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# Factors Affecting Global Passenger Flow and a Model Proposal for Forecasting

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**Abstract:** While the world is getting globalized, the transportation sector, which provides transportation of people or goods from one point to another, is becoming more and more important. At the beginning of the 20th century, air transport compared to other transport types has come to the fore in the best possible way. The reason why globalization deeply influences air transport is the fact that it is one of the most open sectors in the international arena in terms of facilities in this sector. On the one hand, some of the important activities internationally conducted in the sector are deregulation, privatizations, and corporate mergers. On the other hand, this sector has been adversely affected by the recent economic crises and terrorist incidents. In this study, factors affecting the demand of international flights are revealed and these factors are analyzed. The effects of the identified factors are quantified by evaluating the effects of univariate regression analysis using SPSS software, then the effects of the factors are weighted by multiple regression analysis and a model that could be used for predicting future passenger numbers for the following years is obtained. The obtained model has been tested with real data on the basis of countries.

**Keywords:** Airline Transportation, Global Passenger Flow, Modeling, Regression Analysis, Demand Forecasts, Passenger Demand

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## 1. Introduction

Transportation is the economic, rapid, safe and beneficial displacement of living and non-living assets, services and information. Transportation is now one of the compulsory necessities in people's lives. It is unimaginable to sustain life without modern transportation systems. The development of industrialization, the increase of the population and the proliferation of settlements led to an increase in the economic relations of the countries and the widespread of touristic travel for people.

Transportation plays an important role in determining the level of development of countries. In passenger and freight transport, the number of countries that use only one type of transportation is quite a little. Most of the countries benefit from several types of transport like road, rail, air, sea and pipeline.

The air transport sector, which will be discussed within the scope of the study, showed very rapid technological and structural changes in a short time. Development of aircrafts

which have large-capacity, fuel-saving, low-noise and emission level has greatly influenced the activities, service quality and scope of airline companies. Moreover, the factors that make this sector into a market dominated by consumers are liberalization and privatization [1]. Cooperation between countries is carried out for technical, financial, economic and institutional issues regardless of distance and people or products are transported safely and comfortably from one point to another as soon as possible by air transport.

There have been many studies on air transport passenger flow in the literature. Sarilgan [2] is interviewed industry managers on what can be done on the issue of developing the regional airline transportation in Turkey by using the semi-structured interviews. In his study, he interviewed public and private sector managers and asked questions about regional air transport. The technique used in the study is data collection technique made by verbal communication. Benitez et al. [3] presented a modification of the Grey Model (GM) to forecast routes passenger demand growth in the air transportation industry. They suggested that their proposed method could be

used as an option to predict airline customer flow when there is little data. The advantages of this model are that it can predict data with unknown parameters, and that a small amount of data is required to estimate the behavior of unknown systems. Ozan *et al.* [4] modeled domestic air transport demand and evaluated by using indexing method which is able to indicate observed monthly and seasonal variations in demand. Rolim *et al.* [5] developed an empirical model of passenger demand for routes of airports subject to either imminent or recent privatization and investigated whether the privatization process produces a sequential impact over traffic. One of the most fundamental results of this study is an overall increase in airline demand for privatized airports. Celik [6] investigated the purposes of the air transport industry and provided benefits to the economy. But no technique was used in this study.

When the literature is examined, it is found that the techniques used for airway transport passenger flow are few and insufficient. Moreover, many studies have been found for the flow of metro systems passenger. Wei and Chen [7] developed a hybrid EMD–BPN forecasting approach which combines empirical mode decomposition (EMD) and back-propagation neural networks (BPN) to predict the short-term passenger flow in metro systems. Their proposed approach indicated a good and stable performance in forecasting short-term metro passenger flow. Leng *et al.* [8] proposed a novel metro-net oriented method, called the probability tree based passenger flow model, which is also based on historic origin-destination (OD) information. Their results showed that although the proposed method has lower performance than existing prediction approaches for forecasting exit passenger flows, it is able to predict several additional kinds of passenger flow in stations and throughout the subway system. Sun *et al.* [9] proposed a novel hybrid model Wavelet-SVM (Support Vector Machines) which combines the complementary advantages of Wavelet and SVM models. Therefore, they obtain the predicted passenger flow time series in target period.

In this study, the factors affecting global passenger flow will be determined and the effects of these factors will be evaluated numerically by using univariate regression analysis and SPSS package program. Then, the effects of these factors will be weighted by multiple regression analysis and a model that can be used to estimate the number of national passengers for the coming years will be obtained.

In Section 2, information about transportation and transportation sector are given. The definition of the problem is explained in Section 3 and the factors affecting the global passenger flow are explained in Section 4. In Section 5, a model is proposed for global passenger flow. Finally, the results are summarized and future research directions are discussed in Section 6, which concludes the paper.

## 2. Transportation and Transportation Sector

In the globalization process, transportation includes information and the market access from one point to another.

Activities which create a market by reaching the places like workplaces of people, entertainment and holiday places, health centers, training areas etc. and bringing the consumer and producer position are the transportation activities [10].

In today's conditions, the fact that a commodity can be transported from the production point to the markets as soon as possible becomes an important part of the competition. Furthermore, in order to eliminate the problem of scarcity and price differences, goods are transported from points that are cheap and cheap to points that are scarce and expensive [11].

The aim of the transportation sector is to realize the transportation demand that will be required by economic development in a fast, safe, efficient and minimum cost. One of the most important factors that will accelerate the development of developing countries is the balanced and planned use of investments in transportation sector [12]. In short, transport systems are one of the most important tools for the revival of economic, social and cultural activities in the countries [13].

Air transport, which is considered within the scope of the study, increases its importance day by day in the globalized world, and the world states that realize this situation are involved in support air transportation activities for privatization, liberalization and airway companies in certain factor. The Wright brothers in 1903 after the historical step in the air transport, this sector is constantly developing. Due to the economic crises, the demand for airways has shown a downward trend in some periods. Nevertheless, the forecast for the near future is that the air transport sector in the world can balance with other modes of transport [14]. However, the number of international passengers is increasing day by day. Considering this increase trend, passenger mileage revenue forecasts made by Boeing for 2029 are shown in Figure 1.

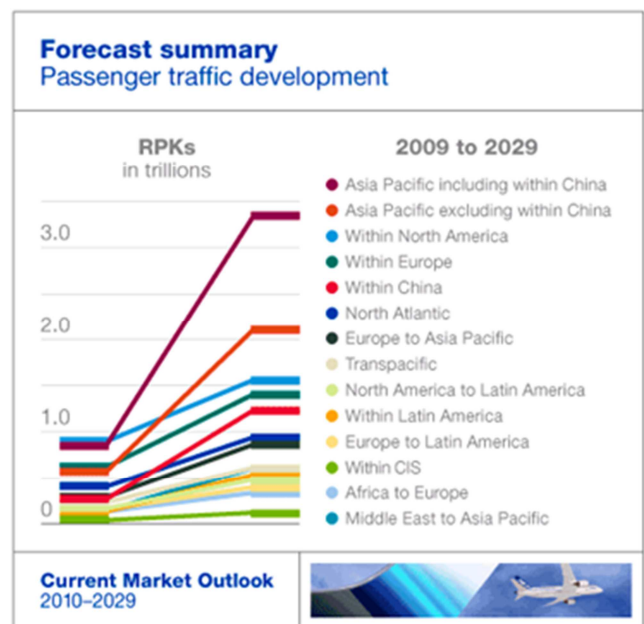


Figure 1. Revenue per Passenger Kilometer Change foreseen for 2029 Year [15].

### 3. Problem Definition

The aim of this study is to determine the factors affecting the demand for international flights and to examine these factors. In the research, it was first determined which country data to use. Then, the factors affecting the demand for international flights have been determined and these factors are examined in detail.

While determining the data used in the study to which countries, the social and economic factor of the countries were used that affect the traffic among them. These factors are

1. Gross National Product
2. Population
3. Purchasing Power
4. Number of Tourists
5. Airport Density
6. Life Quality.

The first 25 cities in the world were determined according to these factors (Table 1). Considering that it is more meaningful to evaluate the passenger traffic as international rather than being evaluated as intercity, the countries of the cities which are among the first 25 cities are determined according to these factors (Table 2).

*Table 1. The first 25 cities in the world according to determined factors.*

Order	Gross National Product	Population	Purchasing Power	Number of Tourists	Airport Density	Life Quality
1	Tokyo	Shanghai	Zurich	London	London	Zurich
2	New York	Mumbai	Sydney	New York	Paris	Geneva
3	Los Angeles	Karachi	Luxembourg	Bangkok	Amsterdam	Vancouver
4	Chicago	Delhi	Belo Horizonte	Singapore	Hong Kong	Vienna
5	İstanbul	São Paulo	Miami	Kuala Lumpur	Frankfurt	Auckland
6	London	Moscow	Los Angeles	Paris	Dubai	Düsseldorf
7	Paris	Seoul	Geneva	Antalya	Singapore	Frankfurt
8	Osaka	Beijing	New York	Dubai	Tokyo	Munich
9	Mexico	Mexico	Chicago	Hurgada	London	Bern
10	Philadelphia	Tokyo	Nicosia	Hong Kong	Bangkok	Sydney
11	São Paulo	Kinshasa	Berlin	İstanbul	Madrid	Copenhagen
12	Washington	Jakarta	Montreal	Mecca	Incheon	Wellington
13	Boston	New York	Brussels	Miami	Munich	Amsterdam
14	Buenos Aires	Lagos	Helsinki	Toronto	Dublin	Brussels
15	Dallas	Lima	London	Rome	New York	Toronto
16	Moscow	London	Copenhagen	Shanghai	Zurich	Berlin
17	Hong Kong	Bogotá	Toronto	Los Angeles	Rome	Melbourne
18	Atlanta	Tehran	Amsterdam	Las Vegas	London	Luxembourg
19	San Francisco	Ho Chi Minh	Frankfurt	Barcelona	Taipei	Ottawa
20	Houston	Hong Kong	Munich	Dublin	Copenhagen	Stockholm
21	Miami	Bangkok	Lyon	Amsterdam	Vienna	Perth
22	Seoul	Dhaka	Stockholm	Macau	Toronto	Montreal

*Table 2. Countries of the first 25 cities.*

Order	Country	Order	Country	Order	Country	Order
1	Argentina	18	Denmark	35	Kenya	52
2	United States	19	Dominican Republic	36	Latvia	53
3	Australia	20	Egypt	37	Lithuania	54
4	Austria	21	Estonia	38	Luxembourg	55
5	Bahrain	22	Finland	39	Malaysia	56
6	Bangladesh	23	France	40	Mauritius	57
7	Belarus	24	Greece	41	Netherlands	58
8	Belgium	25	Germany	42	New Zealand	59
9	Brazil	26	Hong Kong	43	Norway	60
10	Bulgaria	27	Hungary	44	Pakistan	61
11	Canada	28	India	45	Peru	62
12	Chile	29	Indonesia	46	Philippines	63
13	China	30	Iran	47	Poland	64
14	Colombia	31	Ireland	48	Portugal	65
15	Cote d'Ivoire	32	Israel	49	Qatar	66
16	Cyprus	33	Italy	50	Russia	67
17	Czech Republic	34	Japan	51	Romania	68

While determining the factors affecting the global passenger flow; the factors mentioned in various sources which have an effect on international passenger demand were evaluated. These factors are

1. Gross National Product
2. Annual Gross National Product Increase
3. Gross National Product Per Capita
4. Age Dependency Ratio
5. Tourism Income
6. Tourism Expenditures
7. Population
8. Urban Population
9. Trade
10. Foreign Investments

The effects of these factors were quantified by using univariate regression analysis and SPSS packet program. Then, the effects of the factors are weighted by multiple regression analysis and a model that can be used to estimate the number of passengers for the coming years is obtained. The model obtained with the data of 2013 and 2014 was tested with the data of 2015.

## 4. Factors and the Effects On Global Passenger Flow

In this part of the study, the factors affecting global passenger flow will be discussed. Then, definition of factors and the relationship of factors with global passenger flows will be mentioned.

### 4.1. Gross National Product Factor

Gross national product (GNP) is the sum of the value of all the goods and services produced by the citizens in a country in a certain period (usually for a year) using the production factors.

It is thought that gross national product affects global passenger flows. The reason of this; the welfare of a country is closely related to the level of the financial resources of that country's passengers. If the country's welfare level is high, the citizens of the country will not have any problem creating funds for the flights they would like to perform and they can perform their flights more freely because they are relatively less affected by the funding constraint.

In addition, the gross national product of a country determines the multiplicity of investments in areas that may affect flights in that country. In countries with high GNP investments will be more. Thus, the number of flights will be higher as the investments will be higher in the countries with high GNP.

It is stated in the "Aviation and the Global Atmosphere" report published for the intergovernmental panel on climate change, where the gross national product affects global passenger flows: "Although the growth of world air traffic is much larger than the world economic growth; economic theory and analytical studies show a high correlation between the two. Many estimates on aviation demand are based on the

assumption that air transport estimation is determined by economic development. Statistical analysis shows that the growth in the gross national product clarifies two-thirds of the growth in air transportation, reflecting the growth in commercial activity, personal income, and the trend toward travel" [16].

### 4.2. Annual Gross National Product Increase Factor

Annual gross national product increase is a factor used to reveal the size of the annual change in the gross national product. The reason why this factor is addressed is that the GNP will not reflect the demand with full qualification. Because passenger demand is affected by change. For example; If the GNP of a country shows a downward trend, there is a decrease in the welfare of the citizens of the country. This causes citizens to drag themselves into a more restrictive policy of transferring funds to transport activities in the face of negative change and thus the airline transportation demands also fall. Conversely, it can be observed that GNP is in a rising trend. As a result; since the change in GNP may affect passenger demands and thus global passenger flows, this factor should be taken into consideration.

### 4.3. Gross National Productivity Per Capita Factor

GDP per capita is found by dividing the gross national product of a country by the population of that country.

In the February-April 2007 period, 569 people in the intercity travels were interviewed and empirical findings were obtained after analyzing these questionnaires. As a result, it is seen that as the income level increases, the demand for airway transportation increases and the demand for airway transportation decreases as age increases [17].

Lisker-Melman [18] stated that the gross national product is an factor that reflects the general situation of the country's economy or the size of the improvements in the aviation industry and emphasized that another factor that should be considered is the per capita gross national income. The reason for this is stated as the fact that the potential candidates who can use the airway transportation are the determinants of the magnitude of their personal income in the frequency of travel.

Similarly, the characteristics of each city such as income level, education level and age of the population will have an impact on air transportation demand. Cities with higher income levels will create a greater demand for air transport [19].

### 4.4. Age Dependency Ratio Factor

This factor is expressed as the ratio of the population aged 0-14, 65 and over, to the population aged 15-64. The age factor is thought to affect global passenger flows. The reason for this is that the passenger demand changes depending on the age factor. The change in passenger demand due to the age factor in certain income groups is shown in Figure 2.

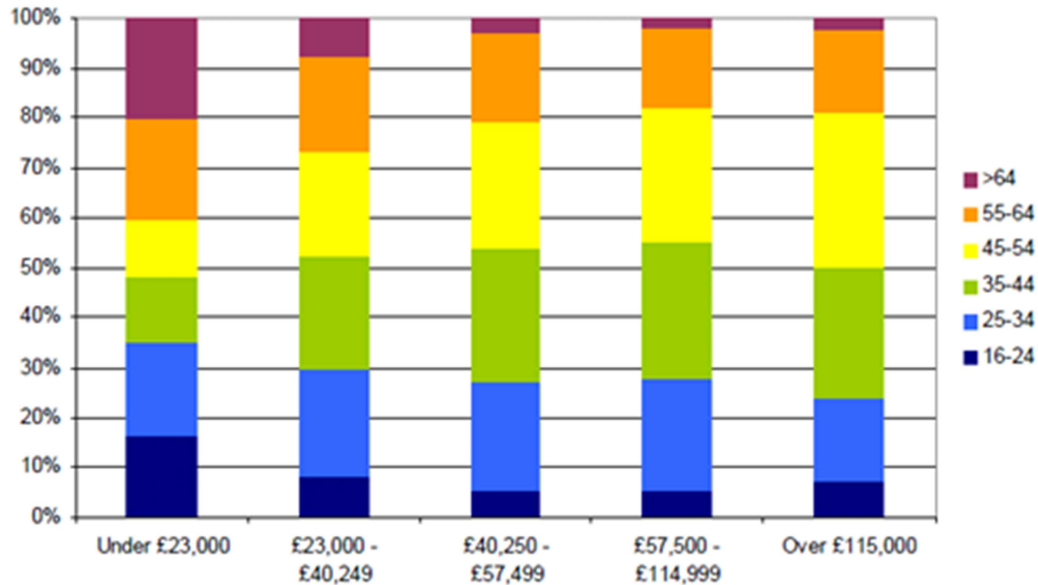


Figure 2. Change in passenger demand depending on age factor in certain income groups [20].

#### 4.5. Tourism Income Factor

Tourism income is defined as the total expenditure made in countries by foreigners and citizen visitors resident in abroad (excluding real estate expenditures, repair-maintenance expenses for residences, durables etc.). Tourism income includes the expenditure on food and beverages, accommodation, health, transportation, sports, education, culture, mobile phone roaming expenditures, marina service expenditures, souvenirs etc [21]. Since tourism income is a factor of the frequency of tourist activities, it can be considered as one of the factors affecting global passenger flows.

#### 4.6. Tourism Expenditure Factor

Tourism expenditure refers to the total consumption expenditure made by a visitor, or on behalf of a visitor for goods and services during his/her trip and stay at the destination place (country). It also includes payments in advance or after the trip for services received during the trip [22]. Since tourism expenditure is a factor of the frequency of tourist activities, it can be considered as one of the factors affecting global passenger flows.

#### 4.7. Population Factor

The reason for the consideration of the population factor within the scope of the study is the close relationship between the amount of passenger demand and the number of potential passengers forming this demand. When the number of potential passengers is evaluated independently from other factors, it increases in direct proportion to the increase in the population of a country.

Socio-economic and demographic variables reflect the characteristics of potential passengers in a Start-Target market. The population of cities A and B will have a clear impact on air transportation demand (The larger the population, the

greater the demand for potential air transport will be) [19].

Population stands out as a very important independent variable affecting all transport systems. It is obvious that the demand for transportation systems will increase with the increase of the population. Therefore, population data is considered as the main data for all systems [23].

#### 4.8. Urban Population Factor

The reason why this factor is addressed is that when the socio-economic levels are taken into account, the number of people living in a number of cities creates a higher passenger potential compared to the number of units living in rural areas. It is thought that people's cultural infrastructure, education levels and interactions with their environment will have an impact on the demand of the passengers.

#### 4.9. Trade Factor

The reason why trade factor is considered as a factor affecting global passenger flows is that a certain part of the cross-country flights originates from commercial activities between countries. The size and type of interaction between cities A and B will also affect air transportation demand. The two cities with common industries will create air transport demand (For example; Most of the business transportation between Detroit and Seoul is related to the car manufacturing industry) [19].

#### 4.10. Foreign Investments Factor

It is clear that the investments made in the country will have an impact on the country's trade volume, the relationship with the international market and the airline passenger and goods transportation. While the size of the GNP is effective in realizing the investments with its own resources, the investments to be made can be realized by external sources regardless of the country's own resources.

## 5. Application and Model Proposal

In the application part of the study, the effects of the factors affecting the global passenger flow were evaluated numerically by using univariate regression analysis. After that, the effects of factors were weighted by multiple regression analysis and a model that can be used to estimate the number of passengers for the coming years is obtained.

The univariate regression analysis and multiple regression analysis performed with SPSS 13.0 were used to express the effects of factors affecting global passenger flow numerically. In the analysis, the total number of passengers belonging to the countries were used as the dependent variable, while the factors affecting the global passenger flow were used as independent variables.

In the scope of the analysis, it was targeted to work with 50 countries and the analysis was carried out in 2013, 2014, 2015 as the most recent years in which data on all the factors could be obtained. The data for use in SPSS were converted by dividing each data by the largest data and multiplying by 100 to match the largest value found to 100. The transformed data are given in Tables 3, 4 and 5 respectively.

### 5.1. Analysis of Factors

According to SPSS results, Table 6 shows how global passenger flow depends on the determined factors.

According to Table 6, it is found that global passenger flow depends on “trade”, “tourism income”, “tourism expenditures” and “gross national product” factors. The factor dealt with according to the ANOVA table was found to be statistically significant at the level of  $p < 0.01$ .

### 5.2. Proposed Model

In order to weight the effects of the factors affecting global passenger flow and to obtain a model that can be used to estimate the number of passengers in the coming years, multiple regression analysis using SPSS program was utilized.

Since the most recent years in which all factors were available for analysis were 2013, 2014 and 2015, models were created by multiple regression analysis in SPSS for 2013 and 2014. Then, the accuracy of the models was tested using the 2015 data.

The univariate regression analysis method was used to

evaluate the effects of factors one by one and the factors affecting the global passenger flow vary considerably. For this reason, it is thought that the associations with some of the factors may not be significant; while multiple regression analysis was performed with SPSS, the variables were added to the model with backward method. Thus, the models formed by all factors and variables whose significance level were less than 0.05 ( $p < 0.05$ ) were obtained.

As a result of the analysis made with the data of 2013, the results given in Table 7 are obtained in order to form the model where all factors are included.

From the value in the the column “Adjusted R Square” in the model summary table (Table 7), it is understood that the variance of the “factors affecting global passenger flow” as independent variable and “global passenger flow” as dependent variable explained with 81 percent. In other words, 81% of global passenger flow depends on specified factors.

It was found that the relationship between global passenger flow and GNP, per capita GNP, age dependency ratio and tourism income factors is significant at  $p < 0.05$  level, the relationship between other factors and global passenger flow is not statistically significant in Table 8.

It can be said that some factors do not make a significant contribution to global passenger flow. For this reason, as a result of the analysis made by using the data of 2013 with the fact that some of the factors are not included, some of them are removed from the model with the backward method, the value of global passenger flow can be formulated as follows:

$$\text{Global Passenger Flow}_{2013} = 67.309 - 1.434 * \text{Gross National Product} - 0.2 * \text{Gross National Product Per Capita} - 0.684 * \text{Age Dependency Ratio} + 1.276 * \text{Tourism Income} + 0.597 * \text{Tourism Expenditures} + 0.81 * \text{Trade}$$

Similarly, the value of global passenger flow for 2014 is as follows:

$$\text{Global Passenger Flow}_{2014} = 76.025 - 1.541 * \text{Gross National Product} - 0.223 * \text{Gross National Product Per Capita} - 0.755 * \text{Age Dependency Ratio} + 1.185 * \text{Tourism Income} + 1.478 * \text{Trade} - 0.19 * \text{Foreign Investments}$$

The data of 2015 were assigned to independent variables in these equations and the results were compared with the known global passenger flow data for 2015. The values of 2015 which are obtained with the models of 2013 and 2014 are given in Table 9 and Table 10, respectively.

Table 3. Data of 2013 converted for using in SPSS.

Country Name	Total Number of Tourists	Gross National Product	Annual Gross National Product Increase	Gross National Product Per Capita	Age Dependency Ratio
Argentina	8,065	1.61	66.66	22.51	91.93
Australia	10,473	5.62	24.17	64.39	77.99
Austria	30,303	2.42	28.33	67.94	76.47
Bangladesh	2,019	0.46	52.20	2.18	94.34
Belgium	14,847	2.99	21.19	64.07	83.91
Brazil	9,642	8.17	31.14	16.94	81.04
Bulgaria	9,338	0.25	51.26	20.78	71.61
Canada	40,997	9.59	22.23	69.06	70.99
Chile	5,258	1.10	36.14	24.40	77.93
China	84,437	20.34	100.00	8.93	66.19

Country Name	Total Number of Tourists	Gross National Product	Annual Gross National Product Increase	Gross National Product Per Capita	Age Dependency Ratio
Colombia	2,821	1.22	52.52	14.87	88.81
Cyprus	3,190	0.14	32.62	45.14	74.47
Denmark	10,871	2.06	26.73	67.60	83.14
Dominican Republic	4,385	0.27	84.02	13.10	100.00
Finland	9,131	1.56	34.72	62.10	80.62
France	102,996	16.99	17.46	61.17	86.42
Germany	94,769	21.88	26.52	63.25	80.73
Hong Kong	91,633	1.42	55.27	73.48	57.08
Hungary	26,871	0.85	31.50	34.46	72.73
India	12,787	7.12	74.30	4.83	95.87
Indonesia	9,838	2.73	43.31	6.49	81.85
Ireland	14,849	1.66	42.17	79.06	73.85
Israel	5,538	1.09	44.87	46.81	98.63
Italy	66,755	13.97	16.03	56.71	83.03
Japan	24,869	32.71	16.06	59.77	83.34
Latvia	4,686	0.15	96.32	28.12	72.08
Mexico	35,355	7.14	38.84	25.93	90.95
Morocco	8,693	0.49	61.10	7.32	86.83
Netherlands	27,434	5.08	36.73	71.40	77.77
New Zealand	4,251	0.83	6.75	50.88	81.08
Norway	7,306	2.52	17.96	100.00	83.03
Peru	3,624	0.69	60.95	13.04	94.78
Poland	60,366	2.56	49.04	28.27	66.50
Portugal	29,660	1.51	11.33	42.91	78.42
Romania	14,943	0.92	62.20	20.88	69.98
Russian Federation	51,593	7.42	64.20	28.18	64.45
Saudi Arabia	10,620	2.67	24.86	41.40	93.62
Singapore	13,121	1.09	68.04	92.54	61.41
Slovak Republic	24,300	0.52	66.96	34.50	63.12
Slovenia	4,297	0.29	45.74	47.75	68.25
South Africa	12,735	1.96	44.12	17.39	88.70
Spain	68,682	9.26	31.64	56.88	73.62
Sweden	15,861	2.99	33.84	66.96	84.71
Thailand	17,204	1.55	40.52	13.63	68.41
Turkey	27,191	3.98	54.28	23.29	82.24
Ukraine	35,811	0.81	57.48	11.68	70.68
United Kingdom	100,190	18.29	22.46	65.47	82.86
United States	114,640	100.00	21.06	83.79	79.85
Uruguay	2,415	0.15	34.06	19.51	95.29
Venezuela	1,843	1.38	77.73	20.77	90.61

Table 3. Continued.

Country Name	Tourism Income	Tourism Expenditures	Population	Urban Population	Trade	Foreign Investments
Argentina	3.02	3.87	2.98	91.60	2.54	4.29
Australia	18.40	15.69	1.58	88.38	8.21	3.43
Austria	14.65	11.22	0.63	66.72	9.43	-4.22
Bangladesh	0.06	0.43	11.86	26.18	0.74	0.96
Belgium	9.02	17.13	0.80	97.32	17.29	9.80
Brazil	3.55	7.18	14.35	84.66	7.58	-13.03
Bulgaria	2.57	2.01	0.59	70.50	1.25	10.49
Canada	13.17	24.96	2.49	80.20	24.03	19.28
Chile	1.47	1.51	1.26	87.88	3.02	6.30
China	28.80	27.04	100.00	41.30	51.58	78.74
Colombia	1.56	1.72	3.33	73.90	1.69	7.69
Cyprus	2.09	0.99	0.06	69.50	0.50	1.35
Denmark	4.33	7.11	0.41	86.16	7.46	-7.92
Dominican Republic	3.04	0.47	0.74	67.54	0.66	1.50
Finland	2.72	3.92	0.40	62.70	4.83	3.93
France	42.20	36.27	4.68	76.92	33.45	-54.73
Germany	33.29	79.53	6.28	73.48	66.86	-86.53
Hong Kong	12.05	13.45	0.52	100.00	20.45	0.10

Country Name	Tourism Income	Tourism Expenditures	Population	Urban Population	Trade	Foreign Investments
Hungary	3.87	2.46	0.77	66.70	4.72	1.55
India	6.91	8.37	84.65	28.98	11.69	8.29
Indonesia	3.79	5.23	16.93	49.22	5.57	3.03
Ireland	5.94	6.68	0.32	60.78	8.93	-21.56
Israel	2.55	3.71	0.54	91.62	3.35	-0.23
Italy	32.30	26.27	4.50	67.76	28.26	-4.80
Japan	8.91	36.05	9.74	66.16	36.41	-78.76
Latvia	0.48	0.75	0.17	68.04	0.60	2.06
Mexico	10.34	8.99	7.95	76.60	14.67	19.78
Morocco	5.35	1.07	2.35	55.34	1.31	2.78
Netherlands	13.59	16.71	1.25	80.74	25.19	-78.87
New Zealand	3.70	2.43	0.32	86.32	1.75	6.30
Norway	3.30	11.56	0.36	77.36	6.79	-20.12
Peru	1.38	0.99	2.15	71.20	1.20	4.79
Poland	6.30	7.33	2.91	61.44	7.60	14.83
Portugal	8.10	3.97	0.81	58.22	3.83	5.25
Romania	1.30	1.40	1.65	53.88	2.25	15.17
Russian Federation	7.54	18.65	10.87	72.88	14.60	9.06
Saudi Arabia	4.04	12.92	1.81	82.00	9.13	25.38
Singapore	5.85	10.64	0.34	100.00	17.12	14.17
Slovak Republic	1.28	1.18	0.41	56.32	3.22	5.25
Slovenia	1.48	1.01	0.15	49.20	1.40	-0.35
South Africa	6.95	5.01	3.64	59.78	4.39	-8.45
Spain	44.63	19.48	3.37	76.84	19.64	-100.00
Sweden	8.13	12.29	0.69	84.38	10.12	2.99
Thailand	12.88	5.91	5.07	32.64	8.02	11.73
Turkey	14.36	3.02	5.50	67.76	7.19	26.64
Ukraine	3.12	3.07	3.57	67.86	2.79	7.93
United Kingdom	33.97	74.36	4.62	89.78	39.54	94.73
United States	100.00	100.00	22.78	81.10	100.00	-2.45
Uruguay	0.55	0.29	0.25	92.10	0.33	2.07
Venezuela	0.65	1.73	2.06	92.64	2.87	-2.81

Table 4. Data of 2014 converted for using in SPSS.

Country Name	Total Number of Tourists	Gross National Product	Annual Gross National Product Increase	Gross National Product Per Capita	Age Dependency Ratio
Argentina	8,729	1.85	60.94	24.32	92.17
Australia	11,106	6.09	26.55	66.22	78.84
Austria	30,642	2.65	26.26	69.00	77.41
Bangladesh	2,616	0.49	45.27	2.29	93.31
Belgium	15,416	3.26	20.58	64.63	84.61
Brazil	9,849	9.71	42.90	17.86	81.08
Bulgaria	9,666	0.30	45.41	22.38	72.29
Canada	43,098	10.13	15.49	69.80	71.44
Chile	5,741	1.17	32.40	25.23	77.63
China	95,674	24.85	100.00	10.19	65.81
Colombia	3,236	1.47	48.63	15.72	88.63
Cyprus	3,348	0.15	31.30	47.14	74.23
Denmark	11,334	2.21	11.92	67.71	84.68
Dominican Republic	4,423	0.29	59.68	14.06	100.00
Finland	9,268	1.75	37.56	65.92	81.57
France	105,980	18.45	16.72	62.38	87.60
Germany	94,821	23.68	18.72	64.77	82.30
Hong Kong	97,836	1.47	44.93	77.72	56.21
Hungary	27,109	0.99	7.04	35.08	73.42
India	14,862	8.77	67.85	5.24	95.41
Indonesia	10,664	3.07	44.68	6.85	82.00
Ireland	16,045	1.85	42.42	82.75	75.03
Israel	6,214	1.19	37.43	48.32	99.58
Italy	71,388	15.05	10.44	57.83	84.55
Japan	25,642	31.13	16.64	61.08	85.75
Latvia	5,051	0.20	70.26	31.11	72.86
Mexico	36,453	7.29	23.53	26.50	90.47
Morocco	10,077	0.53	19.05	7.46	86.09



Country Name	Total Number of Tourists	Gross National Product	Annual Gross National Product Increase	Gross National Product Per Capita	Age Dependency Ratio
Netherlands	28,564	5.53	25.44	73.80	78.89
New Zealand	4,412	0.98	20.70	52.21	81.54
Norway	7,772	2.76	19.23	100.00	83.57
Peru	3,882	0.76	62.45	14.09	94.74
Poland	62,536	3.02	47.78	30.41	66.13
Portugal	33,310	1.64	16.80	43.68	79.61
Romania	18,702	1.20	42.25	23.07	70.44
Russian Federation	57,194	9.24	60.11	30.61	64.27
Saudi Arabia	15,657	2.73	14.21	41.43	92.68
Singapore	13,981	1.26	60.11	96.74	60.48
Slovak Republic	25,522	0.60	74.50	37.79	62.93
Slovenia	4,247	0.34	47.86	49.53	69.24
South Africa	13,524	2.04	38.63	18.22	88.99
Spain	69,942	10.25	25.09	58.66	74.96
Sweden	16,115	3.29	23.34	69.99	85.57
Thailand	18,482	1.76	34.72	14.26	68.53
Turkey	31,186	4.60	32.88	23.97	81.89
Ukraine	40,457	1.01	55.63	12.73	70.47
United Kingdom	100,320	19.91	18.02	65.17	83.57
United States	120,003	100.00	13.71	84.92	80.64
Uruguay	2,387	0.17	52.55	21.00	95.68
Venezuela	2,181	1.61	57.41	22.18	90.64

Table 4. Continued.

Country Name	Tourism Income	Tourism Expenditures	Population	Urban Population	Trade	Foreign Investments
Argentina	3.43	4.60	3.00	91.80	2.90	3.48
Australia	18.32	18.75	1.60	88.56	8.64	14.78
Austria	14.50	11.66	0.63	66.94	10.41	-5.33
Bangladesh	0.05	0.48	11.97	26.66	0.79	0.46
Belgium	8.49	17.54	0.81	97.34	18.51	9.17
Brazil	3.63	9.49	14.43	85.12	8.53	19.27
Bulgaria	2.73	2.36	0.58	70.80	1.45	9.04
Canada	12.26	28.37	2.50	80.30	23.98	41.96
Chile	1.53	1.85	1.26	88.16	3.27	6.98
China	28.28	30.25	100.00	42.20	58.87	85.04
Colombia	1.56	1.90	3.37	74.20	1.88	5.70
Cyprus	2.14	1.41	0.06	69.70	0.55	0.72
Denmark	4.28	8.00	0.41	86.42	7.88	-5.73
Dominican Republic	2.79	0.48	0.74	68.28	0.68	1.17
Finland	2.95	4.38	0.40	63.00	5.27	3.83
France	43.77	40.51	4.70	77.14	35.32	-48.17
Germany	32.25	85.28	6.24	73.56	71.52	-60.50
Hong Kong	12.54	13.68	0.53	100.00	20.78	-4.73
Hungary	3.89	3.17	0.76	67.10	5.47	3.26
India	7.72	9.72	85.35	29.26	13.82	5.74
Indonesia	4.01	5.98	17.05	50.34	5.87	1.58
Ireland	6.37	7.99	0.33	61.06	9.75	2.81
Israel	2.58	3.87	0.54	91.64	3.58	0.14
Italy	31.73	29.79	4.51	67.92	30.52	-36.47
Japan	8.54	33.89	9.70	66.32	36.39	-35.93
Latvia	0.61	0.93	0.17	68.08	0.75	1.36
Mexico	9.62	8.94	7.99	76.90	14.74	14.32
Morocco	5.71	1.29	2.37	55.68	1.50	1.54
Netherlands	13.70	17.71	1.24	81.28	27.17	49.74
New Zealand	3.70	2.80	0.32	86.44	1.97	-0.18
Norway	3.46	12.77	0.36	77.42	7.31	-6.10
Peru	1.53	1.16	2.16	71.30	1.36	3.80
Poland	8.04	7.59	2.89	61.38	8.89	12.60
Portugal	8.88	4.42	0.80	58.84	4.15	-1.75
Romania	1.42	1.57	1.63	54.06	3.08	6.76
Russian Federation	8.66	21.98	10.78	72.86	16.65	6.41
Saudi Arabia	4.65	19.62	1.84	82.58	9.77	17.14
Singapore	6.31	11.35	0.35	100.00	17.73	5.70
Slovak Republic	1.62	1.66	0.41	56.44	3.64	2.07

Country Name	Tourism Income	Tourism Expenditures	Population	Urban Population	Trade	Foreign Investments
Slovenia	1.70	1.15	0.15	48.90	1.65	-0.19
South Africa	6.80	5.55	3.66	60.26	4.64	1.93
Spain	44.71	22.16	3.41	76.98	21.61	-51.03
Sweden	9.42	14.32	0.69	84.46	11.03	-6.56
Thailand	14.18	6.26	5.08	32.98	8.47	5.82
Turkey	14.20	3.38	5.54	68.22	7.98	13.97
Ukraine	3.66	3.66	3.53	67.92	3.37	6.46
United Kingdom	33.14	79.52	4.63	89.86	39.20	-88.26
United States	100.00	100.00	22.88	81.40	100.00	-100.00
Uruguay	0.64	0.32	0.25	92.20	0.34	0.87
Venezuela	0.61	2.03	2.09	92.98	3.19	0.68

*Table 5. Data of 2015 converted for using in SPSS.*

Country Name	Total Number of Tourists	Gross National Product	Annual Gross National Product Increase	Gross National Product Per Capita	Age Dependency Ratio
Argentina	9,276	2.27	69.24	23.49	91.97
Australia	11,394	7.23	38.21	60.74	79.40
Avustria	31,612	2.89	22.32	64.88	78.00
Bangladesh	1,342	0.55	63.42	2.19	91.80
Belgium	16,052	3.52	10.29	60.28	84.93
Brazil	9,986	11.40	52.63	16.99	80.64
Bulgaria	11,507	0.36	63.69	22.39	72.87
Canada	44,179	10.43	5.31	63.41	71.65
Chile	5,760	1.19	37.76	23.65	77.06
China	98,893	31.47	98.35	10.15	65.35
Colombia	3,264	1.69	27.97	14.54	88.04
Cyprus	3,446	0.17	36.57	45.26	73.74
Denmark	10,850	2.37	-8.91	62.80	85.83
Dominican Republic	4,393	0.32	53.84	13.34	99.47
Finland	9,437	1.88	9.45	61.27	82.18
France	101,796	19.86	2.22	58.10	88.46
Germany	97,884	25.29	10.12	60.12	83.32
Hong Kong	99,230	1.50	24.23	72.14	55.04
Hungary	26,242	1.08	6.15	33.77	73.83
India	16,014	8.45	52.44	4.97	94.40
Indonesia	11,720	3.55	61.53	6.56	81.70
Ireland	15,903	1.85	-31.10	71.09	76.08
Israel	6,779	1.41	43.66	45.03	100.00
Italy	71,018	15.98	-13.51	53.24	85.61
Japan	24,338	34.01	-12.33	55.04	87.81
Latvia	5,466	0.24	-46.63	29.96	73.62
Mexico	37,087	7.58	15.27	24.93	89.49
Morocco	10,937	0.62	57.24	7.11	85.04
Netherlands	28,562	6.07	20.45	70.05	79.67
New Zealand	4,376	0.82	-14.24	47.51	81.69
Norway	7,994	3.14	18.59	100.00	83.81
Peru	4,029	0.90	100.00	13.96	94.20
Poland	63,203	3.68	51.26	29.51	65.56
Portugal	36,960	1.75	-0.36	41.04	80.37
Romania	21,934	1.39	96.56	24.59	70.70
Russian Federation	60,214	11.60	53.70	33.17	63.89
Saudi Arabia	18,844	3.31	44.36	38.58	91.39
Singapore	14,606	1.35	18.26	85.30	59.24
Slovak Republic	21,684	0.69	63.21	37.78	62.63
Slovenia	4,230	0.38	35.78	47.57	69.99
South Africa	14,021	1.92	37.69	17.07	88.92
Spain	68,545	11.10	8.79	53.73	76.06
Sweden	16,889	3.39	-4.19	64.21	86.24
Thailand	18,444	1.90	25.23	13.27	68.38
Turkey	34,867	5.08	6.75	22.91	81.08
Ukraine	40,948	1.26	21.51	11.94	69.85
United Kingdom	99,153	18.53	5.61	60.77	83.99
United States	121,487	100.00	-0.01	76.87	81.13
Uruguay	2,672	0.22	87.44	20.76	95.48
Venezuela	2,490	2.17	48.99	20.89	90.31

Table 5. Continued.

Country Name	Tourism Income	Tourism Expenditures	Population	Urban Population	Trade	Foreign Investments
Argentina	3.19	5.06	3.01	92.00	3.35	7.55
Australia	17.10	21.11	1.62	88.74	9.78	8.31
Avustria	14.62	11.86	0.63	67.16	10.62	-20.78
Bangladesh	0.05	0.78	12.08	27.14	0.89	0.91
Belgium	7.84	17.70	0.81	97.36	19.60	-21.58
Brazil	3.67	11.25	14.49	85.58	10.20	22.29
Bulgaria	2.90	2.87	0.58	71.10	1.61	8.32
Canada	10.67	28.83	2.51	80.40	23.51	-23.82
Chile	1.58	1.52	1.27	88.44	3.32	6.52
China	26.50	34.74	100.00	43.10	64.01	85.46
Colombia	1.50	1.98	3.40	74.50	2.13	7.56
Cyprus	1.93	1.59	0.07	69.90	0.60	0.06
Denmark	4.01	8.20	0.41	86.68	8.31	-11.45
Dominican Republic	2.51	0.44	0.75	69.02	0.67	2.60
Finland	2.92	4.69	0.40	63.30	5.53	-9.63
France	40.13	44.19	4.70	77.36	36.08	-91.17
Germany	30.76	87.64	6.20	73.34	73.16	-100.00
Hong Kong	12.26	13.47	0.53	100.00	20.28	8.21
Hungary	4.27	3.93	0.76	67.50	5.69	1.83
India	7.48	10.24	86.06	29.54	14.49	20.79
Indonesia	4.89	7.25	17.16	51.46	6.80	3.10
Ireland	5.98	8.94	0.33	61.34	9.46	-31.62
Israel	2.89	3.77	0.55	91.66	3.75	3.32
Italy	29.30	31.98	4.52	68.08	30.46	-24.89
Japan	8.28	33.04	9.64	66.48	38.78	-96.28
Latvia	0.68	1.06	0.17	68.12	0.74	0.99
Mexico	8.80	8.63	8.03	77.20	14.52	20.97
Morocco	5.34	1.62	2.39	56.02	1.79	1.95
Netherlands	12.33	18.83	1.24	81.82	28.79	-55.18
New Zealand	3.02	2.54	0.32	86.56	1.68	4.77
Norway	3.34	13.51	0.36	77.48	7.93	-14.91
Peru	1.44	1.15	2.18	71.40	1.57	5.61
Poland	7.71	8.80	2.88	61.32	10.09	10.64
Portugal	8.44	4.48	0.80	59.46	4.30	1.73
Romania	1.58	2.04	1.62	54.24	3.40	12.33
Russian Federation	9.56	23.84	10.72	72.84	20.16	17.58
Saudi Arabia	4.34	14.13	1.87	82.42	11.36	32.58
Singapore	6.36	12.03	0.37	100.00	18.60	17.57
Slovak Repuclic	1.80	2.20	0.41	56.56	3.77	2.70
Slovenia	1.87	1.33	0.15	48.60	1.71	0.46
South Africa	5.32	5.76	3.68	60.74	4.65	10.66
Spain	42.17	22.74	3.44	77.12	21.28	-0.09
Sweden	8.65	14.67	0.70	84.54	11.05	6.23
Thailand	13.20	5.90	5.09	33.32	9.32	4.02
Turkey	15.02	3.42	5.58	68.68	8.68	14.24
Ukraine	4.04	3.89	3.49	67.98	3.67	8.97
United Kingdom	27.23	71.39	4.64	89.94	36.94	-63.10
United States	100.00	100.00	22.98	81.70	100.00	-20.66
Uruguay	0.71	0.41	0.25	92.30	0.44	1.65
Venezuela	0.59	2.18	2.11	93.32	3.62	-0.84

Table 6. Relation between global passenger flow and factors.

Factors	"R square" value
Gross National Product	0.389
Annual Gross National Product Increase	0.032
Gross National Product Per Capita	0.109
Age Dependency Ratio	0.097
Tourism Income	0.642
Tourism Expenditures	0.632
Population	0.059
Urban Population	0.009
Trade	0.657
Foreign Investments	0.004

**Table 7.** Model summary table for all factors of year 2013.

<b>Model Summary</b>				
<b>Model</b>	<b>R</b>	<b>R Square</b>	<b>Adjusted R Square</b>	<b>Std. Error of the Estimate</b>
1	.922a	.851	.812	13.4344692

Predictors: (Constant), Investment, Age, UrbanPopulation, GDP, GDPanual, Population, GDPppp, Expenditure, Income, Trade

**Table 8.** Table of coefficients for all factors of year 2013.

<b>Coefficients<sup>a</sup></b>					
<b>Model</b>	<b>Unstandardized Coefficients</b>		<b>Standardized Coefficients</b>	<b>t</b>	<b>Sig.</b>
	<b>B</b>	<b>Std. Error</b>	<b>Beta</b>		
(Constant)	65.146	21.528		3.026	.004
GDP	-1.453	.329	-.706	-4.421	.000
GDPanual	-.041	.123	-.029	-.332	.742
GDPppp	-.245	.121	-.205	-2.028	.049
Age	-.706	.231	-.234	-3.058	.004
Income	1.282	.273	.697	4.703	.000
Expenditure	.506	.363	.334	1.394	.171
Population	-.006	.183	-.003	-.031	.975
UrbanPopulation	.104	.149	.058	.695	.491
Trade	.928	.535	.560	1.733	.091
Investment	.036	.072	.038	.496	.623

Dependent Variable: GlobalPassengerFlow

**Table 9.** Global passenger flow for the year 2015, derived from the 2013 year model.

<b>Country Name</b>	<b>Global Passenger Flow for the 2013 Year Model</b>	<b>Global Passenger Flow for the year 2015</b>	<b>Difference (%)</b>
Austria	31,176,612	31,612,000	1.38
Canada	40,523,769	44,179,000	8.27
China	81,857,870	98,893,000	17.23
Denmark	9,388,910	10,850,000	13.47
Germany	112,852,134	97,884,000	15.29
India	17,028,611	16,014,000	6.34
Italy	56,340,246	71,018,000	20.67
Romania	18,021,372	21,934,000	17.84
Slovak Republic	22,598,238	21,684,000	4.22
South Africa	14,309,717	14,021,000	2.06
Spain	73,248,964	68,545,000	6.86
Sweden	19,352,953	16,889,000	14.59
Turkey	28,218,395	34,867,000	19.07
United Kingdom	78,416,694	99,153,000	20.91
United States	121,339,554	121,487,000	0.12

**Table 10.** Global passenger flow for the year 2015, derived from the 2014 year model.

<b>Country Name</b>	<b>Global Passenger Flow for the 2014 Year Model</b>	<b>Global Passenger Flow for the year 2015</b>	<b>Difference (%)</b>
Austria	35,186,400	31,612,000	11.31
Canada	43,625,154	44,179,000	1.25
China	85,700,777	98,893,000	13.34
Denmark	12,775,265	10,850,000	17.74
Germany	124,317,367	97,884,000	27.00
India	16,957,872	16,014,000	5.89
Italy	59,363,264	71,018,000	16.41
Romania	19,569,142	21,934,000	10.78
Slovak Republic	26,451,860	21,684,000	21.99
South Africa	13,272,145	14,021,000	5.34
Spain	70,955,237	68,545,000	3.52
Sweden	16,756,380	16,889,000	0.79
Turkey	29,790,594	34,867,000	14.56
United Kingdom	69,354,826	99,153,000	30.05
United States	113,752,957	121,487,000	6.37

As can be seen from Table 9 and Table 10, the number of passenger flows estimated with the final models is close to the actual number of passenger flow data. Especially the

model established in India, South Africa, Spain and the United States gave very close results to reality.

## 6. Conclusion and Suggestions

With the decrease in prices in air transport, the demand for air transportation increased. As a result, new airlines have started to fly, existing companies have opened new routes and the number of flights to the places has increased. In order to increase the number of new lines or the number of flights on existing lines, it is important for the companies to know the demand on those lines and the policy they will form.

The aim of this study is to determine the factors affecting the demand for international flights and to examine these factors. Studies in the study have shown that there are many factors that affect the demand for air transport. Among these factors, the most important ones were found as “trade”, “tourism income”, “tourism expenditures” and “gross national product” factors.

In the study, the factors were examined one by one in detail and their relations with global passenger flows were emphasized, the effects of these factors were weighted numerically and models were created to predict the passenger demand for the coming years. The estimated number of passenger flows with the models created is close to the actual number of passenger flow data. Especially the model established in India, South Africa, Spain and the United States gave very close results to reality.

With this study, it is aimed that the companies operating in the field of passenger transportation will be able to use the findings obtained and reach a decision-making result. As further studies, models will be developed to give closer results to the values realized for all countries and countries will be grouped to determine which model is more meaningful for which countries.

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