction, the variables x and y can be switched. Bidirectional causality can also be seen (Lopez and Weber, 2017, p. 973).

When applying the Granger causality test, the stationarity condition of the variables is sought. Non-stationary series should be differenced to ensure the stationarity condition (Freeman, 1983, p. 330). In addition, the Granger causality test is very sensitive to the number of lags. Because of its sensitivity to the number of lags, it is important to determine the appropriate number of lags to obtain the correct result (Thornton and Batten, 1985, p. 166). Vector Autoregression Estimation - VAR models were used to determine the appropriate lag coefficients.

In this study, the number of domestic, international and total passengers transported by airlines, which are used as parameters for demand in Turkey in many studies, and the number of domestic tourists, foreign tourists and total tourists, which indicate tourism demand, are used as research variables. In this context, the number of passengers and tourists were included in the analysis for the 58-month period between 2017-2021. Some months within the 5-year period were not included in the analysis due to the lack of flights and border closures during the pandemic period. 34 units (airport-city) were included in the analysis to examine the relationship between domestic flights and domestic tourist demand, 27 units were included in the analysis to examine the causality between international flights and foreign tourist demand, and 36 units (airport-city) were included in the analysis to examine the relationship between total airline demand and tourism.

Among the variables included in the analysis, the number of domestic passengers is shown as "DPAX", the number of international passengers as "IPAX", the total number of passengers as "TPAX", the number of domestic tourists as

"DTOUR", the number of international tourists as "FTOUR" and the total number of tourists as "TTOUR". To ensure normalization, the logarithms of all variables have been taken and the variables are denoted in the analyses as 'LDPAX, LIPAX, LTPAX, LDTOUR, LFTOUR, LTTOUR'. The statistics from the General Directorate of the State Airports Authority were used to compile the information on passengers (DHMİ, 2023), while the statistics from the Ministry of Culture and Tourism's website were used to compile the information on tourists (KTB, 2023).

The investigation started by looking at the variables' descriptive statistics before looking at the correlation matrix to check for any potential issues with high multicollinearity. Unit root tests were run following these tests. The findings of the unit root test were used to determine the maximum degree of integration. The ideal number of lags for the VAR model was determined in the second phase using information criteria and descriptive tests, and the causality between variables was examined. The Granger causality test was then used to determine whether the variables were causally related.

4. Findings

In this study, which analyses the relationship between air transport and tourism demand, descriptive statistics are first presented. In this context, numerical values related to the number of air passengers and tourists are given in Figure 1.

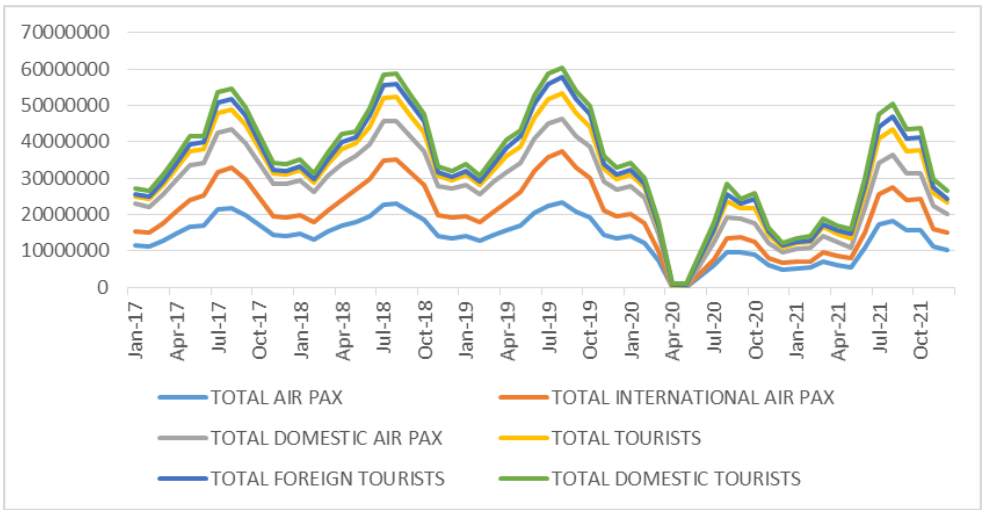

Figure 1. Air passenger and tourist numbers

Source: DHMİ, 2023

As can be seen in the graph above, the trends in the number of air passengers and tourists are similar. Demand in both areas is seasonal and both were negatively affected by the Covid-19 period, with declines observed during this period. Looking at the number of airline passengers and tourists on a monthly basis, it can be seen that there is a large increase in the summer months and a gradual decrease towards the winter period.

Although there is a recovery towards the summer months during the Covid-19 period, it can be seen that the pre-pandemic period has not yet been reached. The remainder of the study presents findings related to causality. In this context, descriptive statistics for the variables are first presented in Table 2.

Table 2. Descriptive Statistics

	LDPAX	LDTOUR	LFTOUR	LIPAX	LTPAX	LTTOUR
Mean	4.58068	4.30071	3.41044	3.36353	4.57522	4.43450
Median	4.75888	4.30080	3.24870	3.58972	4.73028	4.37302
Maximum	6.60486	5.83807	6.38851	6.82601	7.00840	6.45436
Minimum	0.00000	0.00000	0.00000	0.00000	0.00000	2.83219
Std. Dev.	1 .14314	0.640018	1.05556	1.70865	1.17793	0.56997
Skewness	-2.15594	-2.47337	0.527828	-0.53349	-1.66160	0.85580
Kurtosis	9.734431	9.78924	3.279804	3.021151	8.258982	.232569
Jarque-Bera	5254.143	25171.67	77.82361	74.31481	3366.951	387.0634
Probability	0 .00000	0.00000	0.00000	0.00000	0.000000	0.000000
Sum	9033.116	481.003	5340.763	5267.298	9553.077	9259.253
Sum Sq. Dev	2575.47	807.3680	1743.75	4569.044	2895.77	677.9971
Observations	1972	1972	1566	1566	2088	2088

The values of the variables' skewness and kurtosis are also displayed in Table 2, together with the variables' means, standard deviations, maximum and lowest values. It can be seen that the mean values are between 3.36-4.58 and the standard deviation values vary between 0.56 and 1.70. While the minimum value for all variables is 0, the maximum value is between 5.83-7. Table 3 then displays the correlation matrix after the descriptive statistics.

Table 3. Correlation Matrix

	LDPAX	LDTOUR	LFTOUR	LIPAX	LTPAX	LTTOUR
LDPAX	1	0.6186	0.3588	0.2585	0.5232	0.4806
LDTOUR	0.6186	1	0.1913	0.0710	0.5861	0.7339
LFTOUR	0.3588	0.1913	1	0.6723	0.1632	0.1342
LIPAX	0.2585	0.0710	0.6723	1	0.1738	0.1436
LTPAX	0.5232	0.5861	0.1632	0.1738	1	0.6502
LTTOUR	0.4806	0.7339	0.1342	0.1436	0.6502	1

According to the information in Table 3, it can be seen that the correlation values between the variables are between 0.07 and 0.73. It is stated that when the correlation values between variables are high, it leads to the problem of multicollinearity (Alin, 2010, p. 370). When the values between the variables were analyzed, no relationship was observed that would lead to this problem. Following the presentation of the correlation matrix, the results of the unit root tests, which test the stationarity of the series, are presented.

The concept of stationarity implies that the mean, variance and autocovariance of a series do not change over time. It is important for the series to be stationary in order to avoid

spurious relationships between the series and to prevent the effect of a shock from becoming permanent (Akgeyik et al., 2006).

Different tests can be used for stationarity research. The most basic are the Dickey-Fuller and Augmented Dickey-Fuller Test (1979, 1981). In the Augmented Dickey-Fuller Test, the equation to be estimated is as follows:

$$\Delta Y_t = \beta_1 + \beta_2 t + \delta Y_{t-1} + \sum_{i=1}^{m} \alpha_i \Delta Y_{t-i} + \varepsilon_t \quad (3)$$

The null hypothesis stating that the series has a unit root in Equation 4:

$$H_0: \delta = 0 \quad (4)$$

If the null hypothesis is accepted, the difference is taken to stationaries the series; if it is rejected, the series is trend stationary. The Phillips-Perron (1988) test is another widely used test that does not consider structural breaks. Although its functioning is the same as the ADF test, the lag structure of the dependent variable, which is added to the right-hand side of the equation to eliminate the autocorrelation problem, is determined by the Newey-West (1987) estimator. In this context, Table 4 presents the results of unit root tests for series stationarity.

Table 4. Unit Root Results for Variables

Variables	Model	ADF – Fisher Chi-square		ADF - Choi Z-stat		PP – Fisher Chi-square		PP - Choi Z-stat	
		Stat.	Prob.	Stat.	Prob.	Stat.	Prob.	Stat.	Prob.
LDPAX	Constant	496.741	0.000	-17.819	0.000	405.385	0.000	-15.63	0.000
	Constant and Trend	449.808	0.000	-16.764	0.000	321.118	0.000	-13.10	0.000
LDTOUR	Constant	466.092	0.000	-17.22	0.000	310.457	0.000	-12.99	0.000
	Constant and Trend	378.914	0.000	-14.990	0.000	220.217	0.000	-9.883	0.000
LIPAX	Constant	316.548	0.000	-13.385	0.000	285.855	0.000	-12.55	0.000
	Constant and Trend	297.040	0.000	-12.603	0.000	259.188	0.000	-11.34	0.000
LFTOUR	Constant	243.831	0.000	-11.268	0.000	185.953	0.000	-9.503	0.000
	Constant and Trend	198.339	0.000	-9.5997	0.000	126.995	0.000	-6.636	0.000
LTPAX	Constant	420.033	0.000	-15.420	0.000	385.686	0.000	-14.79	0.000
	Constant and Trend	437.842	0.000	-16.382	0.000	307.649	0.000	-12.54	0.000
LTTOUR	Constant	382.124	0.000	-14.541	0.000	302.460	0.000	-12.82	0.000
	Constant and Trend	316.926	0.000	-12.504	0.000	210.659	0.000	-9.415	0.000

The ADF (Augmented Dickey Fuller) and PP (Philips-Peron) unit root tests in Dickey and Fuller (1979, 1981) and Philips and Perron (1988) studies determine the stationarity levels of the series used in the analysis, and lag lengths are established in accordance with the automatic selection criterion in Eviews 9 version. According to the unit

root test results, all variables are found to be stationary at level (I(0)). Following the stationarity tests, Vector Autoregression Estimates - VAR models were used to determine the lag lengths of the series. The appropriate lag length was determined according to LR (sequential modified LR test statistic), FPE (Final prediction error), ACI (Akaike information criterion), SC (Schwarz information criterion) and HQ (Hannan-Quinn) information criteria. Table 5 presents VAR results for DPAX and DTOUR variables, Table 6 for IPAX and FTOUR variables and Table 7 for TPAX and TTOUR variables.

Table 5. Domestic Tourists and Air Passengers VAR Results

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-4232.312	NA	0.499468	4.981543	4.987941	4.983912
1	-1422.206	5610.293	0.018398	1.680243	1.699437	1.687348
2	-1391.098	62.03447	0.017821	1.648350	1.680341	1.660193
3	-1272.179	236.8573	0.015567	1.513152	1.557939	1.529732
4	-1270.535	3.270109	0.015610	1.515924	1.573507	1.537241
5	-1241.401	57.89146	0.015155	1.486354	1.556733	1.512409
6	-1225.610	31.34123	0.014947	1.472482	1.555657*	1.503274*
7	-1221.296	8.552560	0.014941	1.472112	1.568084	1.507641
8	-1216.029	10.42849*	0.014919*	1.470622*	1.579390	1.510888

N: 1700
* identifies the lag order chosen by the criterion.

Table 5 provides information on the determination of the appropriate lag length of the VAR model constructed to reveal the causality relationship between domestic tourism demand and airline domestic passenger demand. LR, FPE, AIC, SC and HQ criteria were used to determine the appropriate lag length. According to LR, FPE and AIC criteria, the lag length is 8 and according to SC and HQ criteria it is 6. As a result of VAR models, the appropriate lag length was determined as 8.

Table 6. Foreign Tourists and International Air Passengers VAR Results

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-4255.858	NA	1.881716	6.307938	6.315653	6.310827
1	-2309.902	3883.263	0.105950	3.430967	3.454113	3.439635
2	-2289.442	40.76853	0.103398	3.406581	3.445158	3.421028
3	-2259.141	60.28796	0.099446	3.367617	3.421624	3.387843
4	-2246.313	25.48593	0.098154	3.354538	3.423976	3.380542
5	-2222.044	48.14234	0.095251	3.324510	3.409378*	3.356293
6	-2213.177	17.56245	0.094566	3.317300	3.417599	3.354862
7	-2206.776	12.66122	0.094231	3.313742	3.429472	3.357083
8	-2179.669	53.52977*	0.091060*	3.279510*	3.410671	3.328630*

N: 1350
* identifies the lag order chosen by the criterion.

Table 6 provides information on the determination of the appropriate lag length of the VAR model constructed to reveal the causality relationship between foreign tourism demand and airline international passenger demand. LR, FPE, AIC, SC and HQ criteria

were used to determine the appropriate lag length. According to LR, FPE, AIC and HQ criteria, the lag length is 8 and according to SC criterion it is 5. As a result of VAR models, the appropriate lag length was determined as 8.

Table 7. Total Tourists and Total Air Passengers VAR Results

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-4022.126	NA	0.299841	4.471251	4.477357	4.473505
1	-1092.611	5849.264	0.011619	1.220679	1.238998	1.227441
2	-1015.101	154.5898	0.010708	1.139001	1.169532	1.150271
3	-883.2574	262.6622	0.009290	0.996953	1.039696	1.012731
4	-879.3519	7.771786	0.009291	0.997058	1.052013	1.017344
5	-830.7763	96.55767	0.008842	0.947529	1.014697	0.972323
6	-808.4871	44.25644	0.008664	0.927208	1.006588	0.956510
7	-795.9537	24.85784	0.008583	0.917726	1.009319	0.951537
8	-771.5224	48.40102*	0.008390*	0.895025*	0.998830*	0.933343*

N: 1800
* identifies the lag order chosen by the criterion.

Table 7 provides information on the determination of the appropriate lag length of the VAR model constructed to reveal the causality relationship between total tourism demand and airline passenger demand. The results of the analysis show that all criteria give the lag length as 8. Accordingly, the appropriate lag length was determined as 8. After the appropriate lag lengths are given, the findings of VAR Granger Causality analyses are presented in Table 8.

Table 8. VAR Granger Causality/Block Exogeneity Wald Tests

Causality	*df*	$\chi 2$ Stat	Prob.	Decision
LDPAX → LDTOUR	8	83.61086	0.0000	H_0 Rejected
LDTOUR → LDPAX	8	84.96387	0.0000	H_0 Rejected
LIPAX → LFTOUR	8	5.511977	0.7017	H_0 Accepted
LFTOUR → LIPAX	8	82.95807	0.0000	H_0 Rejected
LTPAX → LTTOUR	8	50.57761	0.0000	H_0 Rejected
LTTOUR → LTPAX	8	248.6028	0.0000	H_0 Rejected

In Table 8, the main hypothesis of Granger causality tests is that there is no causality (Wang and Li, 2012). Here, the acceptance or rejection of the H_0 hypothesis is determined by looking at the probability value. If the probability value is less than 0.05, H_0 will be rejected and the alternative hypothesis will be accepted and it will be understood that there is a Granger causality relationship between the variables. Table 8 shows that H_0 is rejected in all tests except LIPAX → LFTOUR. Wald test results indicate that there is a bidirectional causality between the LDPAX variable and the LDTOUR variable, and a bidirectional causality between the LTPAX variable and the LTTOUR variable. In addition, a unidirectional causality was found from the LFTOUR variable to the IPAX variable. There is no causality from the LIPAX variable to the LFTOUR variable.

According to the research, there is a two-way causality between domestic air travel demand and tourism. In other words, an increase or decrease in both air transport

demand and tourism affects the other. Looking at the dynamics of domestic air traffic in Turkey, there are several reasons for this situation. First of all, our country has a relatively wide geography with a length of approximately 1650 km in the east-west direction. In this context, air transport is one of the most important means of connecting the eastern provinces with the western provinces. In addition, many of the eastern and south-eastern provinces play an important role in domestic tourism. Cultural heritage, food, history and natural beauty all play an important role.

A unidirectional causality is observed between international passenger transport and inbound tourism. This can be attributed to the fact that airlines transport passengers from other countries to other (third) countries using their own hubs as part of their hub and spoke strategies, and this situation has no effect on tourism. When analyzing airlines and tourism as a whole, there is also a bi-directional causality.

5. Discussion

The research results show bidirectional causality between air transport and tourism. In this context, bidirectional causality was found between domestic passenger demand and domestic tourism, and between total tourism demand and total airline demand. Only a unidirectional relationship was found between international passenger demand and foreign tourism demand, and a unidirectional causality was observed from tourism demand to airline demand. The results are in line with previous studies. In Kılıç and Aslan's (2021) study, a bidirectional causality relationship was observed between tourism and air transport in the context of Mediterranean countries. On the other hand, similar limited results were obtained in İlban and Güngör's (2020) study. İlban and Güngör evaluated the relationship between air transport and tourism on a regional basis, using two important regions on the Marmara and Aegean coasts, which are important for tourism, as cases. Together with this research, all studies conducted in the context of Turkey show that there is a relationship between air transport and tourism. Turkey is a country surrounded by the sea on three sides and tourism has an important place in the distribution of income sources. In this context, it is important to empirically establish the causality with tourism, which is the main catalyst of air transport.

The research findings are also consistent with studies conducted in different contexts. Warnock-Smith and Morrell (2008) in the US-Bahamas market context and Dobruszkes and Mondou (2013) in the EU-Morocco market context concluded that the liberalisation of airline markets strengthens tourism potential. Eugenio-Martin and Inchausti-Sintes (2016) found that there is a relationship between tourism and low-cost travel, and that tourists can spend more in holiday destinations when travelling with LCCs. Koo et al. (2017) found that direct airline access stimulates tourism flows. On the other hand, Tsui et al. (2021) found a bidirectional causality between the number of inbound tourists and scheduled flight capacity in the context of Hong Kong. Among studies conducted in similar geographical contexts, Law et al. (2022) found that the number of tourist arrivals in the South Asian countries of Vietnam, Cambodia, Laos and Myanmar had a significant impact on air transport demand in the long run, but there was no significant

relationship between the two in the short run. This consistency across studies in different contexts suggests that the causality between tourism and air transport is quite strong.

6. Conclusions and Implications

Airline transport is one of the fastest options where relocation service is provided. With the development of technology, the production of aircraft with safer and technically better features than in the past is one of the most important factors that make this mode of transport the fastest option. In this way, people can reach the places they wish more comfortably. People who can reach their desired destinations faster than in the past have started to prefer airline transport for their holidays. With the effect of liberalization, airlines offering air transport services have started to organize more frequent flights to holiday regions, which has started to increase tourism mobility in the region.

The goal of this study is to conduct a rigorous analysis of the relationship between Turkey's tourism sector and the demand for all types of air travel, including domestic, international, and international. Even if there are studies in the literature that analyze the link between the two factors, this study nevertheless adds to the body of knowledge because the relationship between the two variables is not segmented. Although there are differing opinions on what causes this link, theoretically it is obvious that there is a connection between the demand for air travel and tourism. In this study, the relationship between domestic, international and total air travel demand and tourism is analyzed by Granger (1969) causality analysis. The study's findings indicate that there is both a one-way and a two-way causal link between these factors. In general, the increase in air transport contributes to tourism and the increase in tourism contributes to air transport. It is anticipated that the rise in domestic aviation passenger demand would boost domestic tourism. Similarly, an increase in total air travel demand is expected to increase tourism demand. The opposite is also expected. However, the causality between international flights and outbound tourism demand is unidirectional. While tourism is the cause of the increase in international passenger demand, the reverse is not observed. The results of the study are consistent with previous research and contribute to the literature with the segmentation of the airline-tourism demand relationship.

Tourism and air transport are closely linked. The availability of flights to remote destinations makes them accessible and supports the commercial, economic and social development of the region in today's world where borders are gradually disappearing. Tourism also benefits from this development. In some cases, the tourism potential of the region attracts airlines, and airlines that want to meet the potential demand in the region, based on the analyses made, enter these markets to the extent permitted by the regulations. At this point, there is a mutual benefit between airlines and tourism.

Considering that air transport stimulates tourism demand in the region, national and regional policy makers should give due importance to air transport in order to revitalize regional tourism. Creating airport infrastructure that can accommodate all types of aircraft, liberalizing economic regulations and allowing airlines to enter these markets more easily are the first steps to be taken. In addition, regional promotion through more effective channels will stimulate the demand for tourism, which in turn will increase the demand for air transport, in line with the reality of mutual benefit.

In future studies, more comprehensive research can be carried out with a larger data set and longitudinal studies. Cointegration analyses can be made to see the long-run relationship between variables. Adding different variables to the relationship between air transport and tourism will contribute to the literature. In addition to different causality analyses, panel regressions or time series analyses can also be conducted and the results on the direction and magnitude of the effect can be presented comparatively.

One of the major issues today is the threat to the environment. Aviation stands out among other modes of transport in terms of its carbon footprint. In this context, it is believed that in the future, politicians and decision-makers will face increasing pressure in terms of carbon emissions and will be faced with the dilemma between economy and environment. Tourism is an important resource, especially for underdeveloped or developing countries. The loss of this resource means a decrease in the inflow of money into the country and economic problems. On the other hand, the pressure from environmental groups and public opinion on the environmental impact of air transport will create the dilemma just mentioned. For this reason, decision-makers should take steps to reduce the environmental impact of air transport as soon as possible and be more effective in the decisions they make. In future research, the effects of environmental factors in tourism-aviation relationship can also be taken into consideration.

7. References

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