Nisa Secilmis[1], **Aylin Koc**[2]

ECONOMIC FACTORS AFFECTING AVIATION DEMAND: PRACTICE OF EU COUNTRIES

The study examines the relationship between aviation demand and economic factors affecting it. For this purpose, cross-sectional data analysis was applied, and the test was performed on Turkey and EU. Income per capita, ticket prices, industrial production index, inflation and exchange rate have been accepted as the factors affecting aviation demand. According to the empirical results, national income per capita and industrial production index have positive impact on aviation demand, while ticket prices, inflation and exchange rate have a negative impact on it.
Keywords: *aviation demand; cross-sectional data analysis; EU; Turkey.*

Ніса Сечілмищ, Айлін Коч

ЕКОНОМІЧНІ ФАКТОРИ ВПЛИВУ НА ПОПИТ НА АВІАПЕРЕЛЬОТИ

У статті проведено оцінювання взаємозв'язку між попитом на авіаперельоти та економічними факторами, що впливають на нього. Для цього було використано перехресний аналіз даних, тестування проведено для країн ЄС та Туреччини. Як фактори, що впливають на попит на авіаперельоти, використано: дохід на душу населення, ціни на авіаквитки, індекс промислового виробництва, інфляцію та обмінний курс.
Ключові слова: *попит на авіаперельоти; перехресний аналіз; ЄС; Туреччина.*
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Ниса Сечилмищ, Айлин Коч

ЭКОНОМИЧЕСКИЕ ФАКТОРЫ, ВЛИЯЮЩИЕ НА СПРОС НА АВИАПЕРЕЛЁТЫ

В статье проведена оценка взаимосвязи между спросом на авиаперелёты и экономическими факторами, влияющими на него. Для этого был использован перекрёстный анализ данных, тестирование проведено для стран ЕС и Турции. Как факторы, влияющие на спрос на авиаперелёты, использованы: доход на душу населения, цены на авиабилеты, индекс промышленного производства, инфляция и обменный курс.
Ключевые слова: *спрос на авиаперелёты; перекрёстный анализ; ЕС; Турция.*

Introduction. Air transport industry plays an important role in the economy of any country today. Aviation industry has the power to increase national income, employment and tax revenues with its various extensions such as airline companies, airports, ground services and aircraft manufacturers (Oxford Economics, 2014: 7). Since the 1980s, airline industry has been growing dramatically worldwide. As a result of liberalization and deregulation movements, air transportation has commenced into intense competition, and this competition has forced airline companies sell lower-priced tickets. Reduced ticket prices has led to significant increase in demand for air transport, as a result the increased demand expanded the airline network globally, and it has facilitated contacts with foreign markets. Growth of international bonds has the effect of increasing the overall performance of national economy and efficiency (OECD, 2014: 3–4). Aviation demand is affected by many factors which interact with each other. It can be said that in general economic factors affect the demand for air

[1] Corresponding author; University of Gaziantep, Turkey.
[2] University of Gaziantep, Turkey.

transport. Income levels and product prices are the most influencing factors for demand. The higher is the income, the higher is the demand for further travel. If income decreases, people give up these kinds of needs that they think as luxury (Doganis, 2010: 200).

Aviation demand is the subject of this study because of the importance of its impacts on the economy. This study aims to measure the impact of economic factors affecting aviation demand. For this purpose, an empirical study will be conducted on member states of the European Union having the most liberal airline market in the world.

In literature, there are studies mostly on the relationship between airline demand and national income. In this study, unlike previous literature, in order to measure the impact of economic factors, national income per capita, airfare price index, inflation rate, industrial production index and exchange rate factors are shown. Instead of the time series analysis usually used in previous studies, cross-sectional data analysis method will be used here. Economic factors affecting aviation demand and effect of these factors on passenger demand will be presented. Following it, the influence of economic factors on aviation demand will be tested empirically.

Factors affecting air transportation demand. Almost all people from time to time need air travel to meet various needs. Therefore, aviation demand is a derived demand or intermediate good. It is known that very few people opt for air transportation just for the purpose of flying (O'Connor, 2001: 103).

Because it acts as a catalyst for economic activities of air transport, the sector is vital for any country's economy. As well as supporting international, regional and local prosperity and economic growth, it increases the quality of life serving many different purposes such as business, education, health, social activities (Baikgaki and Daw, 2013: 389). Therefore, air transport is very important as it affects people's living and working conditions, their relations with other nations and daily life – economically, socially and politically (Kane, 2007: 5).

Before proceeding to the factors influencing aviation demand, it will be useful to provide information on the passengers who prefer flying. R. Doganis (2010) distinguishes two categories of airline passengers. The first group contains the majority of the demand including both business and leisure travels. Passengers who travel for business can be classified as employees or company owners. Neither employee, nor the boss pay for their expenses during travel, but the company does. Leisure travel is classified as holiday or visiting friends and relatives (VFR). In contrast to business travellers, these groups pay for their own expenses. The miscellaneous category that makes up a small part of aviation demand includes students studying in different cities or countries, those who have health problems and those who migrate (Doganis, 2010: 236). Passengers who prefer to travel by air are classified in Figure 1.

First, the majority of international air passengers consists of passengers travelling for work, the rest consisted of wealthy leisure travellers. Cheapening of air tickets, continuous increase of business in time and also personal incomes led to a rapid decrease in the number of passengers who travel for business (Doganis, 2010: 236). Beside the decrease in transportation price, an increase in income per capita has an increasing effect on aviation demand. The most important two impacts that affect the demand are transportation price and personal income (Hollaway, 2008: 79).

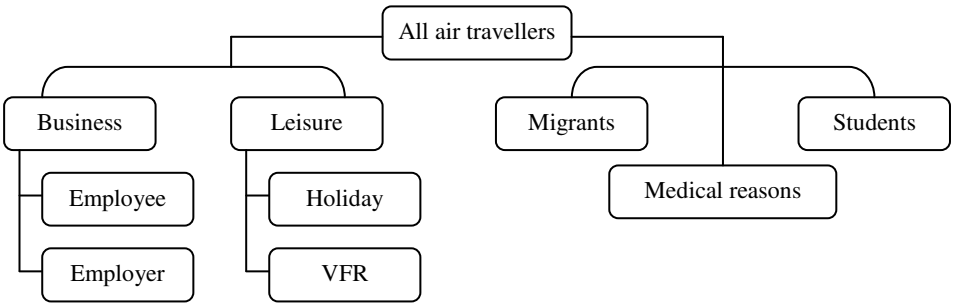

Figure 1. **Air passengers classification,** *authors'*

General economic climate in countries or regions and economic development are the other factors that affect aviation demand. These factors give distinguishing data about economic performance of countries, their level of industrial development and their volume of international trade. Therefore, these factors directly affect the demand for business passengers, and they do it indirectly affecting leisure traveller demand by increasing personal income (Doganis, 2010: 249). Namely, regions or countries in which industry and commerce is developed are the centers of attraction so that demand is directed to these centers to benefit from activities such as business negotiations, marketing, logistics, maintenance and repair (Sarilgan, 2011: 74).

Economic factors include economic recession as well. Stagnation at the market will leave a different impact on passengers who prefer air transportation for business, leisure or other reasons (Doganis, 2010: 242). Another factor affecting aviation demand is exchange rate. The demand will be affected if there is a difference between departures and arrivals relatively to the international market (Hollaway, 2008: 92).

Besides factors such as ticket prices, income per capita, economic climate, exchange rate, demographic factors also have significant role for aviation demand. The size or distribution of population is one of potential determinants of demand. Even if a country or a region has good economic performance, population will be affected negatively if demand is insufficient. On the contrary, if a region or a country with a very large population is weak in terms of economic performance, the airline demand will also be affected negatively. Therefore, it can be said that demographic and economic factors have supportive effect on airline demand. Such factors as gender and age distribution within population, the level of education are the determinants of demand too.

Social rights and life style in a country also affect airline demand. The multitude of religious or public holidays has a determining role on the demand for leisure travel, and under longer holiday time higher is the demand for holiday and VFR travel. Exchange rate, tourist attraction sites, cultural bounds between places and reflections of previous migrations may change the demand (Doganis, 2010: 251). For example, migration of Turkish workers to Germany that started in the 1960s with a formal agreement even today affects the aviation demand between Germany and Turkey. Of course, geographical conditions are the most important parameters besides these factors. Because if it does not meet the conditions appropriate for the airline industry in terms of geographical features, air transport market development will not be possible.

There are some other factors that influence airline demand and that will mostly affect the market share of airline companies. Among these are the preference factor for a particular airline company (due to brand, quality of service, campaign, frequency of flight, direct or transfer flights, flight time, catering services etc.) and the factors related to aircraft technical features (seating capacity, space between seats etc.) (Yaylali and Dilek, 2009: 13).

Literature. There are a few researches on the relation between aviation and economic growth. One of the earliest is M. Marazzo et al. (2010). This article tested the relationship between aviation demand (passenger-km: PAX) and GDP for Brazil. They used the data from 1966 to 2006 and a vector autoregressive model. They found there is a long-run equilibrium relationship between the two variables and a strong positive causality between GDP and PAX, on the other hand, slower and moderated casualty vice versa.

H. Zhang and M. Zhu (2011) studied the relation between air transportation (total turnover of air transport) and GDP in China for the years of 1990–2009 by using a causality test. Their research shows that in the long term economic growth can significantly promote civil aviation growth but civil aviation has a strong catalytic role on economic growth too.

S. Sun and Y. Li (2011) analyzed the correlation between the development of air transport industry and economic growth, and the contribution to economic growth in China for the years since 1978 till 2009. They found a strong correlation between these indicators: economic growth will play a significant role in improving the development of air transport industry and, air cargo is the cause of economic growth; air passenger subsector is more effective than air cargo one in terms of economic growth, but with civil aviation reform, this situation became reverse after 2002.

B. Mehmood and K. Kiani (2013) tested the relationship between aviation and economic growth using the data from 1973 to 2013 by using causality analysis for Pakistan data. They found a causal relationship between these indicators, and according to their causality result effect of aviation demand on economic growth is more efficient than effect of economic growth on aviation demand.

B. Mehmood et al. (2013) researched the interaction between aviation demand (passengers carried by air transport-PC) and economic growth (current LCU-GDP) in India, 1970 to 2012. They used causality analysis, graphic methods and variance decomposition model and revealed a co-integration between PC and GDP in both long and short run. Also their research shows there is no positive and strong reaction from PC to a shock in GDP, but on the contrary, there is a positive and strong reaction from GDP to a shock in PC.

According to B. Mehmood at al. (2014) in the long run there is a co-integration equation between aviation demand (PAX) and economic growth in Romania for the years from 1970 to 2012 and this situation holds in the short run. Granger causality exists running from PAX to GDP, but does not exist from GDP to PAX.

B. Mehmood and A. Shahid (2014) used co-integration and causality analyses to estimate the relationship between aviation demand (passengers carried by air transport: PAX) and economic growth (GDP) in Czech Republic, 1970–2012. They stated there is a significant positive co-integration between PAX and GDP which was revealed by using fully modified OLS, dynamic OLS and conical co-integration tests.

The result of Granger causality analysis shows that PAX is affected by GDP but not the other way round.

B. Mehmood et al. (2014) has revealed the relationship between aviation demand and economic growth for Bangladesh with the data covering 1973–2012. By using fully modified OLS, dynamic OLS and conical co-integration tests, they revealed a relationship between aviation demand. And economic growth, and by using Granger causality test they show that the direction of causal relationship is from GDP to PAX.

Y. Hu et al. (2015) investigated domestic air passenger traffic (APT) and real economic growth in China by using heterogeneous panel models for the time span of 2006Q1–2012Q3. They found that in the short run there is Granger causality from APT to GDP, but from GDP to APT there is no Granger causality. And also there is a co-integration between APT and GDP in the long run.

There are also regional studies on this subject such as D. Baker et al. (2015). They examined the relation between regional air transportation and regional economic growth by using 88 regional airports data in Australia and found there is a strong and mutual relation between these indicators.

Model and data sources. This study has been conducted to test the relationship between aviation demand and economic factors. In the study, the impact of economic factors on aviation demand was investigated by conducting the cross-sectional analysis method for the European Union countries. In this context, 28 EU member countries and Turkey, 2014 period, were based so that "*the impact of economic factors on aviation demand*" will be tested. Countries considered in this study are shown in Table 1.

Table 1. **Countries in the model,** *authors'*

Germany	Sweden	Slovakia
Austria	Italy	Cyprus
Belgium	Greece	Lithuania
England	Portugal	Poland
Denmark	Luxemburg	Slovenia
Finland	Czech Republic	Bulgaria
France	Estonia	Romania
Holland	Hungary	Croatia
Ireland	Latvia	Turkey
Spain	Malta	

As theoretically stated in the previous section, the relationship between economic factors and aviation demand will be tested in the application part of the study using the cross-sectional analysis method. This method is aimed to define whether there is a relationship between aviation demand and economic factors, or not. If there is such a relationship, we will also define whether this relationship is positive or negative.

1. Empirical model and data sources. The main purpose of econometric model that will be used in this study is to determine the impact of economic factors on aviation demand. In this context, in the scope of econometric models to be created, income per capita, industrial production index, price level, inflation rate and

exchange rate have been included as an explanatory variable in the model. And aviation demand is the dependent variable of the model.

The study is based on M. Marazzo et al. (2010) model which was used in their study while defining the impact of economic factors on aviation demand. The mathematical expression of the model is:

$$\ln APD = \beta_0 + \beta_1 GDP + \beta_2 API + \beta_3 PI + \beta_4 INF + \beta_5 RER + \varepsilon_i. \quad (1)$$

Equation (1) indicates the natural logarithm taken ln*APD* aviation demand, and explanatory variables *GDP, API, PI, INF* and *RER* define income per capita, air price index, production index, inflation rate and real effective exchange rate respectively. β_0 defines fixed term; β_1, ..., β_5 – slope parameters; ε_1 – error term.

2. Data. Dependent and independent variables used in the model and sources of these data are described below. All these variables belong to 2014.

The data on aviation demand which is a dependant variable for econometric model that is used in the model have been provided from "Eurostat (Statistical Office of the European Communities)" (ec.europa.eu/eurostat).

The definition and the source of data for explanatory variables in the model are described below:

Income per capita data which are used as one of the explanatory variables have been taken in terms of purchasing power parity value. Industrial production index is showing the changes in production volume index of enterprises operating in the industrial sector. Manufacturing sector calculation includes the industrial production index, electricity, gas, steam and air conditioning production and distribution subsectors and the mining and quarrying sector. Inflation rate is expressed as % of the average annual change in the consumer price index. As exchange rate, consumer price index based real effective exchange rate has been used. Income per capita, industrial production index, inflation rate and reel effective exchange rate datas have been provided from the "Eurostat".

For ticket prices which are one of other explanatory variables used in one study, price index, prepared by GoEuro (goeuro.com), has been used. To create a variety of ticket price indices, prices of flights across the globe are compiled. The average price is calculated at 100 km by defining the cheapest regular flight between each country's two most populous cities.

The model has been defined as follows:

$$APD = f(GDP, API, PI, INF, RER), \quad (2)$$

where *APD* – air passenger demand (logarithmic); *GDP* – income per capita; *API* – air price index; *PI* – production index; *INF* – inflation rate; *RER* – reel effective exchange rate.

The sources of variables data and the expected aviation demand are shown in Table 2.

3. Estimation results. In the estimated model, the relationship between aviation demand that is the dependent variable and income per capita that is the independent variable, air price index, production index, inflation rate and exchange rate variables is examined. The variables were estimated by cross-sectional analysis methods using the data as or 2014 of 28 EU member countries and Turkey.

Table 2. **Sources of variables and their expected signs,** *authors'*

Variable	Source of Variable	Expected Signs
Air Passenger Demand	EUROSTAT	
Income Per Capita	EUROSTAT	+
Production Index	EUROSTAT	+
Air Price Index	GOEURO	-
Inflation Rate	EUROSTAT	-
Reel Effective Exchange Rate	EUROSTAT	-

The main problem commonly encountered in the studies using cross-section method is heteroscedasticity. Therefore, in the horizontal section analysis, the estimation should be done by eliminating the problem of heteroscedasticity. The model has been estimated by using "White heteroskedasticity-consistent standard errors & covariance" method which is the most common and preferred one (Wooldridge, 2001: 55) to overcome heteroscedasticity. Thus, by removal heteroscedasticity the estimates were obtained.

Table 3. **The estimation results,** *authors'*

Dependent Variable: LNAPD			
Variable	Coefficient[H]	t-statistics	p-value
GDP	2.185239	6.212648	0.0000*
API	-2.021190	-5.106661	0.0001*
PI	1.197542	4.672183	0.0003*
INF	-1.071225	-3.257678	0.0053*
RER	-1.661733	-4.744338	0.0003*
Constant term	27.83594	15.61070	0.0000*
R^2	0.618052		
F-statistics	24.86781		
Prob (F-statistics)	0.00000		

* 1% level of significance, statistically significant coefficients.
** 5% level of significance, statistically significant coefficients.

The estimated results obtained by the Ordinary Least Squares (OLS) method are given in Table 3. R^2 value which belongs to the estimated economic model has been found as 0.58[3]. In this respect, R^2 obtained from the model demonstrates the model's significance as a whole. In addition, H0 hypothesis is rejected according to the F statistical results that test the significance of slope coefficient in the model. Therefore, our model is significant both according to R^2 and F-statistics result.

According to empirical results, there is 1% significance level relation between income per capita and aviation demand. In terms of the nature of this relationship, a positive effect has been found. In other words, 1-unit increase in income per capita is increasing aviation demand by 2.185239 points.

[3] R^2 value that shows the amount of changes in dependant variables are explained by independent variables if evaluated in terms of econometric methods that can be seen low. It is known that R^2, which are provided from estimates done with horizontal cross-sectional data, are generally low. A.H. Studenmund (1992: 47) suggested an R^2 as big as 0.50 in horizontal cross-sectional data is a good match (Agir and Kar, 2010: 167).

According to the estimate results of the model, it is understood that ticket price index has 1% significance level on aviation demand. The effect is statically significant and negative.

As a result, 1-unit increase in ticket price index results in a -2.021190 points decrease in aviation demand.

For another explanatory variable, industrial production index, it has been understood that it has 1% significance level on aviation demand. The effect is significant statically and positive. As a result, 1-unit increase in industrial production index results in a 1.197542 points increase in aviation demand.

According to the empirical results, there is 1% significance level relation, which is statically significant and negative, between inflation rate and aviation demand. 1-unit increase in inflation results in a -1.071225 points decrease in aviation demand.

According to the estimated results, there is a significance level of 1% significance level statically significant and a negative relationship between real effective exchange rate and aviation demand. 1-unit increase in exchange rate results in a -1.661733 points decrease in aviation demand.

Conclusion. In this study, the interaction between aviation demand and economic factors has been estimated using the method cross-sectional data analysis method. In this context, a model has been created consisting of aviation demand and other control variables (income per capita, air price index, production index, inflation rate, real effective exchange rate), and it has been tested. According to the findings of this study, it has been statically proven that an increase in income per capita and a decrease in ticket price have a positive impact on aviation demand. In addition, the authors conclude that there is a statically significant and expected interaction between other economic factors that are used in the model and aviation demand. It is revealed by this research that in addition to income and price, also exchange rate, industrial production index and inflation rate have great impact on aviation demand.

Unlike other studies, the impacts of economic factors on aviation demand were tested here by means of cross-sectional data analysis for the EU and Turkey. In addition to this difference, other studies have generally emphasized the relation between aviation demand and national income, but in this study other economic variables were added to the model.

The most important limitation of the study is that the analysis covers only the year 2014. Another limitation, although there are many economic factors affecting the aviation demand, accessible data have been included in the analysis. Further study can be extended by using different analysis methods and other country groups.

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