IBN HALDUN UNIVERSITY
SCHOOL OF GRADUATE STUDIES
DEPARTMENT OF MANAGEMENT

Master Thesis

DETERMINANTS OF AIR TRAVEL DEMAND IN RUSSIA: THE CASE OF MOSCOW-ISTANBUL FLIGHTS

BULAT SABITOV

JUNE 2019

IBN HALDUN UNIVERSITY
SCHOOL OF GRADUATE STUDIES
DEPARTMENT OF MANAGEMENT

Master Thesis

DETERMINANTS OF AIR TRAVEL DEMAND IN RUSSIA: THE CASE OF MOSCOW-ISTANBUL FLIGHTS

by

BULAT SABITOV

A thesis submitted to the School of Graduate Studies in partial fulfillment of the requirements for the degree of Master of Science in Management

JUNE 2019

APPROVAL PAGE

This is to certify that we have read this thesis and that in our opinion it is fully adequate, in scope and quality, as a thesis for the degree of Master of Science in Air Transport Management.

Examining Commitee Members:

	OPINION	SIGNATURE
(Title and Name)		
Prof. Dr. Fuat Erdal (Thesis Advisor)	Approved	
Dr. Sadullah Yıldırım (Title and Name)	Approved	
Dr. Murat Güven (Title and Name)	Approved	
(Title and Name)		
(Title and Name)		

This is to confirm that this thesis/project complies with all the standards set by the Graduate School of Business Ibn Haldun University:

Date 26.08.2019

Seal/Signature

Ibn Haldun University
Graduate School of Business

PLAGIARISM CLEARANCE PAGE

I hereby declare that all information in this document has been obtained and presented in accordance with academic rules and ethical conduct. I also declare that, as required by these rules and conduct, I have fully cited and referenced all material and results that are not original to this work.

Bulat Sabitov: Signature: 

ABSTRACT

DETERMINANTS OF AIR TRAVEL DEMAND IN RUSSIA: THE CASE OF MOSCOW-ISTANBUL FLIGHTS

Bulat Sabitov
MSc in Air Transport Management
Thesis Advisor: Prof. Dr. Fuat Erdal
June 2019, 92 Pages

This study examines the factors affecting air travel demand for Moscow – Istanbul market and presents a comprehensive econometric demand model in which the most significant parameters for air travel demand have been identified. The analysis is build on time series data from January 2014 to December 2018. DOLS and FMOLS regression models are applied to find the cointegration relationship and compare the effect of these variables. The aim is to find out the most critical factors and how they affect the air travel demand and to provide robust air travel demand elasticity estimates. Besides using the standart demand factors like income per capita and price, frequency, crude oil price and PMI index are included in the model. The scholarly contribution of the thesis lies in taking into account the effect of currency crisis and international economic sanctions in Russian Federation between 2014-2018 in estimating the model. Empirical results indicate that ticket price of Turkish Airlines, ticket price of Aeroflot Russian Airlines (a rival company) and per capita income of Russian travellers are the most significant determinants of travel demand. The coefficients of all three determinants are estimated to be elastic, indicating that the Russian travelers are quite sensitive to the changes in prices and income. Moreover, travel demand is affected negatively by seasonal changes. Flight frequency is found to be statistically insignificant in the model.

Keywords: Air Travel Demand Factors, Air Travel Demand Elasticity, Econometric Demand Model, Russian Federation Air Travel Industry.

ÖZ

RUSYA'DA HAVAYOLU SEYAHATİ TALEBİNİ BELİRLEYEN ETKENLER: MOSKOVA-İSTANBUL UÇUŞLARI ÖRNEĞİ

Bulat Sabitov
Hava Taşımacılığı Yönetimi Yüksek Lisans
Tez Danışmanı: Prof. Dr. Fuat Erdal
Haziran 2019, 92 sayfa

Bu çalışma, Moskova - İstanbul pazarı için havayolu seyahati talebini etkileyen faktörleri incelemekte ve en önemli parametrelerin tanımlandığı kapsamlı bir ekonometrik talep modelini sunmaktadır. Analiz, Ocak 2014 - Aralık 2018 zaman aralığına ait veriler üzerine kuruludur. Eşbütünleşme ilişkisini bulmak ve değişkenlerin etkilerini karşılaştırmak için DOLS ve FMOLS regresyon modelleri uygulanmaktadır. Amaç, en kritik değişkenlerin, havayolu taşımacılığını nasıl etkilediklerini anlamak ve talep elastikiyetini tahmin etmektir. Kişi başına gelir, fiyat ve uçuş frekansı gibi standart talep faktörlerini kullanmanın yanı sıra ham petrol fiyatı ve PMI endeksi kriterleri değerlendirilmektedir. Tezin bilimsel katkısı, döviz kuru değişkeninin kullanılması, ayrıca havayolu taşımacılık pazarının Rusya Ruble değerinin düşmesi ve Rusya'ya uygulanan uluslararası ekonomik yaptırımların nedeniyle 2014-2018 senelerinde yaşanan ekonomik kriz döneminde değerlendirilmesidir. Tahmin sonuçları, Türk Hava Yolları bilet fiyatları, rakip bir firma olan Aeroflot Rus Hava Yolları bilet fiyatları ve Rus tüketicilerin kişi başına gelirlerinin, havayolu seyahati talebini etkileyen en önemli faktörler olduğunu göstermektedir. Her üç katsayının da esnek bulunması, tüketicilerin fiyat ve gelirdeki değişmelere karşı oldukça esnek olduklarını göstermektedir. Havayolu seyahatinin, mevsimsel etkenlerde negatif etkilendiği görülmektedir. Uçuş frekansının ise istatsitiksel olarak anlamlı olmadığı ortaya çıkmıştır.

Anahtar Kelimeler: Havayolu Taşımacılık Talep Faktörleri, Havayolu Taşımacılık Talep Elastikliği, Ekonometrik Talep Modeli, Rusya Federasyonu Havacılık Endüstrisi.

DEDICATION

It is dedicated to my wife Nataly and our daughter Emily.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

PMI	Purchasing Managers Index
PPP	Purchasing Power Parity Index
LCC	Low Cost Carrier
FSNC	Full Service Network Carrier
ADF	Augmented Dickey-Fuller Test
PP	Phillips – Perron Test
KPSS	Kwiatkowski–Phillips–Schmidt–Shin Test
DOLS	Dynamic Ordinary Least Squares Test
FMOLS	Fully Modified Ordinary least Squares Test
SIC	Schwarz Information Criterion
ARIMA	Autoregressive Integrated Moving Average
BPNN	Back-Propagation Neural Network
LSSVR	Least Squares Support Vector Regression
TS	Time Series
LM	Lagrange Multiplier
ML	Maximum Likelihood
MIDAS	Provider of GDS Marketing Information Data
GDS	Global Distribution System
MIDT	Marketing Information Data
TCH ATSS	Transport Clearing House Air Transport Settlement System
OTA	Online Travel Agency
FFP	Frequent-Flyer Program
CPI	Consumer Price Index
ICAO	International Civil Aviation Organization
IATA	International Air Transport Association
FDI	Foreign Direct Investment
GDP	Gross Domestic Product
O&D	Origin and Destination
VCIOM	Russian Public Opinion Research Centre
CIS	Commonwealth of Independent States
MIA	Russian Federation Ministry of Internal Affairs
UNWTO	United Nations World Tourism Organization
ATOR	Association of Tour Operators of Russia
MAH	Moscow Aviation Hub
CASK	Cost Per Available Seat Kilometers

CHAPTER 1

INTRODUCTION

As in any industry, understanding the factors affecting demand is an important point for making effective management decisions. It would be correct to assume that the travel prices and income have a significant impact on air travel demand. It should be borne in mind that there is a certain number of additional factors that will have an indirect effect on the degree of demand sensitivity. To date, the existing databases in aviation industry allow us to analyze a very large amount of quantitative data. This data is often sufficient for planning and forecasting the development of various situations in the market. Including the information available, it is possible to make reliable estimates of the elasticity of demand. The availability of reliable quantitative information is a prerequisite for making the right management decisions, because it provides an opportunity to prepare for various development scenarios. In the aviation industry, pricing, being one of the priority directions of management, also strongly depends on the availability of reliable statistics on passenger traffic and fares.

Knowing the main determinants of demand is an important step. However, measuring the impact of each factor, especially price and consumer's income on demand gives more accurate information to the sellers and producers. The elasticity of demand shows how much demand will change in response to a one unit of price change. In other words, price elasticity of demand measures the reaction of the consumers to the price changes. It must be understood that consumer demand is a volatile category. In this regard, it is necessary to constantly monitor changes in the structure of demand. Among the factors determining the volume and structure of consumer demand, the most significant are the price of goods, incomes of consumers, prices of related goods (interchangeable and complementary), advertising, tastes and preferences of consumers. Each of these factors requires a detailed study.

In this study, we will focus our attention on three types of demand elasticity:

1. The price elasticity of demand estimates the change in demand sensitivity for a product when the price changes. More precisely, it is the percentage change in the demand divided by the percentage change in price. Price elasticity of demand is the value used to measure the sensitivity of the volume of demand to a change in the price, if other factors affecting demand are constant. The calculation of the coefficient of price elasticity is important because the degree of elasticity influences the change in the amount of revenue when the price changes.

2. Cross price elasticity of demand means demand sensitivity for one product in response to a change in the price of another product. According to the coefficient values of cross elasticity of demand, there are substitute or rival goods, i.e. a rise in prices for one product leads to an increase in demand for another; and complementary products, i.e. higher prices for one product leads to a decrease in demand for another product and vice versa.

3. Income elasticity of demand is the degree of demand sensitivity in response to changes in consumer income. Depending on the value of the coefficient of income elasticity of demand, there are normal goods, the demand for which grows with the growth of income; and inferior goods, the demand for which decreases with the growth of income.

The air travel demand will show different elasticities depending on the size of the market. In this study, it will be relevant to highlight the national and regional levels. In the airline industry, the regional level includes different city pair routes. Characteristics such as, the presence of competition and economic freedom, market capacity will determine the elasticity of demand. An individual airline ticket price elasticity will be different from price elasticity within the market as a whole.

Nowadays a twofold trend can be observed in aviation market. Passengers are becoming more sensitive to changes in the cost of air travel due to an increase in sales channels, including the Internet. The airline market has become more transparent. Passengers have open access to the fares of various carriers, including LCC. They have a clear understanding of the quality of services, which increases competition. On the

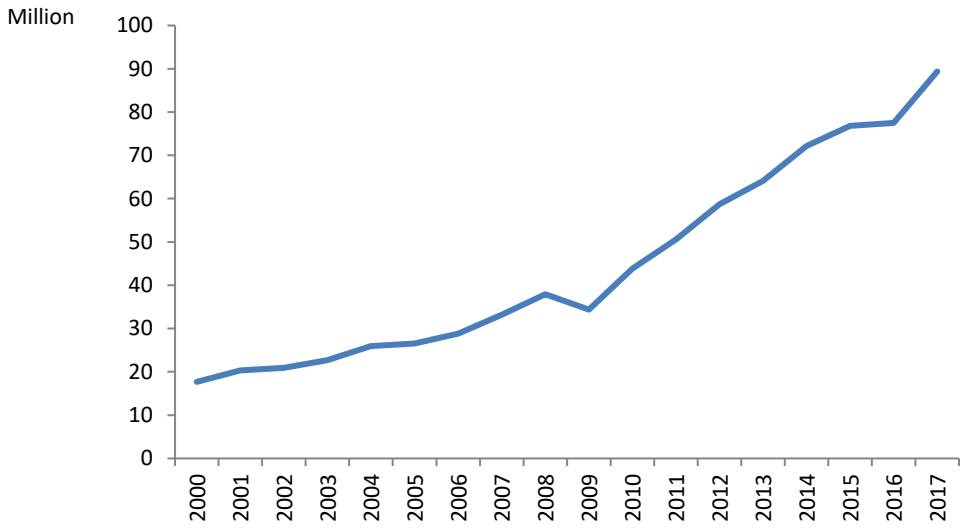
other hand, the cost of the ticket in the total cost of the trip is reducing, making the cost of the ticket less important expenditure item.
Higher prices for related goods, which include the cost of air travel, entail an increase in the price of the tourist product itself. It is believed that in Russia the demand for air travel and tourism is inelastic. The inelasticity of demand is explained by the fact that prices are rising faster than the demand for tourist services decreases because of the economic instability.

This study focuses on the demand and price and income elasticities for Moscow – Istanbul route. It is believed that understanding the socio-economic and transportation factors which determine the air travel volume are being of critical importance for revenue management and tactical decisions.

The aim of this thesis is twofold:
1. To find out main determinants that influence the air travel demand on Moscow – Istanbul market during the period 2014 through 2018.2. To set up an econometric model and estimate the variables and the parameters.

2. To measure air travel demand elasticities that will guide forecast, strategy and tactical decisions related to revenue management and flight planning are based on proper and reliable evidence.

The Russian outbound air travel demand has been growing steadily from 2000s due to opening of markets, decreasing in air fares, air carriers service quality improvements, and rise in income (Figure 1.1).



Source: ICAO, Civil Aviation Statistics of the World and ICAO staff estimates.

Figure 1.1. Russian aviation market, passengers carried

The analysis incorporates time-series monthly data obtained from Turkish Airlines Data Warehouse (DWH) and MIDAS DOB Systems, which is a provider of GDS Marketing Information Data (MIDT). The economic data was derived from the sources of the Russian Federation Federal State Statistics Service, IndexMundi, RateStats and IHS Markit data portals. The correctness and limitations of the data are considered particularly hereinafter.

Chapter 2 summarizes the recent and relevant literature on air travel.

In Chapter 3 we estimate the impact of these variables on air travel demand using two estimation methods namely Fully Modified Ordinary least Squares (FMOLS) and Dynamic Ordinary Least Squares (DOLS). The list of variables in the estimation is limited by the quality and accessibility of the data. The model analyses the relationship between the passenger traffic from Moscow to Istanbul and socio-economic and transport related independent variables. Appendix A illustrates the raw data employed in the models.

The analysis concerns the air passenger traffic from Moscow Aviation Hub (Vnukovo, Sheremetyevo, and Domodedovo airports) to Istanbul Ataturk Airport. Monthly traffic

and price data refer to the time interval from January 2014 to December 2018 for Moscow – Istanbul route. Passenger traffic reflects the amount of economy class passengers on the route on monthly basis. The average ticket price shows the average overall round-trip ticket price for each airline (includes all taxes and fees, in Russian ruble). Passenger flow in the opposite direction is not included. In this thesis ‘traffic’ and ‘air travel demand’ indicate the number of round trip passengers on Moscow – Istanbul route. MIDAS DOB market reports data includes data for 60 months in a row.

CHAPTER 2

LITERATURE REVIEW

Deregulation of aviation industry, evolving of Low Cost Carriers (LCC) and the globalization are encouraging more and more new researchers to study the air travel industry. Estimating the factors affecting the demand is one of the main topics for research. This is relevant not only for airlines, but also for airports as they need to form and prepare the necessary infrastructure in advance, taking into account the projected passenger traffic.

Air travel demand research began in the middle of the last century with the development of civil aviation. As economic theory, statistics, and econometrics developed, each new study made an additional contribution. Social, economic and political changes taking place in the world necessitated to analyze their positive and negative influences and thus complement the list of factors of critical importance. The first studies dealt mainly with the classification and study of factors affecting the demand for air transportation. Most of the authors distinguish socio - economic and quality of service related factors. This separation allows us to understand which determinants are under airlines control, and which are not. Undoubtedly, there are regional and local features. Their study contributes to a more complete understanding of the situation.

(Ippolito, 1981) studies the effect of quality of service variables on demand using demand and supply euqations and two stage least squares. The results suggest that demand is positively related to the number of flights. While high occupancy of the seats has a negative effect. The flight frequency has a positive effect due to the fact that passengers have the opportunity to choose more suitable flight and find lower fares. (Ghobrial, A.; Kanafani, 1995) also examines a number of variables that belong to quality of service group, and includes frequency, aircraft size and trip duration. The study is based on gravity model. The important conclusion of this work is that passengers prefer direct flights, and are willing to partially put up with a low frequency

of flights, rather than fly through a transit airport. After a study of more than 100 airport pairs, he concludes that the price structure of near-monopoly markets is higher than in highly competitive markets.

The effect of charter flights is explored by (Haitovsky et al, 1987). Charter flights, on the one hand, contribute to the development of tourism and the economy of the region due to the fact that they make the air travel more affordable, since the cost of the flight on a charter flight is lower than on a regular flight. On the other hand, charter carriers, first of all, are guided by the desire to gain economic benefits. That is why they choose the most popular destinations and only in the high season. By creating price competition, they thereby undermine the economy of regular carriers, the goal of which is longer-term relationships. In the case of national carriers, the economic component is often not a priority. The main goal is to provide air travel opportunities for the development of a region or country.

As determining factors, opportunity cost and aircraft size variables are used in (Jorge-Calderón, 1997) study. Based on regressions outputs frequency on short-haul routes is more statistically significant than the plane size variable. However, on long-haul routes the situation is the opposite. Of the variables considered, such as population, income, ticket fare and distance, low fares have the greatest impact on the demand for air travel. (Karlaftis et al, 1996) employed TSEV models for demand analysis and passenger traffic forecasting. He notes that a fluctuation of R2 within the 0.72 - 0.94 range is sufficient. Higher R2 means more variables in the model, which means more uncertainty. Also, markets have their own specifics and factors effecting demand. Therefore, it is difficult to choose one universal model and it is necessary to take into account the special aspects of each airport and flight destination. Each market has its own set of variables and at different influence levels. (Xie, Wang, & Lai, 2014) uses a seasonal decomposition and LSSVR approach for the short-term forecast of passenger traffic. He also compares these methods with ARIMA and BPNN, which showed lower forecast accuracy compared to LSSVR.

(Bender & Stephenson, 1998) examines business travel demand. As technology and ground transport modes evolve, airlines are facing increasing competition. To preserve the loyalty of passengers, airlines need to take into account the latest trends in the

transport services market and adjust pricing policies to meet changing conditions. (De Vany, 2001) investigates the time factor. The results suggest that air travel is relatively time-intensive on short-haul routes and time-intensive on long-haul routes. Due to this, price elasticity is greater on short-haul and time elasticity is smaller on long-haul routes. The air travellers and their employers value their time at their wage rate.

(Abed, Ba-Fail, & Jasimuddin, 2001) distinguishes variables that are outside of airline industry influence, and variables that can be controlled by airlines. The first group includes economic, social, political and demographic factors, as well as the level of inflation, interest rate and exchange rates. He applied a number of regression equations, and according to models outputs, the main factors showed to be population and total expenditure. (Bafail, A.O.; Abed, S.Y.; Jasimuddin, 2002) analyze air travel demand in the Kingdom of Saudi Arabia using stepwise regression. The model is based on total expenditures and population. The results obtained allow to conclude that the passenger traffic volume strongly depends on the level of economic activity in the country. Models utilizing more variables were subject to multicollinearity, which adversely affects the ability to make reliable forecasts. (Valdes, 2015) makes an attempt to assess the influence of various factors on demand in Middle Income Countries. Income elasticity and income growth account for 75% of passenger traffic growth. As variables, GDP per capita, FDI, CPI, jet fuel and LCC's were used.

(Metz, 2012) draws attention to the fact that travel demand gradually uncouples from income factor. This is especially true for developed countries with a high average income. A decrease in the birth rate and an aging population leads to a decrease in per capita daily travel. It is already possible to observe that Asian countries and regions with positive demographic situation show the biggest passenger traffic growth. Based on Mexican air transport market (Carmona-Benítez, Nieto, & Miranda, 2017) utilizes the Econometric Demand Model for air travel demand estimation and forecasting. The model primarily uses economic variables, such as economic activity of the population, CPI and the number of incoming tourists. The authors are trying to predict which airport has the potential to become a national hub and determine its geographic location.

The effect of immigration on air travel demand is investigated by (Choo, 2018). The research is based on Canada's and includes distance, GDP per capita and visa requirements as regressors. The results show that a 10% increase in foreign-born Canadian residents affects a 3% increase in inbound travel demand. Also positive relationship can be observed between population, country of origin GDP and demand volume. However, over time the ethnic ties among older generations weaken and the effect on demand decreases. Therefore, it is more important to take into account migration flows in recent years than the total flow of migrants in recent decades.

(Gelhausen, Berster, & Wilken, 2018) makes an attempt to offer an alternative model of passenger traffic forecast, which will take into account demand shocks and GDP - elasticity. The former four-step model, which is used at German airports, needs further work as air traffic data has become more accessible in recent years. Also, an attempt is made to evaluate the effect of Brexit. As in this thesis, he uses MIDT data of several providers. The hallmark of this work is that the model is built based on direct forecasting, without digging into the passenger O&D characteristics and routes.

The demand elasticity is a special subject for study. The most important elasticities for aviation market are price and income elasticities of demand. (Alperovich, Gershon; Machnes, 1994) used the OLS and ML estimation procedures and concluded that air travel demand shows income elasticity but not price elasticity. He considered income not as current income, but as permanent income. According to economic theory, consumers' wealth affects demand more than current income. This being said it is difficult to quantify consumers' wealth. Perhaps that is why many air travel demand studies are based on current income because of the availability of this data. (Brons, M.; Pels, E.; Nijkamp, P.; Rietveld, 2002) utilizes meta regression techniques to estimate air travel demand elasticities. He discusses two groups of variables. The geo-economic factors include income (GDP), transfer distance, geographic scope and fare class. The moderator variables include elasticity time horizon and data collection period. The outputs show that long-run price elasticities are higher. The difference between business and leisure passengers' price sensitivity is about 0.6. (Battersby, B.; Oczkowski, 2001) econometric research draws a conclusion that elasticity indicators vary greatly between routes and classes of service. Price elasticity ranges between -

1.68 and -0.21 for economy class passengers. Elasticity for business class passengers varies from -1.11 to -0.10.

(Bhadra, 2003) study supports the assumption that income and population are key determinants of air travel demand. In his work, he notes that as economic activity increases, the growth rate of demand gradually decreases. Also, short-haul routes showed less elasticity in price compared to long-haul routes. Perhaps this is due to the relatively low air fares. However, all models confirmed the existence of price elasticity. He emphasizes that using a large number of variables increases R2, but reduces the explanatory power of the model. Interestingly, in his research, he uses one way average fares and airlines 'market power.

An interesting demand elasticity study was conducted by (Mumbower, Garrow, & Higgins, 2014). The elasticity of demand for air travel is considered at a more detailed level. Many previous works have studied the sensitivity of demand on market-level and route-level. Deepening on the flight-level makes it possible to form a pricing policy and make forecast based on the day of the week and the time of day. Likewise, not only the time factor is important here, but also the time of day and the weekdays of departures of competitive airlines. This allows you to form more accurate pricing policy and avoid lost profits during promotions and sales campaigns. A feature of the study is the use of online data. Unlike statistical historical data, online information refers to the future and provides an opportunity to adjust the policy and maximize revenue. In this study, OLS and 2SLS approaches were used. (Gallet & Doucouliagos, 2014) study revealed a baseline income elasticity of demand 1.186, which corresponds to the assumption that air travel is a luxury. At the same time, on international routes, the elasticity rises to 1.546. A similar situation is typical for the Russian air travel market. Due to Russian ruble PPP index decrease international air travel and vacation abroad are becoming less accessible due to the financial possibilities of consumers.

Among the latest studies (Boonekamp, Zuidberg, & Burghouwt, 2018) introduces the gravity model, analyses ethnic relations between regions and the number of employees whose professional duties are directly or indirectly related to the aviation industry. The study used a two-stage least squares approach. According to the results, the factor of presence on the LCC market stimulates the growth of passenger traffic. The presence

of ethnic and cultural ties enhances migration, which in turn has a positive effect on passenger traffic. Also, a positive relationship is noted between air travel demand and the level of development of knowledge-intensive and technological sectors of the economy. Price elasticity of demand varies from -0.55 to -0.63, which corresponds to previous studies.

In megacities, airports compete for airlines and passenger traffic. The growth of non-aeronautical revenue in the overall revenue structure is investigated by many authors. (Cohas, Belobaba, & Simpson, 1995) focused on airport market shares for 9 routes in cities with several airports. Moscow Air Hub is an example of such a system. The distribution of passenger traffic between competing airports is considered through the prism of airfare and frequency. The results showed that the cost of tickets and frequency are of high statistical significance. One of the important factors in the choice of airport was transport accessibility. In this case, the catchment area is not the key factor. (Cohas et al., 1995) concludes that the presence of small regional airports in cities with large passenger traffic will help reduce congestion. At the same time, regional airports - satellites will remain competitive due to more affordable air ticket fares and convenient frequency.

Castillo-Manzano (2018) investigates consumer behavior at airports in Spain. Using statistical survey methods, he concludes that at airports that offer a wider choice of services and goods, the probability of consuming services is 4.1% and the probability of making a purchase is 1.3% higher than at reagional airports. The spending also increases by 3.53 Euro. Also it should be taken into account that hub airports have not only a wide range of goods and services, but also are cheaper than regional airports. The study results suggest that the development of shopping malls at airports can provide considerable non-aeronautical revenues. The growth of non-aeronautical revenues in turn gives airports the opportunity to lower fares for airlines and attract new ones, thus expanding the route network.

(Fasone, Kofler, & Scuderi, 2016) also discusses the importance of non-aeronautical revenues based on German airports. It is an attempt to analyze the determinants of non-aviation revenues using ridge regression and partial least squares PLRS. Despite the fact that at some airports, non-aviation revenues account for up to half of all revenue,

airport managers do not concentrate their whole attention on commercial activities to passengers. This is due to the fact that aviation gains are less risky and more predictable.

Later models are based on historical data that have become available in recent decades. One of the trends is forecasting demand and form pricing policies of airlines based on online data. (Granados, N.; Gupta, A.; Kauffman, 2012) examines the elasticity of demand in the light of the development of the Internet as a new sales channel. The availability and transparency of prices, the development of OTA agencies contribute to the fact that an increasing number of travellers independently make a choice about the trip and purchase. In this regard, the demand is becoming more price elastic. For analysis used log-linear demand model and 2SLS. Comparison of demand price elasticity between different sales channels shows that offline channels are less price elastic than opaque OTA's. (Kim & Shin, 2016) analyzes big data from search engines and offers to airports a short term passenger traffic forecasting model. Mainly airports use historical data to predict changes in passenger flow. Despite the fact that this method has advantages, it does not take into account possible factors that may have an effect in the future. The proposed regression model allows making a short-term forecast with an average forecast error of 5.3%.

FFP programs and the consumer behavior are discussed in several studies. (Bieger, Wittmer, & Laesser, 2007) proposes the customer value approach. Along with generally accepted demand factors, the importance of customers for airlines is considered. In the future, in developed markets, airlines will need to pay more attention to the needs of passengers and to allocate new customer segments. This is due to the fact that gradually the level of service and cost of airline services become similar and airlines need to look for new ways to differentiate themselves. (Chin, 2002) concludes that the frequent flyer program can become one of the ways to differentiate. The second factor that is explored is schedule convenience. For analysis, binary choice models are used. A well-thought-out and user-friendly FFP program is an indication that the airline appreciates its passengers and is willing to generously reward them for their loyalty. Despite the fact that, according to the results of the study the FFP has smaller effect on air travel demand than at the schedule convenience, it is a qualitatively different factor, the importance of which is not in quantitative indicators,

but in the long-term passenger loyalty. In contrast to many studies on the growth in demand for air travel, (Graham & Metz, 2017) explores the characteristics of non-flyer consumers group who do not travel by air. In addition to budgetary constraints and personal circumstances, there are travel habits, the study of which can open insights in studying consumer behavior. The conclusion of the study is that the number of infrequent flyers is declining as the welfare of society grows.

Airlines use price discrimination between route endpoints. This phenomenon is investigated by (Luttmann, 2019). The route endpoints have different per capita income and, accordingly, different price elasticity. Airlines build their pricing policy based on the fact that higher income reduces the elasticity of demand. Passengers with high incomes are less sensitive to price changes. To maximize the revenue, airlines increase fares at endpoints, where the elasticity of demand is lower. He investigated direct flights. It is possible that the results of the study will not be relevant for connecting flights.

As is seen from above, researchers cover various aspects of the demand for air travel. Despite the large number of theoretical and practical studies there is no unambiguous solution. First, the demand for air travel depends on a very large number of variables. Secondly, not only the revealed factors constantly change their influence, but also the socio-economic, demographic and political situations in the regions of the world are constantly subject to change. The aviation industry cannot function separately within one region. Changes in one country will certainly affect the air travel markets in other countries. In this regard, when making the research on the air travel demand, it is necessary to understand the general principles of aviation market functioning and to be aware of existing studies.

CHAPTER 3

DEMAND FOR AIR TRAVEL

There are several techniques that can be used for identifying, evaluating, and forecasting the critical factors which influence the air travel demand. These methods can be classified as judgemental, mechanical, and analytical.

Judgemental method is solving non-formalizable problems by obtaining predictive estimates of air travel demand in the future, regardless of the information availability using the method of expert assessments. The essence of the judgemental method lies in the experts conducting an intuitive-logical analysis of the situation with a quantitative assessment of judgments and formal processing of the results. In this case, a generalized expert opinion is based on historical passenger traffic data and intuitive consideration of factors that may influence the demand . The use of past experience, intuition, logical thinking and quantitative assessments with formal processing allows to predict the air travel demand.

The mechanical method is based on the assumption that future travel demand is a temporary function of the previous time period. As a model of a mechanical approach, one can use both a simple extrapolation of historical trends and mathematical growth curves, such as the Logistic and Gompertz curves. Time acts as the only predictive variable reflecting the interaction of socio-economic and other factors. Demand generated by the time factor is a function of time only. However, direct extrapolation, as a rule, simply indicates that there are parameters that have influenced demand in the past with the power that is a function of time. In this regard, without having quantitative data on the main parameters and the degree of their influence, based only on time, it is not possible to reliably predict demand. The degree of influence of these factors in the future may either change or stop at all.

In contrast to the mechanical, the analytical method does not consider time as the only predictor variable. When analyzing the parameters that influenced the demand in the

past and which may affect the demand in the future, this method allows to evaluate the effect of several variables at once. First of all, it is worth noting such variables as income and cost of fares. These methods are known as regression methods.

The analytical method identifies significant socio-economic and transport independent variables and supposes carrying out mathematical transformations of the model, leading to a certain result. Initially, hypotheses are written in the form of mathematical equations. Then, on the basis of quantitative data of dependent and independent variables for the analyzed period of time, the functional relationships between the variables are evaluated. The degree of importance of each of the variables is also estimated. Further, based on the values of independent variables, a forecast is made. During the analysis, the initial model can undergo a large number of iterations.

For simplicity of analytical approach application, it is assumed that several basic independent variables explain most of the changes in the dependent variable. Of course, the number of influencing factors is greater than the number that is commonly used in a mathematical equation. However, it is not always possible to quantify and reliably measure the value of a particular variable. Secondly, the results of the analysis provide information on what percentage of changes can be explained by the factors being analyzed. Depending on the objectives of the study, we can consider this result sufficient to predict, or, to continue to study the effect of unrecorded factors in order to obtain more complete and reliable results. The accuracy and practicality of the results depends on the accuracy and reliability of historical data. More reliable data on independent variables provide more accurate results. An important assumption is that the identified relationship between the variables will remain over the forecast period. In this study business and leisure segments are not separated due to lack of reliable socio – economic statistics on business and leisure travellers.

The object of the paper is to identify, explain, and estimate the critical socio-economic and transportation factors which influence the air travel demand on Moscow – Istanbul city-pair and to provide sustainable air travel demand elasticity values. Revenue management and flight planning strategical and tactical decisions need to be based on the correct and reliable results.

As we have already noted, the simultaneous interaction of many variables affects the passenger traffic. In previous studies of factors affecting the demand for air transport, two main groups are usually distinguished. Variables of the first group characterize changes in the social, economic and political areas of the studied market. The second group of variables relates more to the distinctive and operational indicators of the aviation industry. In this paper, the second group includes such factors as cost, travel time, comfort, safety and convenience.

3.1. Determinants of air travel demand

There may be several factors affecting the demand for air travel. Some of them are summarized below:

3.1.1. Socio-economic variables

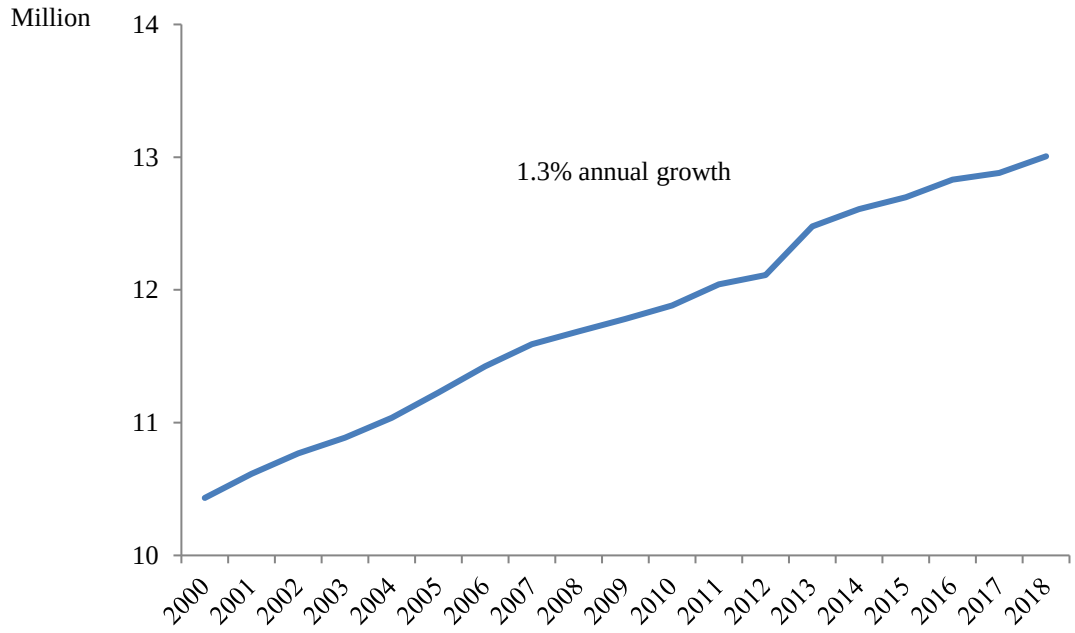
Factors in this category that influence the changes in passenger traffic from Moscow to Istanbul fall into the following categories:

1. Population.
2. Income.
3. Migration.
4. Political events and government regulation:
    a. Restrictions on flights to Egypt.
    b. Economic sanctions against Turkey.
    c. Support of domestic tourism and the airline industry in Russia.
5. Attraction for Turkey and Istanbul.

Population. The aviation market and air travel demand are reliant on population. A population boom may cause a considerable increase in passenger flow rather than the effect of other factos. With population of about 13 million Moscow is the largest city of the Russian Federation. It is within top 10 most populated cities located in Europe, and the largest Russian-speaking city in the world. By broader definitions, Moscow is one of the largest cities in the world. According to Mercer's annual cost of living

survey Moscow is classified as world's 17th most expensive city, and has one of the biggest urban economies.

Moscow has been experiencing continuous population growth for the last decades from 9.9 million in 2000 to 12.5 million in 2018 according to Rosstat (the Russian Federation Federal State Statistics Service) and demonstrated an average annual growth rate of 1.3% (Figure 3.1).



Source: Federal State Statistics Service, Russia.

Figure 3.1. Moscow population

In 2018 the Russian Federation Federal Agency of Air Transport (Rosaviatsiya) registered 39 million passengers carried on scheduled international flights from Moscow Aviation Hub (which includes Moscow's 3 biggest airports Sheremetyevo, Domodedovo and Vnukovo), which was up from 34 million passengers in 2014. It represents 12.8% growth which is 4 times bigger than the 3.1% population growth of Moscow for the same period. The Table 3.1. below shows the number of passengers carried on international scheduled, non – scheduled and domestic flights from Moscow Aviation Hub. We can see decrease in 2015-2016 years due to economical crisis.

Table 3.1. Passenger traffic from from Moscow Aviation Hub

Service	2014	2015	2016	2017	2018
International Scheduled Flights, mln	34,0	31,6	29,9	36,5	39,1
% year-on-year		-7%	-6%	22%	7%
International Non - Scheduled Flights, mln	8,3	6,3	4,1	5,5	6,6
% year-on-year		-25%	-34%	33%	19%
Domestic Flights, mln	34,8	39,7	42,1	46,4	50,6
% year-on-year		14%	6%	10%	9%

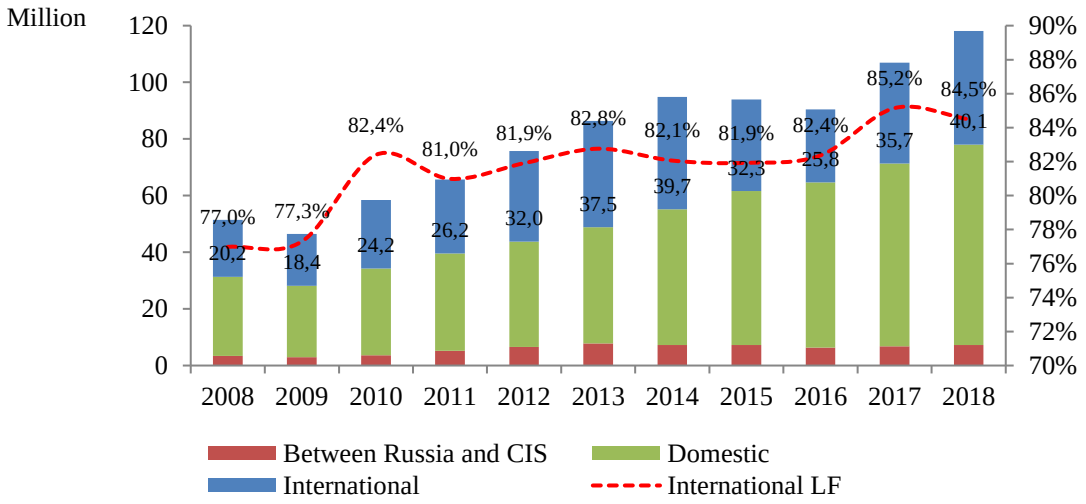
Source: Federal Air Transport Agency, Russia.

Due to the reason that Moscow population figures are not available on monthly basis population was not tested in the econometric models. Provided that the influence of other factors remains unchanged, passenger traffic would grow in proportion to population increase.

Income. One of the main determinants of air travel demand is income. Especially in Russia demand shows high sensitivity to fluctuations in economic activity and the ruble exchange rate. Since 2017 the industry shows significant growth after the passenger traffic decline in 2015 – 2016, due to the resumption of charter flights to popular among Russian tourists Turkey. The structure of air transport significantly changed in favor of domestic routes in 2015 – 2016, and in 2017, the share of international flights returned to growth. Despite the fact that in last 2-3 years, According to VCIOM Russian Public Opinion Research Center only 29% of the country population travelled by air, the propensity to fly continued to grow. The growth of air passenger traffic was primarily due to the increase in the number of trips, made by the same passengers, and not by the increase in the number of new passengers. Introduction of fares with no free baggage allowance and the passenger traffic increase by low cost airlines slowed down the growth rate of prices for air tickets and bended people to choose air travel more often.

The Russian aviation market was experiencing a recovery growth after the crisis of 2015–2016. The key growth factors were the recovery of the market after the departure of Transaero, the opening of charter flights to Turkey, an introduction of fares with no free baggage allowance and the strengthening of the ruble.

According to the Federal Agency of Air Transport (Rosaviatsiya) in 2017 the total number of passengers increased by 18.6%, due primarily to the effect of low base of the previous year, and a reached a record value of 105 million passengers. Passenger traffic between Russia and foreign countries increased by 9.8 million passengers and resulted in 38.1% traffic growth shown on Figure 3.2. The share of international traffic has returned to growth after three years of decline from 53% in 2013 to 36% in 2016 and amounted to 40% of total volume. Passenger load factor increase can be observed: in 2017 the value reached 85.2% after 82.4% in 2016. Rosaviatsiya counts only Russian air carriers' passenger traffic.

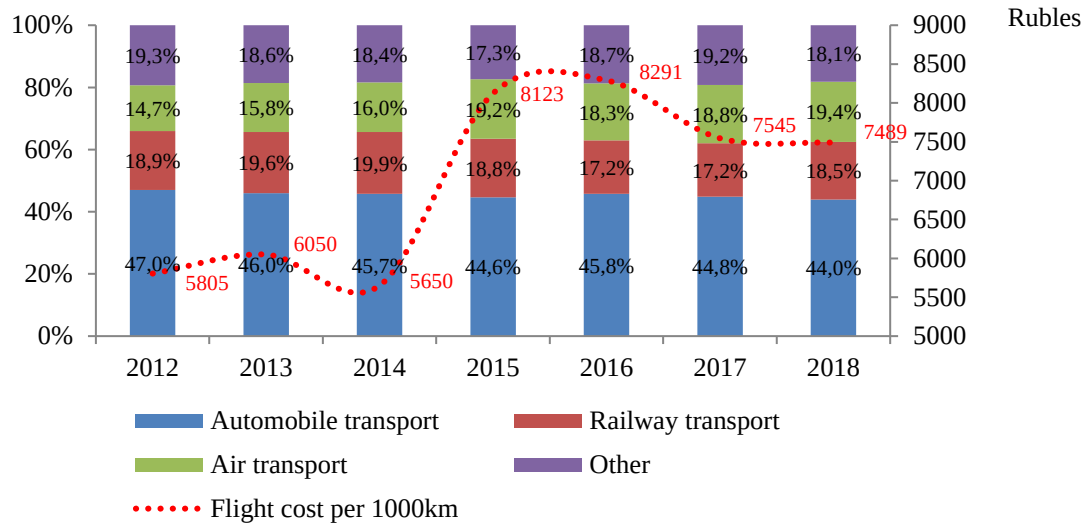


Source: Federal Air Transport Agency, Russia.

Figure 3.2. Passengers by destination and load factor

According to the Federal Agency of Air Transport (Rosaviatsiya), the passenger traffic of Russian airports (foreign airlines included) in 2017 reached 186.8 million people (+17.0% year-over-year). The largest airports have traditionally become airports of Moscow Aviation Hub; the total passenger traffic reached 88.4 million people (+16.2% of the 2016 level). A significant contribution to the growth was made by an increase in passenger turnover between Russia and foreign countries up to 129.3 million passengers (+33.5%).

The share of expenditures on air travel over the past 6 years increased by 4.7 pct (Figure 3.3). In Moscow the flight cost in 2018 in economy class per 1000 kilometers increased by 29% comparing to 2012, while 2016 prices were 42.8% higher compared to 2012. The scale and nature of the use of transport services in Russia in general corresponds to a country with an average level of development, high inequality, large distances and significant pendulum migration of the population between work and housing in the country.

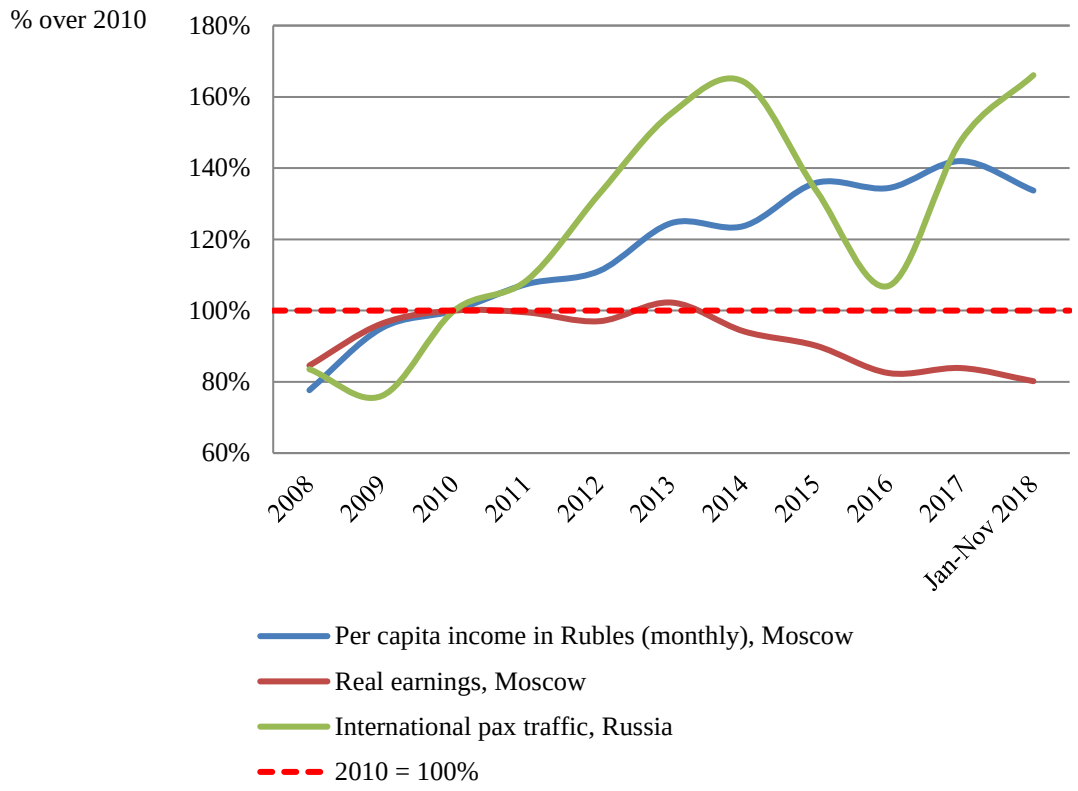


Source: Federal State Statistics Service, Russia.

Figure 3.3. Consumer expenditure weights in transport.

The increase in passenger traffic is primarily due to an increase in the number of trips, performed by the same passengers, and not by the increase in the number of new passengers air transport. According to VCIOM, over the last 2–3 years, only 29% of the population travelled by air. Most of them are Moscow and St. Petersburg (54%) residents with a high welfare (44%). Among them are 18-24 years old (36%) and 25-34 years old (37%) young people. Respondents that didn't used air services in recent years, explain this by the lack of need for air travel (60%), high ticket prices (26%). Holding back growth factors for civil aviation are also aerophobia, 33% of respondents to the VCIOM survey, and the public's perception of aircraft as dangerous means of transportation (36% of respondents). International air traffic (CIS countries excluded) from Russia in 2018 exceeded 2010 level by 66.1% even with the 2015–2016 down

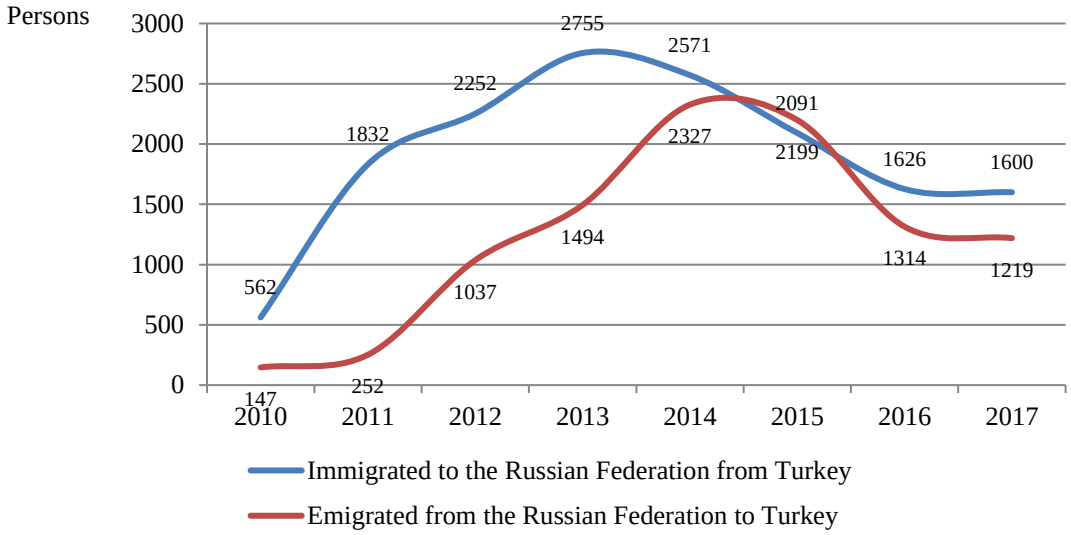
fall (Figure 3.4). Restoration of the welfare of the population of Russia after the crisis of 2008–2009 led to major changes in the total passenger turnover in Russia. Air transport boom in Russia in 2010–2014 led to total air passenger traffic increase by more than 1.5 times in 4 years - from 56.9 to 93.1 million passengers.



Source: Federal State Statistics Service; Federal Air Transport Agency, Russia.

Figure 3.4. Passenger traffic, per capita income and real earnings flow, % over 2010

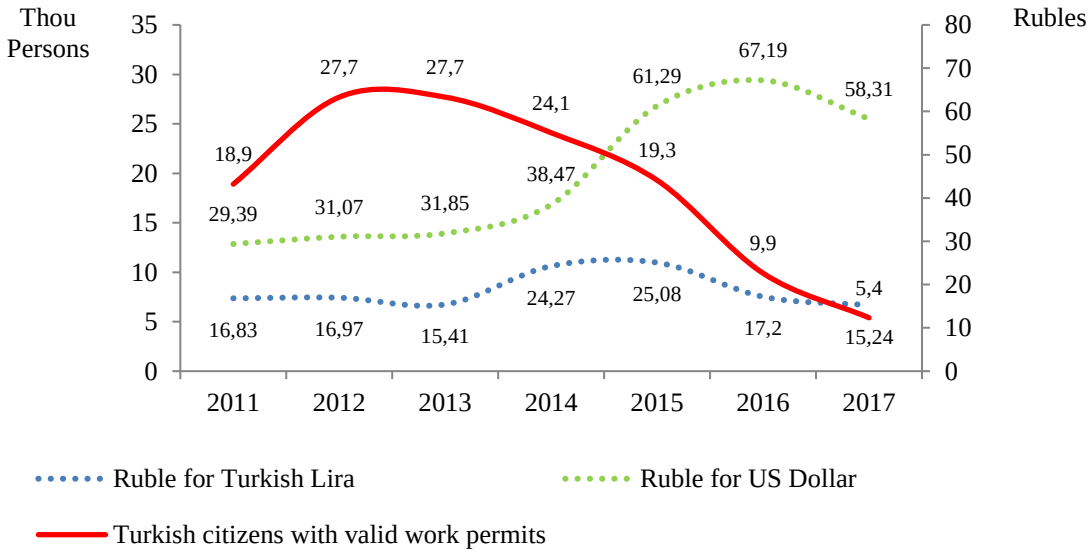
Migration. One of the factors affecting the passenger traffic is migration. Positive migration balance was observed from 2010 to 2017, which equals to 5300 persons. The decrease in migration growth from Turkey to Russia observed after 2014 (Figure 3.5), indicating a decrease in country's migration attractiveness for foreign citizens, is due, among other things, to a drop in the purchasing power of the average monthly nominal wages of workers in the Russian economy in dollar equivalent, caused by the weakening of the ruble against the dollar.



Source: Federal State Statistics Service, Russia.

Figure 3.5. Migration between Russia and Turkey

As per the Ministry of Internal Affairs (MIA) data the number of Turkey citizens with valid work permits dropped fivefold from 27.7 thousand in 2012 to 5.4 thousand in 2017, including stateless persons (Figure 3.6). After the incident with the jet on the Syrian border in November 2015, Russia adopted a series of sanctions against Turkey. The sanctions included imports from Turkey, Turkish companies in Russia and Turkish citizens employed in Russian companies. Cooperation over the project TurkStream - a gas pipeline to Turkey through the Black Sea, was put on hold.



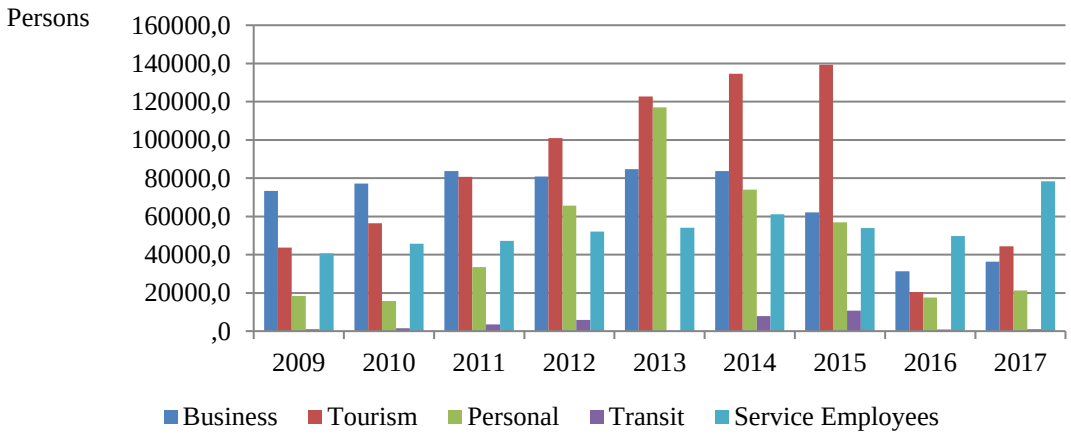
Source: Ministry of Internal Affairs, Russia; Central Bank of Russin Federation.

Figure 3.6. Exchange rates of foreign currencies to Russian ruble

The steady increase in the US dollar rate and the weakening of the Russian ruble in the observed period reduced the purchasing power of wages in the Russian economy in dollar terms. For working migrants earnings in Russia are significant source of income. The ruble exchange rate weakened by 2 times from 29.39 rubles per US dollar in 2011 to 58.31 rubles per US dollar in 2017. The monthly average wages in Russia, in dollar terms, have increased over the 10-year period from 395 to 548 dollars, but during 2014 – 2016 period the wages have decreased by more than a third.

Another reason of migration downtrend is weak dynamics of life quality indicators in Russia in the post-crisis period (real disposable income, real average monthly wage of workers, poverty level, etc.), which act as a factor stimulating the migration of Russians abroad in pursuit of more favorable conditions of life.

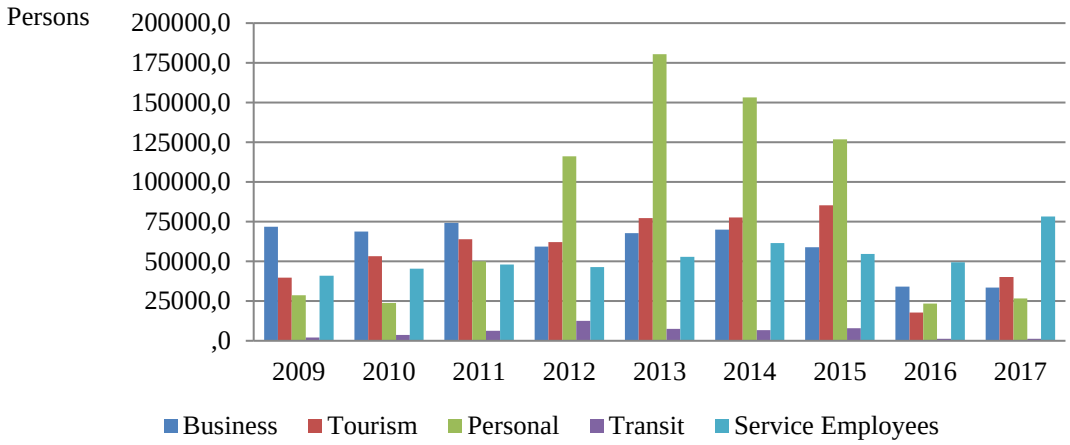
While in 2015 total number of incoming and outgoing migrants was 656,510 persons, in 2016 due to politics the amount dropped by 2,5 times to 246,020 persons. In the structure of incoming migration tourism and business purposes prevail (Figure 3.7).



Source: Federal State Statistics Service, Russia.

Figure 3.7. Distribution of incoming migrants by purpose of travel

In the outgoing migration the share of movements of personal nature is noticeable higher and accounts to 31.5% (Figure 3.8).



Source: Federal State Statistics Service, Russia.

Figure 3.8. Distribution of outgoing migrants by purpose of travel.

When analyzing the air travel demand, one should also take into account political and other events that have had both positive and negative effects. Despite the fact that it is logically possible to establish their influence, it is not possible to estimate the exact effect on passenger traffic and use these results for forecasting. The main reason is that such events are situational in nature and difficult to quantify. The main events that could have an impact are discussed below. However, they were not taken into account in the estimation model.

Restrictions on flights to Egypt. In October 2015, the flight from Sharm El Sheikh to Saint Petersburg with russian tourists crashed over the Sinai Peninsula. As a consequence Russia suspended flights of its air carriers because of security insufficiency at Egypt airports. Restrictions were introduced in accordance with Presidential Decree No. 553 of November 8, 2015. The ban, which started in October 2015 had a negative impact on the Egyptian tourism industry. Egypt used to receive millions of Russian tourists every year. In the aftermath of political events in Egypt, the number of tourists decreased from 14.7 million in 2010 to 5.4 million in 2016. Furthermore as per Egyptian Central Bank tourism earnings dropped by more than half, from 11.6 US dolar billion in 2010 to 3.8 US dolar billion in 2016. This situation

was to boost tourism to Turkey because tourist passengers were redirected to Turkey. However, on December 1, 2015, a ban was imposed on charter flights to Turkey after the Russian jet incident. The travel imports to Egypt and Turkey has decreased several times (Table 3.2).

Table 3.2. Russia – Turkey travel imports, billions of US dollars

Service	2012	2013	2014	2015	2016	2017	2015 – 2016 growth, %
Turkey	5,304	6,947	6,644	4,759	0,832	3,569	decreased by 5 times
Business travel	0,040	0,037	0,040	0,044	0,022	0,049	-49%
Leisure travel	5,265	6,910	6,604	4,715	0,809	3,520	decreased by 5 times
Egypt	2,643	2,500	3,495	3,129	0,001	0,001	-

Source: Federal State Statistics Service, Russia.

In December 2017 Russia and Egypt signed a protocol to resume Moscow-Cairo flights in 2018. Restrictions were relaxed from January 2, 2018 when regular air transportation to Cairo was allowed (Presidential Decree No. 7 of January 2, 2018). Following an almost three-year ban, the Russian national airline Aeroflot started flights to Cairo in April 2018. However, the ban on flights to other Egyptian destinations was not lifted. The Federal Agency for Tourism Russiatourism has confirmed that tour operators can sell tours to Egypt on regular flights to Cairo. The restrictions to selling direct tours to Hurghada and Sharm-el-Shaikh still remain.

Economic sanctions against Turkey. After the incident with the jet on the Syrian border in November 2015, Russia adopted a series of sanctions against Turkey. The sanctions included imports from Turkey, Turkish companies in Russia and Turkish citizens employed in Russian companies. Russia reinstated the need for visas to travel between the two countries. Besides, a decree signed by President Putin called for an end to direct charter flights and recommended to Russian tour operators not to sell tours to Turkey.

On December 1, 2015, a ban was imposed on charter flights by Russian Federation. Russia has also banned selling charter holidays to Turkey. Charter flights between Russia and Turkey were interrupted for nine months. This resulted in a 90 percent drop in tourists from Russia to Turkey in the first months of 2016.

After 18 month Russia lifted most of the sanctions it had imposed on Ankara. From September 6, 2016, the ban was lifted. A bilateral agreement on visa-free movement between the two countries was partially restored, restrictions on Turkish companies operating in Russia were lifted and a ban on employing Turkish workers in the country was ended. Turkish construction companies, which hold a leading position in the Russian market, were enabled to return to the country.

Russian Government support of domestic tourism. A number of federal and regional programs and strategies for tourism industry growth are currently being implemented in Russia. The Federal Target Program "Development of domestic and inbound tourism in the Russian Federation 2011–2018" was extended. According to program almost 100 billion rubles are going to be allocated for the investment projects. The program for tourism development during 2019-2025 period has already been approved. The goal of the Program is to increase the performance of tourism market in Russia, and to provide high-quality travel services. 35 Russian regions and 45 tourism and recreation clusters were involved during the 1st stage, including Kaliningrad and the Black Sea regions.

According to forecasts, the program is going to boost the growth of tourist services rendered to the population by the end of 2025 to 274285.65 million rubles, which will correspond to a growth of 70 percent compared to the base period of 2016. 57 regions of the Russian Federation with more than 100 projects to create tourist clusters are being involved in the selection of investment projects.

The reduction of security and stability of tourist market in Egypt and poor interstate relations with Turkey enabled domestic tourism to grow and expand geographically. The volume of domestic tourism grew by more than 30 percent, giving an average annual increase for the period 2015 - 2016 at the level of 18 percent. By the end of 2016, the internal tourist flow amounted to more than 50 million people. In 2016, Krasnodar received more than 15 million tourists, the Republic of Crimea - about 6 million tourists, the Altai Territory - 2 million tourists, St. Petersburg - 7 million tourists. Government has been heavily subsidizing flights to Crimea, and a 19 km. bridge over the Kerch Strait was opened in May 2018.

In addition to this, “Strategy for the development of tourism in the Russian Federation until 2020” program and the national project “International Cooperation and Export” are being implemented currently.

Despite of government support of domestic tourism in Russia Turkey took the lead in top tourist destinations list after the ban on charter flights and sale of tour packages to Turkey has been lifted in September 2016. Despite of high prices and low service quality Russian Black Sea resorts pull aside part of passenger traffic from Turkey. In the case of air travel cost increase, travelers have the opportunity to choose another type of transport: rail or road. İt is easier to find an alternative for short-haul flights than for long-haul flights.

In the Travel & Tourism Competitiveness Index 2017 Ranking, which takes into account the factors that are contributing to tourism industry growth and, accordingly, the development of the economy, Turkey takes 44th and Russia takes 43rd place.

Government support to the airline industry in Russia. In order to increase the availability of air transport services, the Russian government is implementing a program to support the aviation industry. Complex plan for tourism infrastructure modernization for the period until 2024, developed by Russia, is aiming to increase economic connectivity of the country. Reconstruction of 68 objects in 66 airport complexes was planned in order to increase aviation mobility of people. The plan involves the subsidizing for air travel on 175 routes, as well as aircraft leasing, which will provide passenger traffic increase, bypassing the Moscow aviation hub, up to 25.21 million passengers and a share passenger traffic in the volume of domestic traffic from 37% (base value for January 1 2018) to 51.35% in 2024.

In 2018, the air transport subsidy program was allocated 3.8 billion rubles. In November 2018, changes were made to the subsidies provision rules to air transport organizations that provide year-round service to the Far East, Simferopol and Kaliningrad. Beside, large families were included in the category of citizens who are eligible for discounts on subsidized routes.

Until January 1, 2025, a zero VAT rate is established for air transportation to the regions such as Far East, Kaliningrad region and Crimea. This was necessary for development of transport infrastructure within the regions and increasing their transport availability. Kaliningrad and the Crimea are beach holiday destinations and create competition for Turkey, reducing passenger traffic to Istanbul and Antalya.

Restrictions for Russian government employees. In April 2014, due to aggravated political relations and numerous sanctions, an unofficial ban on travel abroad was imposed on the Ministry of Internal Affairs officers (MIA). According to the document of the Ministry of Defense, ministry employees were banned from travelling abroad on holidays. At the official level, the document was strictly advisory. In total, more than 200 foreign countries were banned. At the end of 2017, the Minister of Internal Affairs of Russia signed a decree on conducting vacations for Interior Ministry officers outside our country.

It is assumed that in 2019 a ban on holidays in foreign countries will officially come into force. Government employees whose work is related to keeping National Security Information will not have the right to visit all European and many Eastern countries. Turkey is in the list of prohibited countries. Presumably it will be possible to travel around the CIS countries, and the countries of Shanghai Cooperation Organization. One of the unofficial reasons should be attributed to the desire of the state to develop domestic resorts.

It is planned that the ban on traveling abroad will be relevant for employees of the Federal departments, ministries, employees of regional authorities, federal and regional legislative assemblies and judges. According to statistics, 4 million employees of the Ministry of Internal Affairs were forbidden to travel abroad in 2018. Taking into account the fact that the ban also applies to family members, this amount increases two times.

2018 FIFA World Cup Russia. It is worth to mention the factor of the FIFA World Cup, which took place in June – July 2018 in Russia. According to the Ministry of Digital Development, Communications and Mass Media, 1.83 million FAN ID's were issued to visit the World Cup in 2018, of which 987 thousand were issued to Russian

citizens. Most often, the FAN ID's were ordered by 25–34 years old people. The international air travel from Russia was indirectly affected because the discretionary income that could be spend on air travel abroad was spend on travelling within the country to visit the host cities for 2018 FIFA World Cup during the peak season (Table 3.3). Travelling within the country acted as a substitute for overseas air travel.

Table 3.3. Football World Cup 2018 host cities tourism flow (thousand people)

City	Tourist flow	Russian tourists	Foreign tourists	Dynamics of tourist flow
Volgograd	220	150	70	190% increase
Kaliningrad	260	190	70	40% increase
Krasnodar	795	595	200	30% increase
Moscow	4470	2161	2309	3% decrease
Nizhniy Novgorod	355	205	150	390% increase
Saransk	140	34	200	30% increase
Tatarstan	300	200	100	30% increase
Rostov	190	118	72	100% increase
Saint-Petersburg	800	300	500	100% increase
Ekaterinburg	165	95	70	100% increase

Source: Federal Agency for Tourism, Russia.

According to Sberbank for ten months of 2018, Russians spent 756.4 bln rubles on domestic tourism and business trips. In 2016 the total expenditure was 776.9 bln rubles. 2018 growth rate is higher than in the previous year (10.6% vs. 5%), which is mostly related to the 2018 FIFA World Cup. Russian fans spent about RUB 40 bln rubles on traveling to other regions to watch matches. This dynamic is related to the constant increase in the number of traveling Russians. The annual growth of trips is about 30%. Krasnodar is within top 3 destinations Russians choose as destinations for domestic tourism.

Attraction for Istanbul. Istanbul is in the world's fastest growing travel destinations list. Due to a number of political events in 2016, the inbound tourist flow to the country has greatly decreased. To improve the situation, the Ministry of Culture and Tourism declared 2018 the Year of Tourism in Turkey. New investments, along with advertising and marketing, were necessary in this situation. As early as 2018, a significant increase was observed in Istanbul (Table 3.4). To date, the positive trend continues.

Table 3.4. Top 10 city destinations in 2017, Europe

	Arrivals (‘000)			Growth (%)	
Destination City	2016	2017	2018	2017	2018
London	19 059,5	19 827,8	20 715,9	4,0%	4,5%
Paris	13 926,3	15 834,2	16 836,5	13,7%	6,5%
Istanbul	***9 218,4***	***10 730,3***	***12 121,1***	***16,4%***	***13,0%***
Rome	9 353,9	9 531,6	9 703,2	1,9%	1,8%
Antalya	***5 952,5***	***9 482,4***	***10 729,3***	***59,3%***	***13,1%***
Prague	8 200,6	8 806,7	9 038,9	7,4%	2,6%
Amsterdam	6 898,6	7 848,0	8 476,6	13,8%	8,0%
Barcelona	6 515,5	6 530,1	6 726,0	0,2%	3,0%
Milan	6 175,0	6 347,9	6 513,0	2,8%	2,6%
Vienna	5 867,6	6 067,1	6 303,8	3,4%	3,9%

Source: Euromonitor International.

In October 2018, the opening of a new airport in Istanbul took place. Due to the high congestion of Ataturk Airport, such a need was long overdue. The new airport will have six runways and will be able to serve up to 200 million passengers a year.

As per MasterCard Global Destination Cities Index Istanbul has been ranked as 9th among Top 10 destination cities in 2017 with 10.7 million international overnight visitors and expecting the largest growth of 19.7%. Among other cities in the list, Istanbul has lowest average spend per day (Table 3.5).

Table 3.5. Global top 10 city destinations by international overnight visitors

Destination City	2016 (millions)	2017 (millions)	2018 Forecast	Average Spend Per Day
Bangkok	19,41	20,05	9,60%	$173
London	19,06	19,83	3,00%	$153
Paris	15,42	17,44	2,90%	$301
Dubai	14,87	15,79	5,50%	$537
Singapore	12,91	13,91	4,00%	$286
New York	12,70	13,13	4,10%	$147
Kuala Lumpur	11,23	12,58	7,51%	$124
Tokyo	11,15	11,93	1,57%	$154
Istanbul	***9,16***	***10,70***	***19,65%***	***$108***
Seoul	12,22	9,54	6,12%	$181

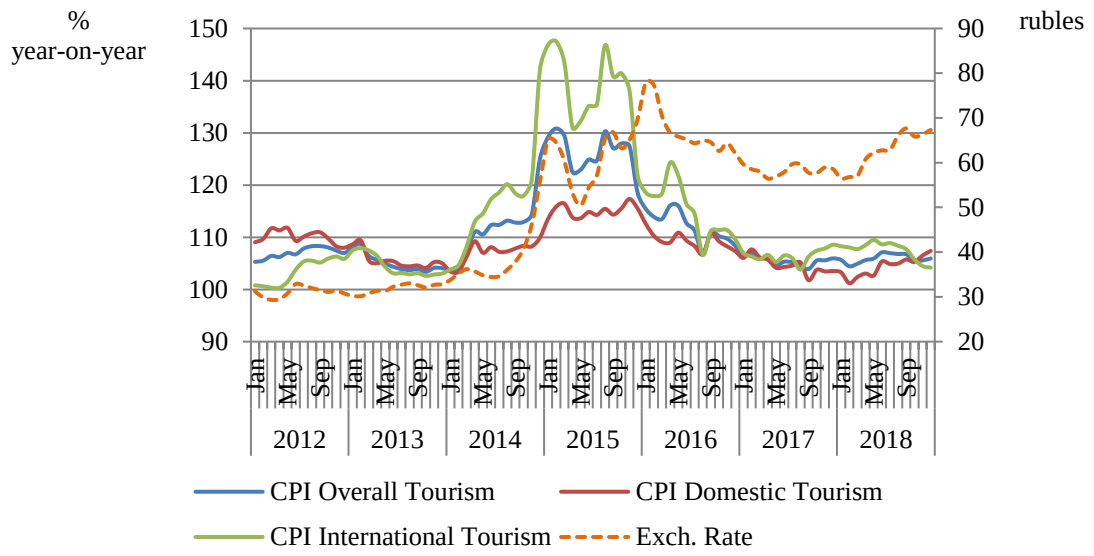
Source: Mastercard Global Destination Cities Index 2017.

Furthermore, Turkey takes 8th place in international tourist arrivals in world’s top 10 tourism destinations according to UNWTO 2018 ranking.

Recovery of air travel demand in 2017. Dynamics of demand for tourism reflects the state of society and the economy, especially segments of the population with higher level of welfare. Russian outbound tourism (as well as holidays on the Black Sea) is mostly family holidays in the sea resort, that is, "compensation" for the difficult weather conditions in most regions of the country. Its development depends on the availability of low-cost resorts, the dynamics of real household incomes and competition of tourism destinations.

Recovery of Russian demand for outbound tourism in 2017 year indicates a revival in the economy. Important reason was the resumption of charter flights with Turkey. But for the choice of Russian families (increasingly in favor of Turkey, Thailand, Bulgaria, Cyprus) more important is the decline in prices for tourism services. Renewal of charter flights to Turkey at the end of 2016 and stabilization of ruble exchange rate below 60 rubles per dollar led to lower prices for services in foreign tourism in 2017. By the beginning of 2017, the volume of tourism in Russia decreased by 30% relative to level of early 2014. In the first quarter of 2017, the volume of tourist services in Russia reached a local minimum and moved to a rapid recovery growth – in September 2017 returned to the level of September 2015.

The depreciation of the ruble and the limitations to travel to popular low-cost areas as Egypt and Turkey led to an growth in cost of services in Rubles terms for international tourism by 37% on average for 2015 and another 13% for 2016 (Figure 3.9).



Source: Federal State Statistics Service, Russia.

Figure 3.9. Moscow CPI Tourism dynamics

According to Rosstat (the Russian Federation Federal State Statistics Service), in 2017, despite the growth in actual earnings (+ 3.0% YoY for the first ten months), the decline in real disposable income which began at the end of 2014 of the year (-1.3% for the same period) has continued. During this period Russians reduced discretionary expenses and consumption of durable goods and, particularly for expensive travel. Due to recession some families reduced travelling due to financial constraints, and others - to reorient from international tourism to domestic.

The volume of tourism in Russia declined during 2014-2016 years, but since I quarter of 2017 has moved to a rapid recovery. In 2014-2016 the tourism (services of travel agencies, tour operators and other booking services and related services) experienced the strongest drop among the various categories of services, which as a whole still remain under the pre-crisis period level. By early 2017, the seasonally adjusted volume of tourism in Russia decreased by 30% compared to the level of the beginning of 2014. In the first quarter of 2017 the volume of tourism reached a minimum and started to recover - in September 2017 it returned to the level of September 2015.

During the recession, people save on the services of tour operators, including independently planning trips, and also switch to domestic tourism. The decline in the

demand of Russians for tourism services has led to a drop in sales of tour packages from a maximum of 4.2 million in 2013 to 1.6 million in 2016 due to slowdown of tours sales to foreign countries (Table 3.6). If in 2013 the number of tour packages to foreign countries exceeded 4.2 million, in 2016 it decreased by 62% (to 1.6 million). At the same time, the demand for tours in Russia sharply increased: more than 1.5 million in 2016 against 1.0 million in 2014 (during the crisis of 2009, Russians reduced purchases, both foreign and domestic tours), although a little behind the 2007 level.

Table 3.6. Tour sales to foreign countries

2010	2011	2012	2012	2013	2014	2015
Number of tour packages sold abroad, million						
3,37	3,33	3,74	4,24	3,25	2,48	1,62
Average cost of tour packages sold abroad, thou rubles						
44	46	49	52	66	74	85

Source: Federal Agency for Tourism, Russia.

Import of touristic services by Russia in 2016 declined in all the most popular destinations with the exception of Cyprus. The cost of touristic services provided to Russians abroad, refers to Russian import of services; the cost of services rendered to foreign nationals in Russia refers for export. In the balance of payments of Russia the cost of importing tourist services consistently far exceeds the value of exports (residents spend on foreign trips more than foreigners on trips to Russia).

In 2016, the dollar value of Russian imports of tourism services declined twice compared with 2014, and in ruble terms downfall amounted to 17% even despite the devaluation of the ruble in 2015-2016 (Table 3.7). The main factor behind this dynamic was the travel restrictions for Russians to Turkey (14% of imports of tourist services in Russia in 2014) and Egypt (7% of imports in 2014). The top three in 2016 included Germany, Spain and Cyprus. Generally imports of tourist services by Russia in 2016 declined relative to 2015 in all popular destinations. Travel imports cover aggregate expenses to buy goods and services in foreign country.

Table 3.7. Russian Outbound Tourism (Travel imports, millions of US dollars)

	2012	2013	2014	2015	2016	2017	2013-2016, %

Total	42 797,7	53 452,6	50 427,6	34 931,7	23 951,1	31 057,9	-55%
EU	18 550,2	24 775,3	23 525,7	15 892,7	12 473,5	14 735,7	-50%
Turkey	*5 304,4*	*6 947,1*	*6 643,9*	*4 759,0*	*831,6*	*3 568,7*	*-88%*
Business Travel	*39,8*	*36,9*	*39,5*	*43,8*	*22,3*	*48,8*	*-39%*
Personal Travel	*5 264,6*	*6 910,2*	*6 604,4*	*4 715,2*	*809,3*	*3 519,9*	*-88%*
Germany	3 085,5	3 725,7	3 494,7	2 646,1	1 829,6	2 112,8	-51%
Finland	2 900,2	3 477,9	3 029,8	1 867,1	1 233,2	1 432,2	-65%
Egypt	2 642,7	2 500,4	3 494,5	3 129,0	0,6	1,0	-
Spain	2 284,7	3 177,4	2 842,7	1 475,3	1 439,6	2 017,1	-55%
Italy	1 737,0	2 439,2	2 425,8	1 567,3	1 118,5	1 350,8	-54%
Thailand	2 199,3	2 888,1	2 460,6	1 213,2	1 219,4	1 776,5	-58%
Greece	1 362,0	2 383,1	2 280,6	1 155,6	1 102,7	1 243,8	-54%
USA	1 566,8	1 695,7	1 695,7	1 198,1	702,5	836,1	-59%
Cyprus	915,5	1 326,4	1 445,7	1 382,1	1 396,0	1 535,1	5%
UAE	1 399,1	1 728,5	1 327,4	829,1	721,6	1 283,1	-58%
Bulgaria	837,8	1 044,5	828,0	511,5	581,7	544,1	-44%

Source: Central Bank of Russian Federation.

In 2015-2016, the number of abroad trips of Russians dropped by 32%. In 2010–2013, the number of Russian trips abroad grew at a rapid pace. The largest decline was recorded in the following areas: Finland (-65%), USA (-59%), Thailand (-58%) and the United Arab Emirates (-58%). The decrease in outbound flow in these areas is largely a result of purchasing power reduction of the Russian people. The decrease in traffic to Egypt (-100%) and Turkey (-88%) was largely due to geopolitical factors. In 2016, the number of foreign trips of Russians decreased mainly due to Egypt and Turkey. In 2017 despite the reduction of real incomes of Russians, many popular overseas destinations recorded positive dynamics: the number of trips to Spain increased by 40%, to Czech Republic by 25%, to Italy by 21%, while the countries with the largest decline returned to growth (Finland + 16%, USA + 19%, Thailand + 46%, United Arab Emirates + 78%), although remained noticeably below the 2014 level. Meanwhile, the dollar value of the services rendered to Russians abroad in 2015-2016 decreased twice as fast than the number of outbound trips, which speaks of a decrease in the average expenditures of Russians traveling abroad.

The share of trips for the purpose of tourism accounts for 36.3% of all trips in the first half of 2017. The number of trips for tourism, according to the data of the Border Guard Service of the Federal Security Service of the Russian Federation, in the first half of 2017, increased by 56.5% in annual terms, to 6.2 million trips. The main

contribution to the growth rate was made by the increase in tourist traffic to Turkey by 1.2 million (Table 3.8). The number of trips to China also increased significantly (+60%, up to 406 thousand), UAE (+ 56%, up to 289 thousand), Italy (+39%, up to 314 thousand) and Germany (+36%, up to 311 thousand). Among the twenty most popular destinations, the number of trips decreased only to Tunisia (-25%, to 131 thousand) and Bulgaria (-3%, to 157 thousand).

Table 3.8. Top 20 countries according to tourism travel purpose, thousands

	2016 half year (‘000)	2017 half year (‘000)	% year-on-year
Turkey	65	1200	1746%
Thailand	370	437	18%
China	254	406	60%
Spain	267	318	19%
Italy	226	314	39%
Germany	229	311	36%
UAE	185	289	56%
Cyprus	246	266	8%
Greece	219	245	12%
Vietnam	153	219	43%
Czech Republic	117	183	56%
Bulgaria	162	157	-3%
France	113	154	36%
Tunis	175	131	-25%
Israel	89	118	33%
Dominicana Republic	55	96	75%
Montenegro	80	89	11%
India	68	87	28%
Austria	61	84	38%
Swiss	72	81	13%

Source: Federal State Statistics Service, Russia.

According to the Federal Agency of Air Transport (Rosaviatsiya), in the first nine months of 2017, air passenger traffic increased by 21.8% year-on-year due to the growth of tourist traffic to Turkey. International air travel was growing in annual terms for all 9 months of 2017, noticeably outpacing the growth rate of the number of passengers on domestic routes: for January-September, the number of passengers flying between Russia and foreign countries, grew by 42.7% in annual terms, and the number of passengers on domestic flights over the same period only by 10.4%.

In addition to the restoration of air travel with Turkey, the expected growth in Association of Tour Operators of Russia (ATOR) is associated with the relative

stabilization of the economy in Russia and the growth prices in the domestic market, which led to outbound trips growth. By Statistics of the Ministry of Culture and Tourism of Turkey, from January to September 2017 4.1 million Russians visited the country. Turkey partially drew off Russian tourist flow from other popular destinations - Thailand, Cyprus and Greece. Russia's exports of tourism services in 2016 dropped by 35% compared to 2013 (Table 3.9). In 2016 export of Russian tourist services only to Egypt and Thailand was higher than in 2013.

Table 3.9. Russian Inbound Tourism **(**Travel exports, millions of US dollars)

	2012	2013	2014	2015	2016	2017	2013-2016, %
Total	10 758,9	11 988,4	11 759,1	8 419,9	7 788,1	8 944,6	-35%
EU	4 040,9	4 756,9	4 582,2	2 676,1	2 651,0	2 745,2	-44%
Turkey	*364,3*	*398,6*	*359,0*	*197,0*	*77,1*	*83,9*	*-81%*
Business Travel	*196,0*	*182,8*	*161,9*	*84,2*	*55,4*	*47,0*	*-70%*
Personal Travel	*168,3*	*215,8*	*197,1*	*112,8*	*21,7*	*36,9*	*-90%*
Germany	856,3	928,2	891,7	585,0	668,6	723,5	-28%
Finland	648,9	594,2	623,5	279,9	244,1	216,3	-59%
Egypt	6,3	10,3	8,9	8,1	12,4	17,0	20%
Spain	78,0	89,0	74,3	53,5	64,9	75,7	-27%
Italy	224,8	249,5	231,6	144,1	153,5	170,8	-38%
Thailand	6,7	8,6	9,2	9,0	9,9	14,5	16%
Greece	41,8	45,5	38,5	24,4	26,6	28,6	-42%
USA	323,9	410,1	371,7	211,8	240,4	280,6	-41%
France	330,7	343,6	322,4	184,0	201,8	225,1	-41%
Cyprus	10,0	9,1	8,2	5,9	6,1	7,3	-32%
UAE	1,8	2,7	2,2	1,8	2,6	3,3	-3%
Czech Republic	74,5	81,4	52,6	28,1	27,2	42,7	-67%
Bulgaria	14,5	15,9	15,3	9,1	10,5	11,7	-34%

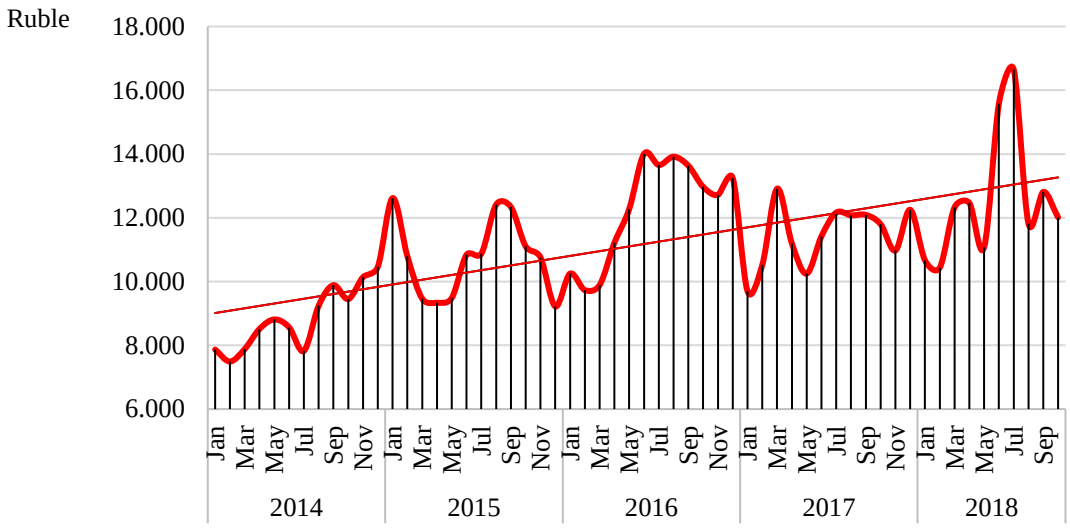
Source: Central Bank of Russian Federation.

According to experts of the search service for airline tickets Aviasales, ruble prices for flights from Russia in January-October 2017 decreased by 11% year-on-year. Most noticeable are savings on flights to China (29%), European countries Union (7-15%) and the CIS countries (up to 13%). Aviasales believes that the decline in average ticket price was influenced by the concept of no baggage fares and non-refundable tickets, which is de jure valid from September of 2017. The only more expensive destination among the leaders was the United States. Maximum growth (+ 78%) was recorded on flights from Russia to Turkey.

3.1.2. Transportation variables

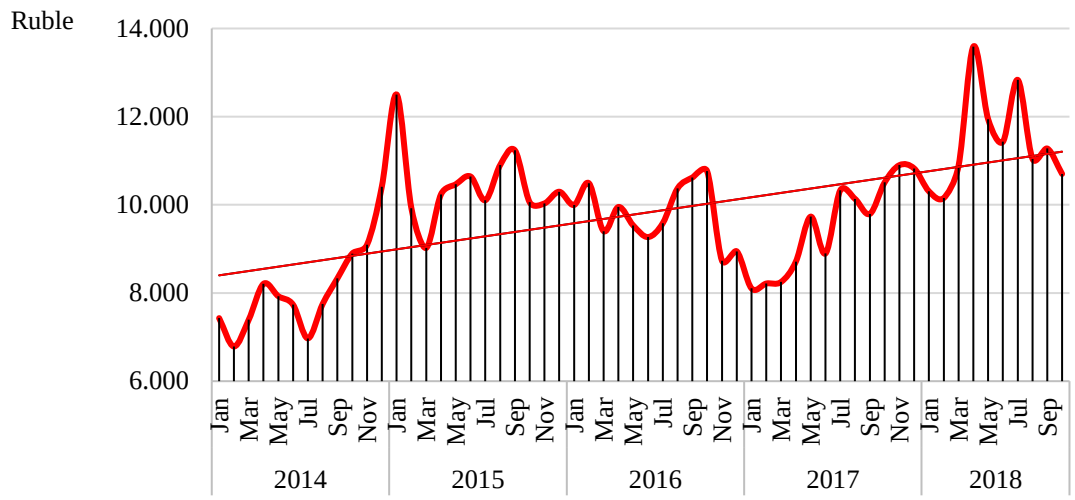
In this paper the factors that refer to the distinctive and operational indicators of the aviation industry are grouped as transportation variables. It includes such factors as cost, travel time, comfort, safety and convenience.

Air travel cost. The air travel demand is inversely proportional to the cost of the trip. Figure 3.10 and Figure 3.11 show Moscow-Istanbul average round trip ticket price in Russian rubles and during January 2014 – December 2018 period for two carriers – Turkish Airlines and Aeroflot Russian Airlines. The average price has increased by 41.8% from 8461 rubles to 12000 rubles. This is due to an attempt of the industry to compensate the operating expenses in US Dollars.



Source: MIDAS DOB Systems.

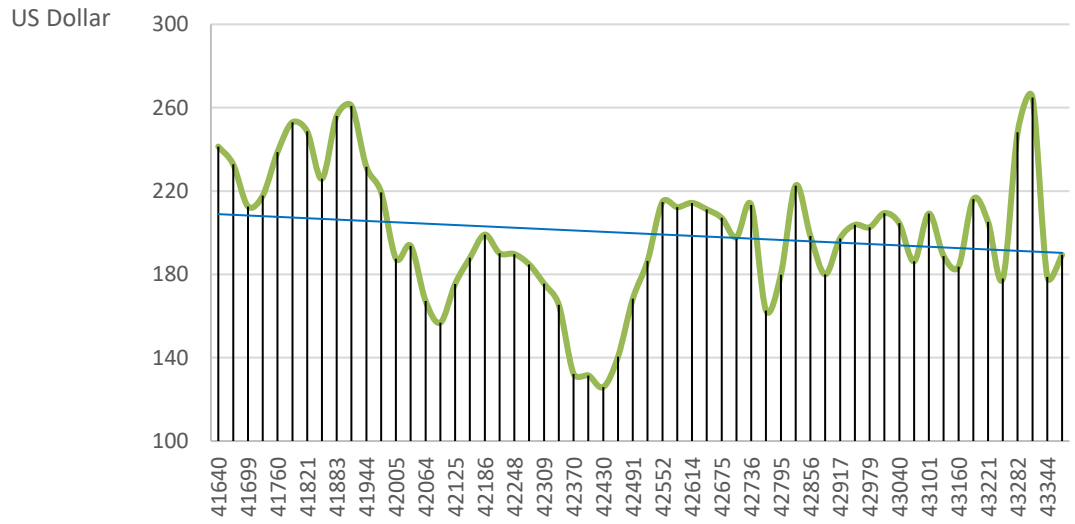
Figure 3.10. Moscow – Istanbul Turkish Airlines average ticket price, Russian ruble



Source: MIDAS DOB Systems.

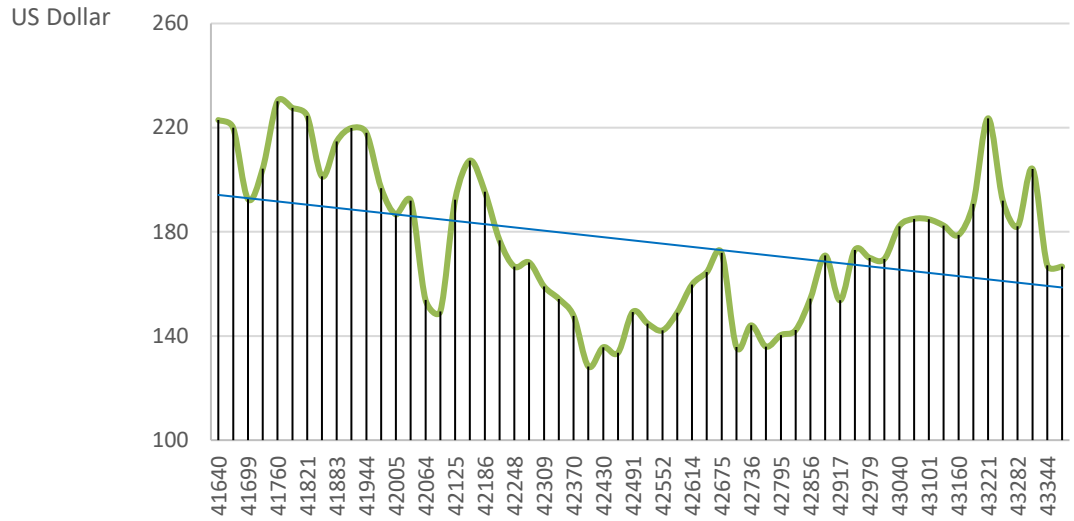
Figure 3.11. Moscow – Istanbul Aeroflot average ticket price, Russian ruble

Figure 3.12 and Figure 3.13 show Moscow-Istanbul average round trip ticket price in US Dollars during January 2014 – December 2018 period for two carriers – Turkish Airlines and Aeroflot Russian Airlines.



Source: MIDAS DOB Systems.

Figure 3.12. Moscow – Istanbul Turkish Airlines average ticket price, US dollar



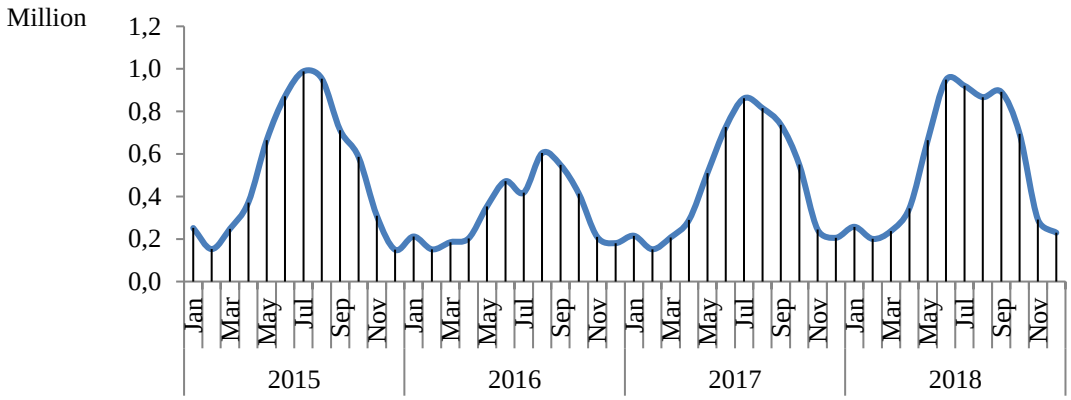
Source: MIDAS DOB Systems.

Figure 3.13. Moscow – Istanbul Aeroflot average ticket price, US dollar

This is due, among other things, to a drop in the purchasing power of the average monthly nominal wages in the Russian economy in US Dollar equivalent, caused by the weakening of the ruble against the dollar. The ruble exchange rate weakened by more than half from 38.47 rubles/US dollars in 2014 to 62.69 rubles/US dollars in 2018.

The presence in the market of charter traffic and package tours, the cost of which is lower than the cost of regular flights tickets, have an effect similar to LCC. People with less financial wealth get the opportunity to travel, thus contributing to market growth. The charter flights are mentioned in this study due to the reason that charter flights from Moscow to Antalya should be considered to a certain extent as an alternative route for Moscow – Istanbul market. Not only leisure travellers can visit Istanbul during the package tour holiday in Antalya, but business travellers can also combine leisure and business purposes of the trip by adding a business component to their leisure trips. Antalya – Istanbul route is served by many domestic LCC's and bus companies that schedule the bus trips on night hours, which take 9 hours by driving. Not to mention many travel agencies selling Istanbul sightseeing tours for reasonable price.

Figure 3.14 gives the passenger totals for international non-scheduled flights from Moscow Aviation Hub (Sheremetyevo, Vnukovo and Domodedovo airports). Peaks are observed during summer months due to charter flights to Antalya.

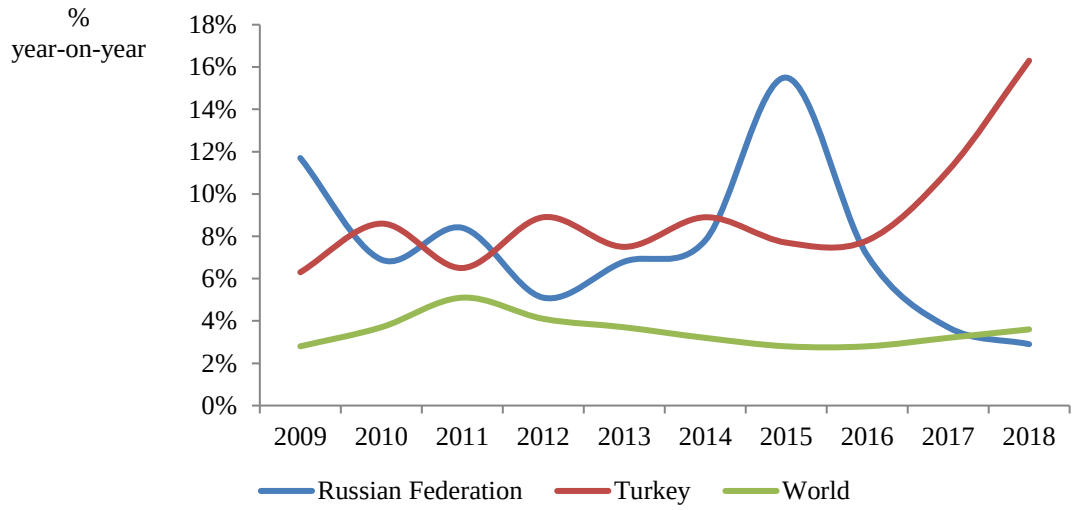


Source: Federal Air Transport Agency, Russia.

Figure 3.14. International non-scheduled flights passenger traffic, MAH

Charter carriers have a cost advantage over regular due to the fact that they have lower costs. First of all, this is due to the fact that charter carriers serve popular routes in the high season, thus ensuring a high load factor and reducing costs. Also, non-scheduled carriers are less dependent on historical slots and are not required to operate the same routes all year round. For a Moscow-Istanbul flights for a given airline, the CASK (cost per available seat kilometers) can range depending on the load factor. The high load factor reduces the CASK value. Regular carriers' fares differ from charter fares. They involve dynamic pricing, and costing includes not only the components of a given route, but also the entire network. At the same time, in order to preserve historic slots at airports and in accordance with many intergovernmental agreements, there is an obligation to operate flights throughout the year. The implementation of flights in the high and low season also makes its own adjustments to the pricing policy.

The airline costs and fares are greatly influenced by inflation. Over the past 10 years, a 3.5% average annual growth has been observed worldwide (Figure 3.15). Part of the increase in operating costs is offset by an increase in the cost of tariffs. On the other hand, airlines improve the operations by introducing new technologies and optimize supply and demand chains.



Source: International Monetary Fund.

Figure 3.15. Inflation rate, average consumer prices

Route distance and trip time. The main advantage of air travel over other modes of transport is time. This factor is relevant for both business passengers and leisure passengers. Business passengers have the opportunity to get to the meeting place or their duty place faster. This increases the efficiency of employees by reducing the time spent on certain tasks. In turn, leisure travelers have the opportunity to visit more distant places without sacrificing valuable vacation days on the trip. Due to shorter travel time, the tendency to make short 3-4 day trips to nearby countries grows.

The higher the need to complete the trip faster, the more urgent the air travel is. There is no doubt that sometimes this is the only possible way to reach the destination in a short time. For this reason, airfare increases as the departure date approaches. Passengers are forced to buy expensive air tickets because they have no choice. It is also worth considering the concept of time value, which is relevant not only for business passengers and does not always depend on the level of income. Some travelers put value upon high-quality family vacation and consider such trips as a kind of contribution to personal success and family well-being, which then will have a positive effect on success in workplace.

Another facet of this air travel feature is the possibility of an alternative. For short flights, the alternative can be rail or road transport, or a flight through a third airport. As for long flights, there is practically no alternative, given the time factor. The previous studies show that the elasticity of demand for short – haul flights is higher than for long – haul flights. The Moscow – Istanbul city pair route distance is 1765 km and flight time is around 3 hours.

Comfort, safety and convenience. The quality of services provided in the aviation industry is constantly growing. Increasing competition and passenger requirements do not allow airlines to ignore the factors of comfort, safety and convenience. Prestigious awards from Skytrax, TripAdvisor Travelers' Choice Awards, and others based on passenger feedback are awarded annually among the world's airlines. However, it is difficult to find and measure the quantitative indicators of these characteristics. For this reason, it is almost impossible to assess their impact on passenger traffic. At the same time, it would be a big mistake to underestimate their influence. The influence of these variables can be referred to a time trend function.

Comfort. The concept of comfort has long gone beyond the scope of convenience on board of the aircraft. Air travel is associated with the ability to comfortably reach the airport, stay at the airport, simplicity of passing formalities and pre flight controls.. If in the recent past, baggage check-in and registration were carried out only at the airport, today with the development of IT services, the concept of comfort extends to the convenience of using the web site and the airline's mobile application.

The level of inflight comfort is also being affected by values of seating density. The air carries nowadays provide coach, comfort, business and first class travel options. All of them different distance between seats. Some of them are available only on aircraft operated on long-distance flights. Airlines are taking care of many details that help passengers relax and enjoy the flight: shopping on board, multimedia entertainment system, and individual travel kits. Another characteristics of inflight comfort are hot food service, special meals, increased legroom, comfortable and flat bed seats.

Airport management has become aware that more comfortable conditions for passengers contribute to the growth of passenger traffic and an increase in the number of carriers who want to operate flights from this airport. Thus, airports become part of

the system that generates passenger traffic, thereby increasing its profits. Airports involved in the competition for passengers. Modern logistics sistems for faster check-in and secirity procedures, VIP and CIP lounges, relax zones and shopping facilities are aiming the make the travellers stay at the airport more enjoyable. This is especially visible in cities that have several airports. Moscow Aviation Hub is a good example. The three main airports in Moscow, Sheremetyevo, Domodedovo and Vnukovo, are competing not only for airlines but passengers as well. Most airports have metro stations, which is rated as one of the most convenient and efficient modes of transport.

Being FSNC (Full Service Network Carrier) and national flag carriers of their countries the airlines serving the Moscow – Istanbul market during the inspected period both have received high ranking from Skytrax, the leading authority on airlines quality. Skytrax is a global passenger survey on the quality of airline and airports services. The company provides information on more than 210 airlines and 65 airports. Turkish Airlines and Aeroflot average fleet age is 5.6 years.

Safety. To date, no consulting company has compiled airline safety ratings. There are safety incidents accounts kept. However, more or fewer incidents do not allow to judge the security level of airlines. It is necessary to take into account the fact that the maintenance of the aircraft fleet is carried out by authorized companies and there are only a few major aircraft manufacturers for civil aviation, the safety standards of which are regulated not only by the governments but by international organizations as well.

Another important aspect of safety records is that they can become a decision making factor for a passenger when choosing a particular airline. Low rating may cause a aggravation of the company's image and, as a result, loss of profits. Security and commercial issues for airlines should be separated and independent in order to avoid possible speculations. The legitimacy issue of airlines safety ratings is also open. In this study Turkish Airlines and Aeroflot being national flag carriers are considered having same safety standards.

Convenience. Convenience can be attributed to the characteristics associated with the size of network, frequency of flights and time of flights. The rights of passengers in the event of flight cancellations, delays or baggage loss are differently regulated

depending on how the air carriage is arranged. For passengers it is more convenient if the whole itinerary is operated by flights of the same airline. In this case, the issues of responsibility are more clear. Flight frequency, i.e. the number of flights per day makes it possible to choose shorter connections and at the same time significantly reduce the cost of the air ticket, since the passenger can choose different waiting times in the case of transit flights. Departure and arrival in the daytime, of course, is more preferable than, flights at night. The success of non-stop flights from Russian cities to Istanbul has shown the convenience of direct flights.

The main effect of these factors is the reduction of flight time and the the wider choice for the passenger.

3.2. Demand elasticity of air travel demand

Air travel demand exhibit sensitivity to changes in ticket prices and incomes. On the other hand, the demand elasticity varies depending on different situations.

This study estimates the demand elasticity of air travel and focuses on its three main features:

1. Price elasticity measures the sensitivity of air travel demand in response to changes in price.
2. Cross price elasticity measures the interaction or the sensitivity of demand to changes in price of another service.
3. Income elasticity is a measure to capture the sensitivity of demand to changes in individual or aggregate income levels.

According to demand law, in response to lower prices, consumers will purchase more services. The demand function establishes the dependence of the volume of demand on price. The main question is how dramatically the volume of demand will change with a particular price change.

As LCC carriers appear on the Russian market, airlines expand the route network and the number of flights along existing routes is increasing, the competition is growing. At the same time, the increasing transparency on the structure of fares and prices data,

the increasing number of sales channels, leads to the fact that today, passengers have become very sensitive to changes in air ticket prices.

The elasticity of demand depends on several major factors. We are going to discuss how these factors affect the elasticity of demand for air travel.

Substitute services. In a competitive market where, by definition, there are several airlines offering flights on the same routes, the demand curve for the services of each individual carrier is completely elastic. If one of the competing carriers raises the price of their service, travellers will immediately shift to easily available substitutes offered by other carriers. In this regard, it is worth noting that the elasticity of demand for short-haul routes is higher than on long-haul routes. This is due to the fact that short-haul routes are subject to competition from other modes of transport and, often, the possibility of a flight to a nearby alternative destination.

The factor of substitution goods is also important when considering price elasticity across a city – pair route, regional market, and country. As we have already noted, when the cost of air tickets of one carrier on a particular route rises, passengers often have the opportunity to use the services of another carrier. However, with an increase in the cost of the flight across the region or the country, passengers have less opportunity to find an alternative. A similar situation was observed in 2015 - 2016, when the ruble exchange rate fell sharply against the US dollar. During this period, there was a general increase in air travel cost departing from Russia for all Russians. An alternative to passengers could be the cancellation of the air travel, or diverting to domestic tourism, or choosing ground transport modes. In this regard, it can be assumed that the larger the market scale, the less elastic the demand.

On all outbound routes from Russia during 2015 – 2016 period we can observe the impact of increased air fares and total travel cost on demand due to economic crysis and reduction in the purchasing power of the Russian people. Not only due to higher travel costs on Moscow – Istanbul route.

In this regard, when measuring the air travel demand elasticity, it makes sense to consider the direction of passenger traffic, and, if possible, distinguish outbound and

inbound passenger traffic. The perception of the cost of the flight by Russians departing from Russia will be different from the cost perception of the air travel by foreign tourists who come to visit Russia. It is assumed that the use of round trip tariffs in this work will help to avoid this problem by obtaining more accurate indicators of the elasticity of demand on the route Moscow - Istanbul.

Share in the income. With other things being equal, the bigger the share of the ticket price in the traveler's budget, the more elastic is the demand for it. Rising ticket prices by 10% can be expressed in a few dollars and almost do not affect the magnitude of the demand. An inevitable increase in fares due to an increase in service quality will not cause a sharp drop in demand. The air travel demand for business class passengers is usually less sensitive to price changes than for economy class passengers.

The share of air ticket fare in the total trip cost. Drawing a parallel with the factor described above, it can be assumed that the decrease in the share of the cost of air travel in the total cost of a trip contributes to a decrease in the elasticity of air travel demand. However, this does not happen for two reasons. First, in most cases, a flight of one airline can be easily replaced by a competing airline's offer. Secondly, airfare and other components of the trip, such as: hotel, car rental, tours, etc., are related products. And before making a final decision on the trip, passengers need to make a decision regarding the cost and details of the air travel.

Sometimes the air travel becomes a necessity. The demand for basic necessities is usually inelastic. Price increases do not significantly reduce the consumption of these services. No one refuses to fly if it is an urgent situation and the air ticket prices have just increased several times. Due to this reason airlines apply advance purchase rules to low fares so that the customers are bound to overpay in situations when they have to book tickets close to flight departure date.

Time factor. Usually, the demand for a product is more elastic, the more time the consumer has for making decisions, since most of them do not have their own habits. If the price of a service rises, traveler need time to find and test other services until he is convinced that they are acceptable. If the price of tickets of one airline rises by 10%, consumers may not immediately reduce their purchases. But over time, they can switch

to another airline. This is one of the reasons why the air tickets are cheaper when purchased in advance.

Price elasticity of demand. The sensitivity of consumers to a change in the price of a service is determined by the price elasticity of demand. The demand for some services is characterized by the relative sensitivity of consumers to price changes; a small change in price leads to significant changes in the quantity of purchased services.

When analyzing demand, the sign of elasticity is of no interest. As a rule, the absolute value of the coefficient of elasticity is used. Therefore, to measure the magnitude of the response of demand to a change in price, it is more convenient to use the absolute value of elasticity. Demand is called inelastic if elasticity is less than one, and elastic if elasticity is greater than one. The elasticity of demand serves as a useful tool for identifying consumer attitudes to various goods.

The degree of price elasticity or inelasticity of demand is measured using the coefficient of elasticity according to the formula:

$$Price\ Elasticity = \frac{\%\ Change\ in\ Quantity\ Demanded}{\%\ in\ Price} \qquad (3.1)$$

If the coefficient is greater that one, then the demand is called elastic. Then the cost decrease will lead to an increase in income received due to the outpacing growth in air traffic. If the coefficient is smaller that one, the demand is inelastic. Reducing the price does not give the desired increase in income, as some passenger traffic increase would not compensate the lost profit due to fare decrease. If elasticity equals to one then the amount of income received will be constant for all values of tariffs.

Speaking of inelasticity in demand, one doesn't mean the absolute insensitivity of buyers to price changes. However, there is an extreme case, which is denoted by the term completely inelastic demand, when a change in price generally does not lead to any change in the magnitude of demand. An example is the demand for fuel in aviation.

Before making decisions about pricing policy the managers should fully assess the situation. Increasing income in the short term may result in a loss in the future. If, while stimulating passenger demand, the frequency of flights wouldn't be adjusted, the load factor would increase. The passengers can consider it as a reduced comfort and this may lead to a demand decrease.

Calculation and analysis of the results is recommended for each route by period. Accumulated statistics will allow to extrapolate the results and model the airline's pricing policy for the future. Cross price elasticity of demand. While price elasticity measures the sensitivity of the magnitude of demand to price change, it is important to know how the consumption of a product is influenced by the price change of the conjugated product. The concept of cross price elasticity of demand makes it possible to measure how sensitive the consumption of one service is to the change in the price of other service. Cross elasticity of demand is calculated in the same way as simple price elasticity, with the only difference that in this case the percentage change in consumption of one service is related to the percentage change in the price of another service.

$$Cross\ Price\ Elasticity = \frac{\%\ Change\ in\ Quantity\ of\ Good\ A\ Demanded}{\%\ in\ Price\ of\ Good\ B} \qquad (3.2)$$

This concept of elasticity makes it possible to quantify and further understand the interchangeability and complementarity of products. If the coefficient of cross price demand elasticity has a positive value: the magnitude of demand for product X varies in direct proportion to the price of product Y, then X and Y are interchangeable goods. For example, a rise in the price of tickets from one airline (X) forces consumers to buy more tickets from another airline (Y). The greater the value of the positive coefficient, the greater the degree of substitutability of the two goods.

Income elasticity of demand. The income elasticity of demand indicates the degree of consumer sensitivity to changes in their income when purchasing a particular service. The coefficient of income elasticity of demand is determined by the following formula:

$$Income\ Elasticity = \frac{\%\ Change\ in\ Quantity\ Demanded}{\%\ in\ Income} \qquad (3.3)$$

The calculation income elasticity of demand makes it possible to distinguish between "lower" goods from "normal" goods. For most “normal” goods, the coefficient of income elasticity is positive, that is, their consumption increases with income. Air travel can be attributed to this category. With rising incomes, households and individuals are willing to spend more on travel.

Income growth associated with GDP is one of the main drivers of air travel demand. For the past 20 years, the global air transport market has shown an average annual growth rate of 5.1%. While world GDP is 3.7%. We can suppose the elasticity coefficient of 1.4. Income growth explains most of the changes in the airline market. The air travel cost changes mostly affect the travel diverting between airlines and markets, rather than the overall growth of the industry as a whole.

CHAPTER 4

EMPIRICAL ANALYSES

This chapter provides insight into the the model, data and estimation results.

4.1. The model

A typical demand model include the price of the good or service, the price of the substitute or complemanry goods or services, consumer’s income and may be expanded to include other economical, social, cultural, sector-specific, country-specific factors depending on the data availability. This study aims to estimate a deman model for air travel, which is a service industry. The related literature suggests the following ad hoc model :

$$PAX_t = f(P_{tk}, P_{su}, Y, PMI, Poil, Distance, Frequency, Dummy) \quad (4.1)$$

Where,

PAX_t	dependent variable and represents air travel demand for Moscow – Istanbul market
P_{tk}	ticket price of Turkish Airlines (own price)
P_{su}	ticket price of Aeroflot Russian Airlines
Y	Russian per capita income
$Dummy$	seasonal dummy (D=1 for high seasons, D=0 for low seasons)

Own Price. Own price is the main determinant of any demand model. Airline own average ticket price reflects the average overall round-trip price paid (includes all taxes and fees, in Russian Ruble). Monthly price data for economy class passengers was taken for January 2014 – December 2018 time range for Moscow – Istanbul city pair route. The average price variable appears in both model specifications.

Substitute Price. A substitute travel price variable was included in the regression models. Competing carrier's Aeroflot Russian Airlines average ticket price was used as a substitute price. Aeroflot serves the same Moscow – Istanbul route and the same catchment area from a different airport Sheremetyevo SVO. Monthly price data for economy class passengers was taken for the period from January 2014 to December 2018 (in Russian Ruble). Only non-stop service is available on this route.

Per capita income. Average per capita income measures the influence of income on demand. Average per capita income data per month for Moscow was taken for the period from January 2014 to December 2018. Income figures reflect the annual money income of population that comprises gains of persons engaged in entrepreneurial business activity, paid remuneration of employees, social transfers (pensions, benefits, grant, insurance compensations and other transfers), property income in the form of interest on deposits, securities, and dividends divided by 12 and by the population size (in USD). This data is collected on regional basis and over time. Regression analysis used Moscow Average per capita money income in US dollars. Per capita income is

used in both models. The income per capita data was obtained from Russian Federation Federal State Statistics Service sources and is given in Appendix B.

Exchange Rates. The tourists flow into the country decreases as it becomes more expensive to stay. During the period from January 2014 to December 2018 a reduction in the purchasing power of the Russian people was observed due to the steady increase in the dollar rate and the weakening of the ruble. Central Bank of Russia exchange rates of US Dollar against the ruble were used to convert average per capita income into US Dollar to evaluate the purchasing power of Russian Ruble. The Central Bank official exchange rates are given in Appendix B.

Seasonal variables. Tourism activities are subject to seasonal fluctuations. Obviously, air travel demand is directly influenced by tourism activities. Therefore a seasonal dummy was tested in the model. Application of high season (from June to August) time dummy variable didn't have effect on explanatory power of the models.

Trip distance. The need to take into account this variable is that the route distance is associated with saving time and alternative types of ground transportation. Long – haul routes imply fewer alternatives, with the exception of a transfer in a third airport. Short flights face competition from rail and road transport. At the Moscow – Istanbul city pair level the distance is 1765 km and flight time is around 3 hours. Due to the fact that the distance remains unchanged this variable was not included in the models.

Flights Frequency. Usually the decision on the flights frequency is made on the basis of the seasonality factor for a given market. Historical data for previous years gives an idea of the demand in a particular market and allows to make more accurate decisions from an economic point of view. Thus, initially, one can speak of a positive relationship between the flight frequency and the volume of passenger traffic. It is worth mentioning the S-Curve Phenomenon, which became known in the 1970s. It was noted that the flight frequency and passenger traffic do not change proportionally. The increase in the number of flights leads to an even greater increase in passenger traffic and vice versa. The effect is estimated by using capacity share on the x-axis. The growth of low-cost carriers (LCCs), leisure-heavy and fare-sensitive passenger segment and improvements of distribution channel decreased the importance of

schedule towards the price component in decision making. Still S-Curve can be observed in markets with FSN carriers and where there is no LCC competition.

Crude oil price. Russia is the world's second largest oil exporter, which makes its economy heavily dependent on the world oil market. Oil and gas exports account for 40 percent of Russia's total federal budget revenues. The fall in oil prices between 2014 and 2016 caused great damage to the Russian economy. In 2014, the Russian ruble depreciated by 59% compared to the U.S. dollar. The price of crude oil decreased by more than 30 percent from $ 75 to $ 53 per barrel between October and December 2016. In this regard, the purchasing power parity (PPP) of the ruble has fallen sharply, which in turn reduces living standards and leads to higher prices for goods and services purchased abroad. In this study, the monthly average crude oil price (Dated Brent US Dollar per barrel) was considered as an alternative for income per capita variable in order to assess the welfare of the population as an important amount of residents of Moscow work in oil-related jobs. Figure 4.1 shows the positive correlation between passenger traffic on Moscow – Istanbul route and crude oil price in US dollar.

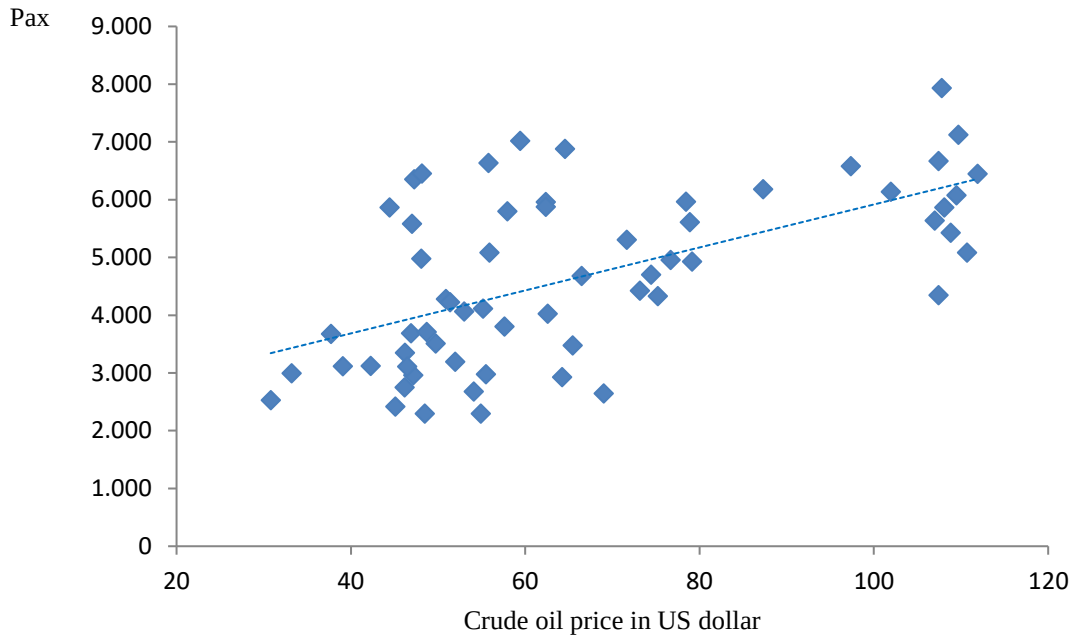


Figure 4.1. Scatterplot: Crude oil price, US dollars and MOW-IST passenger traffic

Due to the reason that income per capita data for Moscow was found to show higher explanatory power of the econometric models the crude oil price variable was excluded from the final regression models.

PMI index. The Purchasing Managers' Index report represents the results of a survey of purchasing managers in the industry and aims to study the impact of the economy on the formation of price space and provides qualitative information on business trends, in fact, it is an optimism index for the top and middle management level of the economy. PMI is a fairly robust indicator for predicting business cycle turning points. For the last 40 years, the maximum PMI values consistently herald the achievement of a peak business cycle on average for seven months, the minimum PMI values are reached three months before the minimum in the business cycle.

The PMI are particularly useful in the case of aviation, as they provide leading indications of changes in demand conditions on both the passenger and the cargo sides of the business. Air passenger demand conditions are closely related to developments in the economic cycle; as a result it is perhaps unsurprising to see that year-on-year growth in passenger traffic is highly correlated with the global composite PMI (a weighted measure of business confidence from both the manufacturing and the services sectors). Purchasing Managers' Indices (PMI) are indicators of changes in economic conditions. Surprisingly it was found that PMI in Russia from October 2013 to October 2018 and Moscow – Istanbul passenger traffic show negative correlation (Figure 4.2). The econometric results indicated a higher influence of per capita income on demand than that of PMI, thus PMI index was excluded from the final model specifications.

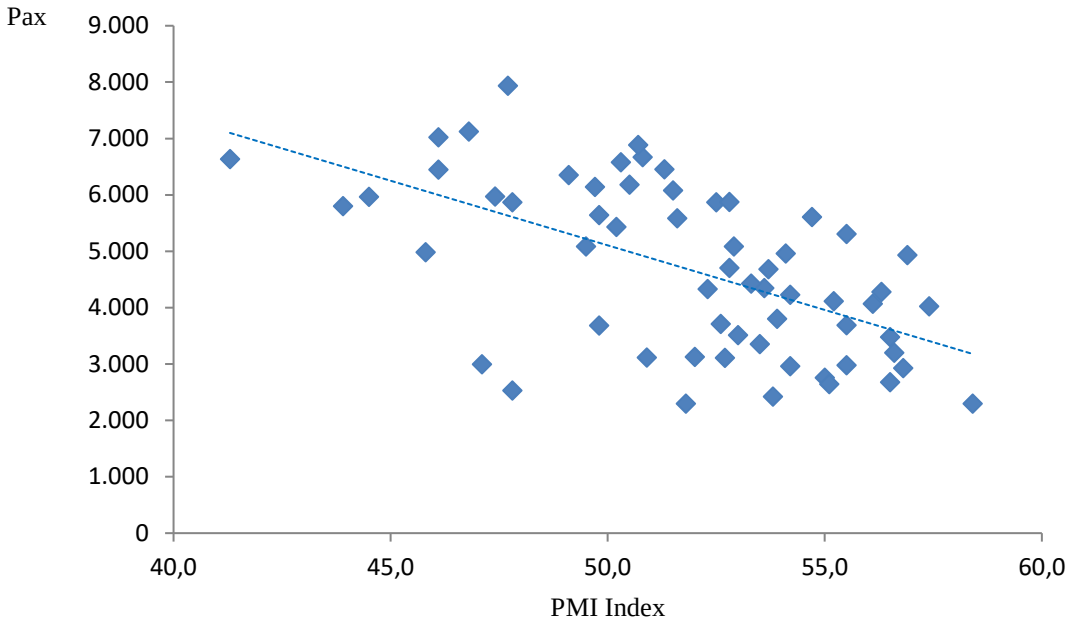


Figure 4.2. Scatterplot: PMI index and MOW-IST Passenger traffic

4.2. Data description and data sources

The evaluation is based on monthly data with seasonal adjustment that relates to the period from January 2014 to December 2018. Table 4.1 desribes the exact definitions and measurement details.

Table 4.1 Description of variables.

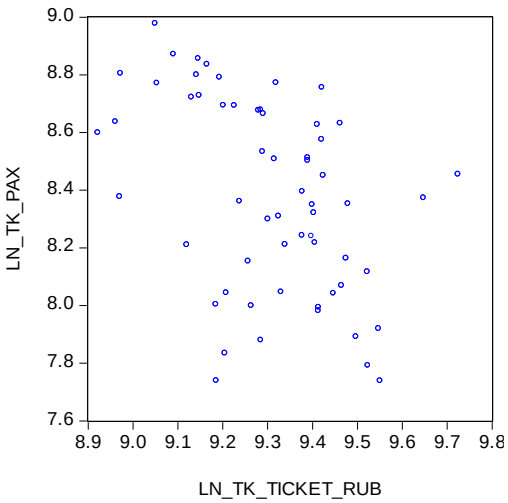
Variable	Definition	Measurement, monthly average
PAX_t	Air travel demand in Moscow – Istanbul market	Number of passengers
Y	Per capita income	Per capita income, in U.S. dollars
P_{tk}	Turkish Airlines ticket price	Ticket price, in Russian rubles
P_{su}	Aeroflot Russian Airlines ticket price (a substitute price)	Ticket price, in Russian rubles
P_{oil}	Crude oil price	Crude Oil; Dated Brent US$ per barrel
PMI	PMI Index	Index
$Frequency_{tk}$	Turkish Airlines flight frequency	Number of flights

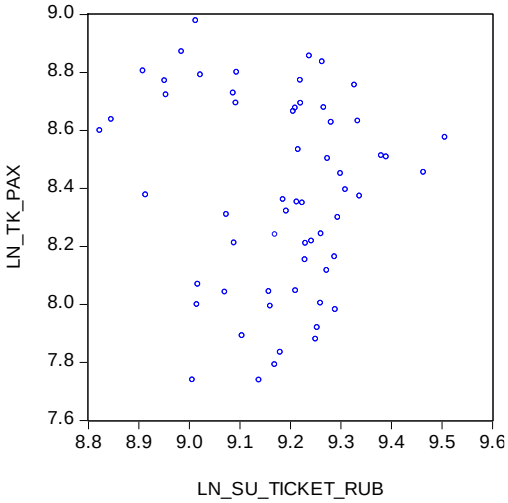
Descriptive statistics are given in Table 4.2.

Table 4.2 Descriptive statistics.

Variable	PAX_t	Y	P_{tk}	P_{su}	P_{oil}	PMI	$Frequency_{tk}$
Mean	4598,03	1057,36	11161,66	9777,66	64,16	51,98	114,40
Median	4339,5	996,9	11122,07	10013,4	57,04	52,75	120
Maximum	7932	1600,35	16716,60	13443,53	111,87	58,40	126
Minimum	2296,00	546,68	7492,87	6787,29	30,80	41,30	84
Std. Dev.	1472,80	257,12	1891,91	1371,80	21,54	3,80	13,20
Skewness	0,23	0,47	0,31	-0,02	0,92	-0,63	-1,11
Kurtosis	1,95	2,50	3,17	3,07	2,87	2,80	2,56
Jarque-Bera	3,27	2,81	1,01	0,02	8,53	4,05	12,90
Probability	0,19	0,24	0,60	0,99	0,01	0,13	0,00
Sum	275882	63441,87	669699,5	586659,7	3849,83	3118,8	6864
Observations	60	60	60	60	60	60	60

The scatter diagrams below provide a visual representation of the relationship of variables. One can notice the expected inverse relation between passenger demand and air carrier's own price. The predicted positive relationship between passenger demand, per capita income, and crude oil prices can be observed as well. The positive relationship between passenger demand and the cross price of rival airline, PMI index isn't obvious though (Figure 4.3). The data used is log-transformed.





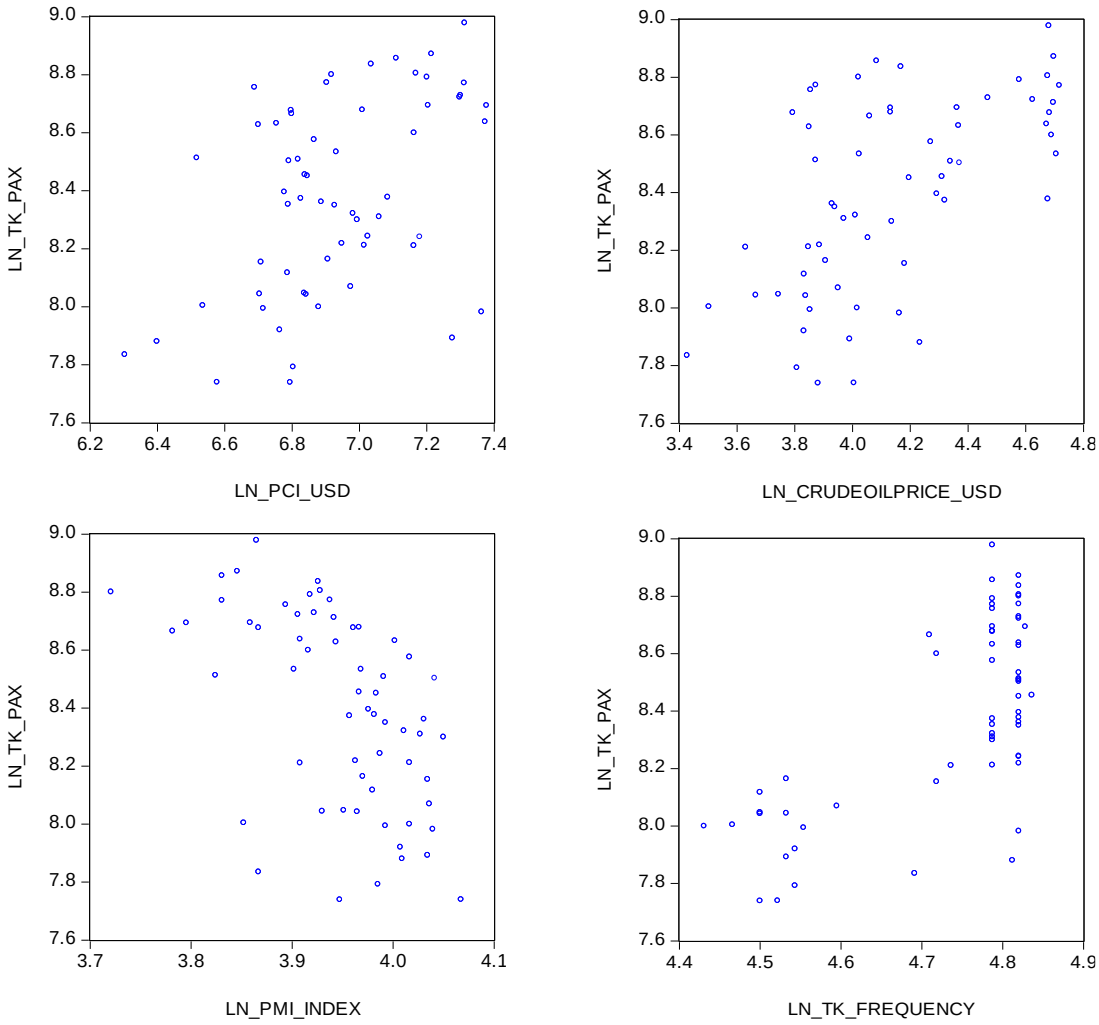


Figure 4.3. Scatterplots

The statistical information used in this paper was obtained from MIDAS DOB Systems which is a provider of GDS Marketing Information Data (MIDT). The economic data was derived from the Russian Federation Federal State Statistics Service and Central Bank of Russian Federation sources. The remaining databases are scientific articles, papers and reports on changes in the socio-economic, political and legislative areas and factors that may have an indirect impact on passenger traffic in the investigated market (Journal of Air Transport management, IndexMundi, RateStats and IHS Markit data portals).

The following databases were used for the econometric research.

MIDAS. DOB Systems provides GDS Marketing Information Data (MIDT). MIDT is an abbreviation for Marketing Information Data Transfer. It is a record of agency booking transactions from the various travel data providers. The raw data is processed and assembled into True O&D format for use in the Midas data warehouse. The system uses each month's data to build a data warehouse on the DOB Servers. Data from the following GDS sources is used in the Midas system – Abacus, Amadeus, Axess, Farelogix, Galileo/Apollo, Infini, Sabre, Topas, Travelsky and Worldspan. MIDAS provides passenger totals for itineraries which travelled through the specified connection points, for specified points of sale, for a single airline or for all airlines for the flight number requested. Monthly passengers and ticket fare data refers to period from January 2014 to December 2018 for Moscow – Istanbul route. Passenger totals represent the monthly number of economy class travellers on the route. Average ticket prices reflect the average overall round-trip ticket prices paid for each airline (includes all taxes and fees, in Russian Ruble). Since MIDAS data excludes the data from TCH CCBT it is not complete. Furthermore, the MIDAS data doesn't include passenger totals carried on non-scheduled flights. Regardless of these discrepancies, the time-series data derived from MIDAS were the most obtainable, and was used to investigate the air travel demand on Moscow – Istanbul city pair.

The Federal State Statistics Service of the Russian Federation. The database comprises regional and federal official statistical data, uncluding Moscow. Average per capita money income data per month in Moscow was taken for the period from January 2014 to December 2018. Income figures reflect the annual money income of population divided by 12 and by the population size (in USD).

The Central Bank of the Russian Federation. Exchange rate of US Dollar against the ruble during January 2014 – December 2018 time range.

4.3. Estimation methods

We use two estimation methods in order to estimate our demand model. DOLS and FMOLS regression analyses are measuring relation of passenger totals to ticket fares, per capita income, and determinants having an intuitional and measurable influence air travel demand, alongside with minimizing the variance of the estimations. The

regression method allows to identify and quantify the relationship between dependent and independent variables separately. In all models, passenger traffic is used as the dependent variable.

Dynamic OLS, DOLS. DOLS is one of the most popular methods for obtaining t-statistics, independent of interfering parameters, proposed in [Saikkonen, 1991; Stock, Watson, 1993]. On the basis of DOLS, it is possible to obtain t-statistics for coefficients of a cointegrating vector explaining the long-run relation between the variables in Moscow – Istanbul air travel demand function with a standard normal distribution. The essence of the DOLS method is to add to the cointegrating regression leads and lags differences of the explanatory variable, as well as the first difference of this variable.

Fully Modified OLS (FMOLS). The FMOLS approach allows eliminating the long run correlation problem among the cointegrating equation and stochastic regressor innovation.Although both methods are asymptotically equivalent, the DOLS is preferred on finals samplings.

4.4. Estimation results

Certainly, these conclusions are made on the basis of external visual observation. To obtain robust results, it is necessary to determine whether the relationship between variables in equation is statistically significant. After that, the actual impact of variables on air travel demand in the Moscow-Istanbul market will be evaluated.

Unit Root Tests. To avoid a spurious regression, it is initially necessary to check for the presence of a unit root. For this, the approaches ADF, PP, Ng-Perron and KPSS were applied. Depending on outputs of the unit root tests, the decision is made which methods to use. ADF, PP, Ng-Perron tests are applied to verify the robustness of the model. The KPSS test is used to justify the aforementioned tests. The data used in the tests is log-transformed.

The ADF method estimates equation (4.2) and tests the stationarity. It is a modification of the Dickey-Fuller test in cases where it is assumed that the model deviations will

autocorrelate. Autoregressive variables (lags) of the variable difference Δy_t are introduced into each equation of the test to correct the possible correlation of random deviations of the tested model. The H_0: $\alpha = 0$ states that series has a unit root. The H_1: $\alpha < 0$ states that series is non – stationary. The standart t-statistic is employed. Lag terms in ADF test are set according to SIC.

$$\Delta y_t = \propto y_{t-1} + x_t\delta + \sum_{p=1}^{p} \Delta y_{t-p} + \varepsilon_t \quad (4.2)$$

x_t exogenous regressors

Δy_{t-p} higher-order correlation correction

The Phillips - Perron method estimates a non-augmented modification of equation (4.2). It is used in the case of violation of the hypothesis of uncorrelated and homoscedastic deviations in the tested model, i.e. random deviations can be autocorrelated, have different variances and not be distributed according to the normal distribution, which allows the test to be used for a wider class of time series. Thus, the PP test is recommended for use in cases of pronounced seasonality and structural changes. Null hypothesis is the same as in the ADF test. The Phillips – Perron approach uses is its own statistic and corresponding distribution.

Ng-Perron approach includes the characteristics of DF-GLS and Phillips Perron methods. Its application provides better results in situations of negative moving average.

The main difference from the previously reviewed tests is that the KPSS criterion tests the hypothesis and belonging of the series to the TS-series as a null hypothesis.
The KPSS equation (4.3) uses LM statistic.

$$\Delta y_t = x_t\delta + \varepsilon_t \quad (4.3)$$

An attempt is made to verify the presence of stationarity in regressors in the model by means of ADF, Phillips&Perron, Ng-Perron and KPSS methods. The outputs allow us to conclude that the series are non – stationary. Only per capita income shows

stationarity in level at Augmented Dickey-Fuller and Phillips – Perron tests. The alternative hypothesis is accepted for per capita income in level as per ADF and PP tests. However, in the case of per capita income in level, Ng-Perron and KPSS unit root tests show non-stationarity of the variable. As per ADF and PP approaches we reject unit root process at a .05 significance level. Consequently, ADF and PP stationarity tests indicate that the series investigated are I(1). KPSS unit root tests justify the results as well. As per KPSS outputs, the null hypothesis is accepted in first difference, but is not accepted in level. Illustration 6.1 provides the outputs of the stationarity tests. H_0 is non – stationary process for Augmented Dickey-Fuller and Phillips – Perron tests. Alternatively, in KPSS H_0 assumes that series don't have a unit root. Unit root test results are given in Table 4.3.

Table 4.3 Stationarity tests: ADF, PP, Ng-Perron and KPSS

		$lPax_{tk}$	lP_{tk}	$lFrequency_{tk}$	lP_{su}	$lFrequency_{su}$	lY	$lExchangeRate$	$lOil$	$lPM1$
ADF	level + intercept	0,1000 NS	0.0620 NS	0.2678 NS	0.1058 NS	0.2533 NS	0.0000 S	0.1804 NS	0.9272 NS	0.2241 NS
	1st difference + intercept	0,0000 S	0,0000 S	0,0000 S	0,0000 S	0.0019 S	0.0000 S	0,0000 S	0,0000 S	0,0000 S
	level + trend & intercept	0.1770 NS	0.0171 S	0.6111 NS	0.1259 NS	0.6080 NS	0.0000 S	0.6719 NS	0.9797 NS	0.0811 NS
	1st difference + trend & intercept	0,0000 S	0,0000 S	0,0000 S	0,0000 S	0.0098 S	0.0000 S	0.0002 S	0,0000 S	0,0000 S
Phillips Perron	level + intercept	0.3139 NS	0.0991 NS	0.3129 NS	0.1246 NS	0.3856 NS	0,0000 S	0.2648 NS	0.9314 NS	0.2467 NS
	1st difference + intercept	0,0000 S	0,0000 S	0,0000 S	0,0000 S	0,0000 S	0.0001 S	0.0173 S	0,0000 S	0,0000 S
	level + trend & intercept	0.6482 NS	0.0176 S	0.6743 NS	0.1405 NS	0.7512 NS	0,0000 S	0.7023 NS	0.9819 NS	0.0835 NS
	1st difference + trend & intercept	0,0000 S	0,0000 S	0,0000 S	0,0000 S	0,0000 S	0.0001 S	0.0729 NS	0,0000 S	0,0000 S
Ng-Perron	level + intercept	S	NS	NS	NS	S	S	NS	NS	S
	1st difference + intercept	S	S	S	S	S	NS	S	S	S
	level + trend & intercept	S	S	NS	NS	NS	S	NS	NS	NS
	1st difference + trend & intercept	S	S	S	S	NS	NS	S	S	S
KPSS LM-Stat.	level + intercept	0.5220 NS	0.8193 NS	0.1843 S	0.5894 NS	0.2313 S	0.1868 S	0.5696 NS	0.2524 S	0.7160 NS
	1st difference + intercept	0.2537 S	0.0568 S	0.1206 S	0.1244 S	0.1238 S	0.1544 S	0.2274 S	0.3951 S	0.1101 S
	level + trend & intercept	0.1811 NS	0.1603 NS	0.1631 NS	0.1337 S	0.1655 NS	0.0887 S	0.2106 NS	0.2216 NS	0.1200 S
	1st difference + trend & intercept	0.2827 NS	0.0301 S	0.0632 S	0.0820 S	0.0674 S	0.1537 NS	0.0631 S	0.0886 S	0.0948 S

* NS stands for non-stationary ** S stands for stationary

To check whether or not the variables are cointegrated we employ Johansen cointegration test. The Trace test statistic illustrated in Table 4.4 indicates existence of at most two cointegration relationships and Max-eigenvalue test indicates existence of one cointegration relationship.

Table 4.4 Cointegration tests results

Null	Trace Statistic	0.05 Ctirical value	Prob.
None*	96.32847	69.81889	0.0001
At most 1*	53.42381	47.85613	0.0137
At most 2*	30.70488	29.79707	0.0392
Null	Max-Eigen Statistic	0.05 Ctirical value	Prob.
None*	42.90465	33.87687	0.0032
At most 1	22.71894	27.58434	0.1858
At most 2	16.58948	21.13162	0.1923

* The hypothesis is rejected at the 0.01 level

Given that the series are integrated of order 1 the DOLS approach is applied to estimate cointegrating vector to characterise the long-run relation between the determinants in the air travel demand model in Moscow – Istanbul market.

DOLS estimation is as following:

$$Y_t = \beta_0 + \vec{\beta} X + \sum_{j=-q}^{p} \vec{d}_j \, \Delta X_{t-j} + u_t \qquad (4.4)$$

Where,

Y_t dependent variable

X matrix of regressors

$\vec{\beta}$ cointegrating vector

p lag lenght

q lead lenght

Lag and lead components used in DOLS estimation make the stochastic error term irrespective of previous innovations in stochastic variables. Stationarity check and DOLS estimation are executed using EViews 8.

DOLS and FMOLS estimation results. We initially estimate an unrestricted model including a large number of regressors. The data used is log-transformed.

$$PAX_t = \beta_0 + \beta_1 Price_{tk} + \beta_2 Price_{su} + \beta_3 Income_t + \beta_4 Frequency_{tk} + \beta_5 Exchange + \beta_6 Dummy + \varepsilon_t \quad (4.5)$$

Where,

$Income_t$ crude oil Dated Brent price was used as an income indicator

$Frequency_{tk}$ Turkish Airlines monthly flight frequency

$Exchange$ Russian ruble and US dollar exchange rate

$Dummy$ time dummy indicating high summer season

The equation (4.5) results are illustrated in Table 4.5. Leads and lags terms are set as fixed.

Table 4.5 Equation (4.5) DOLS estimation results.

β_0	β_1	β_2	β_3	β_4	β_5	β_6		
0.08	-1.17	1.01	0.56	1.16	0.68	0.23		
(0.01)	(-1.62)	(1.39)	(3.04)	(1.74)	(2.65)	1.33		
R2	Adj. R2	S.E.	D.W.	SSR			Leads	Lags
0.88	0.79	0.15	1.12	0.76			1	1

The figures in the parantheses are the t-ratios.

PMI index was used as income indicator in equation 4.6.

$$PAX_t = \beta_0 + \beta_1 Price_{tk} + \beta_2 Price_{su} + \beta_3 Income_t + \beta_4 Frequency_{tk} + \beta_5 Exchange + \beta_6 Dummy + \varepsilon_t \quad (4.6)$$

Where,

$Income_t$ PMI index as an income indicator

The equation (4.6) results are illustrated in Table 4.6. Leads and lags terms are set as fixed.

Table 4.6 Equation (4.6) DOLS estimation results.

β_0	β_1	β_2	β_3	β_4	β_5	β_6		
20.04	-0.67	0.44	-3.34	0.98	-0.32	0.22		
(4.07)	(-0.98)	(0.67)	(-4.39)	(1.56)	(-1.30)	1.37		
R2	Adj. R2	S.E.	D.W.	SSR			Leads	Lags
0.89	0.82	0.14	1.17	0.65			1	1

The figures in the parantheses are the t-ratios.

Frequency, crude oil price and PMI index are found to be statistically insignificant and thus were replaced with income per capita in Moscow metro area. Removing the flight frequency variable and time dummy, indicating high summer season, increased the explanatory power of the model. Also, instead of exchange rate and income in Russian ruble variables, income in US dollars was employed in the final model specification.

Including FIFA World Cup dummy variable for June – July 2018 period reduced the explanatory power of the model. In particular, the p-value of per capita income variable was found to be greater than the significance level. Also, Turkish Lira exchange rate to Russian Ruble variable has been tested in the models. The variable has been used in the models instead of per capita income and as an additional determinant. Obtained probability value was greater than significance level of 0.05 and R2 value was reduced at the same time. Due to this reason these variables were not employed in the final model.

After several iterations, the parsimonious model is restricted to a model with own price, substitute price and income.

$$PAX_t = \beta_0 + \beta_1 Price_{tk} + \beta_2 Price_{su} + \beta_3 Income_t + \varepsilon_t \quad (4.5)$$

We intially estimate the model with the DOLS method. Table 4.7 illustrates DOLS outputs. Leads and lags terms are set as fixed.

Table 4.7 DOLS estimation results.

β_0	β_1	β_2	β_3		
-6.74	-1.60	2.26	1.33		
(-0.90)	(-3.27)	(3.72)	(3.38)		
R2	Adj. R2	S.E.	D.W.	Leads	Lags
0.68	0.59	0.21	0.58	1	1

The figures in the parantheses are the t-ratios.

DOLS output shows that the air travel demand for Moscow – Istanbul market is price elastic. A 1 percent increase in own ticket price would cause a 1.6 percent decrease in passenger traffic. A 1 percent increase in the ticket prices of Aeroflot would cause 2.2 percent increase for Turkish Airlines. Air travel demand also shows sensitivity to income. A 1 % income per capita increase leads to 1.3 % passenger traffic increase. FMOLS results also confirm elasticity of air travel demand for the given market (Table 4.8). A 1 percent decrease in own ticket price would cause 1.6 percent increase in passenger traffic from Moscow to Istanbul. A 1 percent decrease in cross-price would cause 1.6% increase in passenger traffic. A 1 percent decrease in income would cause 0.8 percent decrease in passenger traffic.

Table 4.8 FMOLS estimation results.

β_0	β_1	β_2	β_3
1.90	-1.60	1.66	0.87
(0.37)	(-3.86)	(3.26)	(3.59)
R2	Adj. R2	S.E.	D.W.
0.39	0.36	0.26	1.20

The figures in the parantheses are the t-ratios.

The positive cross price elasticity means that Turkish Airlines and Aerflot are to rival companies. Price increase of one company would result in demand shift towards the lower priced substitute company. Table 4.9 illustrates the air travel demand elasticity on Moscow – Istanbul route.

Table 4.9 Impact of variables on Moscow – Istanbul route, DOLS

	Effect on air travel demand		Elasticity
10% rise in air ticket price	-16%	Price elasticity	-1,6
10% rise in air ticket cross price	22%	Cross price elasticity	2,2
10% rise in per capita income	13%	Income elasticity	1,3

CHAPTER 5

CONCLUSION

In this study an attempt to examine the factors affecting air travel demand for Moscow – Istanbul flight has been made. The analysis is based on time series monthly data from January 2014 to December 2018. DOLS (Dynamic Ordinary Least Squares) and FMOLS (Fully Modified Ordinary least Squares) regression models were applied to find the cointegration relationship and compare the effect of these variables. The aim of the study is to find out main determinants that influence the air travel demand on Moscow – Istanbul market during the observed period; to set up an econometric model and estimate the variables; to measure air travel demand elasticities that will guide strategy and tactical decisions.

The outbound passenger traffic on Moscow – Istanbul city pair route during 2014 – 2018 period was affected by various economical and political events and governemt decisions such as restriction for Russian government employees to travel abroad on holidays, restrictions on flights to Egypt and charter flights to Turkey, FIFA World Cup 2018 in Russia and russian aviation industry and domestic tourism support by russian government.

To investigate socio-economic and transport related factors, the analytical approach was applied. To evaluate the impact of these variables on air travel demand regression models were used. Time-series data on monthly basis was obtained from Turkish Airlines Data Warehouse (DWH) and MIDAS DOB Systems. The economic data was derived from the sources of the Russia State Statistics Service and IHS Markit data portals. In this study business and leisure segments are not separated due to lack of reliable socio – economic statistics on business and leisure travellers.

The analysis concerns the air passenger traffic from Moscow Aviation Hub (Vnukovo, Sheremetyevo, and Domodedovo airports) to Istanbul Ataturk Airport. Passenger traffic reflects the amount of economy class passengers on the route on monthly basis. The average ticket price shows the average overall round-trip ticket price for each airline (includes all taxes and fees, in Russian ruble). Passenger flow in the opposite direction is not included.

In this study price, cross-price and income elasticity of air travel demand was estimated. It was important to consider the direction of passenger flow, and distinguish outbound and inbound passenger traffic because the perception of air travel cost by Russians departing from Moscow is different from the cost perception by foreign tourists coming to visit Moscow.

The first model estimations included Turkish Airlines and Aeroflot monthly average ticket prices on Moscow – Istanbul city pair route, flight frequencies, income per capita in Moscow metro area, crude oil Dated Brent prices and PMI index variables. Flight frequency, crude oil prices and PMI index do not show a significant relationship with the passenger traffic on the Moscow – Istanbul route during the examined period. These variables have not increased the explanatory power of the models, and were not included in the final specifications. The other considered variables were route distance and trip time. These variables were not used in model estimation as well due to the reason that they are almost constant in our case. Comfort, safety and convenience were not included in the model either because it is difficult to find and measure the quantitative indicators of these variables. In the final DOLS and FMOLS models only Turkish Airlines and Aeroflot monthly average ticket prices and income per capita

were included. The list of variables in the estimations is limited by the quality and accessibility of the data.

The air travel demand is described as a function of price in reference to cross price (i.e. ticket price of a rival carrier Aeroflot Russian Airlines), and income per capita for Moscow metro area. The previous researches usually employ yearly GDP or per capita income. In contrast, the air travel demand in this study includes regressors based on monthly data in addition to cross price. The evaluation is based on monthly data with seasonal adjustment.

To avoid a spurious regression, the presence of a unit root was checked and ADF, PP, KPSS and Ng-Perron tests were applied. The outputs showed that the series are non – stationary and are integrated of order 1. The next step was to employ Johansen cointegration test to check if the variables are cointegrated or not. The Trace test statistic indicated existence of two cointegration relationship and Max-eigenvalue test indicated existence of one cointegration relationship.

To estimate the impact of selected variables DOLS and FMOLS regression methods were applied. Per capita income, price, and cross-price variables were used in the estimation model. DOLS output shows that the air travel demand for Moscow – Istanbul market is price elastic. A 1 percent increase in own ticket price would cause a 1.6 percent decrease in passenger traffic. A 1 percent increase in cross-price would cause 2.2 percent passenger traffic growth. Air travel demand also shows sensitivity to income. A 1 % income per capita increase leads to 1.3 % passenger traffic increase. FMOLS results also confirm elasticity of air travel demand. The R2 value is 0.68, which means that these variables explain 68% of the changes in passenger traffic on Moscow – Istanbul route. These major factors account for most of the changes in the dependent variable.

The review of previous research found route level price elasticities ranging from -1.2 to -1.5. Income elasticity on medium-haul route level for developed economies is 1.6 and developing economies is 2.0 (Smyth & Pearce, 2008). The estimated results show that price elasticity is -1.6; cross price elasticity is 2.2 and income elasticity is 1.3. The results are in line with the previous studies.

Empirical results show the presence of a significant long-term relationship amongst the passenger traffic and three determinants namely price, cross price, and income per capita and their significance are remaining the same in all models applied.

This study suggests the regression model that can be applied by national and foreign airlines to make reliable elasticity estimates of the outbound air travel demand in Russia. The air carriers have access to sufficient amount of reliable statistics on passenger traffic and fares, which allow them to analyze a very large amount of quantitative data. In the aviation industry pricing is one of the priority directions of management. Estimated price and cross price elasticities would be of use for seasonal price decisions and during planning route level campaigns. Also, the regression model can be easily employed for other city pair routes. As it is mentioned in Chapter 4 the variables included in final model specification have R2 of 0.68, thus explaining 68% of changes experienced by passenger traffic on Moscow – Istanbul city pair route. With some adjustments the model can also be applied for international routes analysis.

Understanding the factors affecting demand is an important point for making effective management decisions. Knowing the main determinants of air travel demand and the ability to measure the impact of each factor, especially price and consumer's income provides an opportunity to prepare for various development scenarios. The elasticity of demand shows how much demand will change in response to a one unit of price change. In other words, price elasticity of demand measures the reaction of the consumers to the price changes. It must be understood that air travel demand is a volatile category. In this regard, it is necessary to constantly monitor changes in the structure of demand and have effective business tools and reliable methods to influence the market situation to the benefit of Turkish Airlines.

REFERENCES

Abed, S. Y., Ba-Fail, A. O., & Jasimuddin, S. M. (2001). An econometric analysis of international air travel demand in Saudi Arabia. *Journal of Air Transport Management*, *7*(3), 143–148. https://doi.org/10.1016/S0969-6997(00)00043-0

Alperovich, Gershon; Machnes, Y. (1994). The role of wealth in the demand for international air travel. *Journal of Transport Economics and Policy*, *28*(May), 163–173. https://doi.org/10.2307/20053033

Bafail, A. O.; Abed, S. Y.;Jasimuddin, S. M. (2002). Comparison of some forecasting models for air travel movements at Riyadh international airport, Saudi Arabia. *Alexandria Engineering Journal*, *41*(1), 83–91.

Battersby, B.; Oczkowski, E. (2001). An econometric analysis of the demand for domestic air travel in Australia. *International Journal of Transport Economics*, *28*(2), 193–204.

Bender, A. R., & Stephenson, F. J. (1998). Contemporary issues affecting the demand for business air travel in the United States. *Journal of Air Transport Management*, *4*(2), 99–109. https://doi.org/10.1016/S0969-6997(98)00007-6

Bhadra, D. (2003). Demand for air travel in the United States: Bottom-up econometric estimation and implications for forecasts by origin and destination pairs. *Journal of Air Transportation*, *8*(2), 19–56.

Bieger, T., Wittmer, A., & Laesser, C. (2007). What is driving the continued growth in demand for air travel? Customer value of air transport. *Journal of Air Transport Management*, *13*(1), 31–36. https://doi.org/10.1016/j.jairtraman.2006.11.002

Boonekamp, T., Zuidberg, J., & Burghouwt, G. (2018). Determinants of air travel demand: The role of low-cost carriers, ethnic links and aviation-dependent employment. *Transportation Research Part A: Policy and Practice*, *112*(February), 18–28. https://doi.org/10.1016/j.tra.2018.01.004

Brons, M.; Pels, E.; Nijkamp, P.; Rietveld, P. (2002). Price elasticities of demand for passenger air travel: A meta-analysis. *Journal of Air Transport Management*, *8*(3), 165–175.

Carmona-Benítez, R. B., Nieto, M. R., & Miranda, D. (2017). An econometric dynamic model to estimate passenger demand for air transport industry. *Transportation Research Procedia*, *25*, 17–29. https://doi.org/10.1016/j.trpro.2017.05.191

Chin, A. T. H. (2002). Impact of frequent flyer programs on the demand for air travel. *Journal of Air Transportation*, *7*(2), 53–86.

Choo, Y. Y. (2018). Immigration and inbound air travel demand in Canada. *Journal of Air Transport Management*, *71*(April), 153–159. https://doi.org/10.1016/j.jairtraman.2018.04.002

Cohas, F. J., Belobaba, P. P., & Simpson, R. W. (1995). Competitive fare and frequency effects in airport market share modeling. *Journal of Air Transport Management*, *2*(1), 33–45. https://doi.org/10.1016/0969-6997(95)00025-7

De Vany, A. (2001). The revealed value of time in air travel. *Review of Economics and Statistics*, *83*, 77–82.

Fasone, V., Kofler, L., & Scuderi, R. (2016). Business performance of airports: Non-aviation revenues and their determinants. *Journal of Air Transport Management*, *53*, 35–45. https://doi.org/10.1016/j.jairtraman.2015.12.012

Gallet, C. A., & Doucouliagos, H. (2014). The income elasticity of air travel: A meta-analysis. *Annals of Tourism Research*, *49*, 141–155. https://doi.org/10.1016/j.annals.2014.09.006

Gelhausen, M. C., Berster, P., & Wilken, D. (2018). A new direct demand model of long-term forecasting air passengers and air transport movements at German airports. *Journal of Air Transport Management*, *71*(April), 140–152. https://doi.org/10.1016/j.jairtraman.2018.04.001

Ghobrial, A.; Kanafani, A. (1995). Quality-of-service model of intercity air-travel demand. *Journal of Transportation Engineering*, *121*(2), 135–140.

Graham, A., & Metz, D. (2017). Limits to air travel growth: The case of infrequent flyers. *Journal of Air Transport Management*, *62*, 109–120. https://doi.org/10.1016/j.jairtraman.2017.03.011

Granados, N.; Gupta, A.; Kauffman, R. J. (2012). Online and offline demand and price elasticities: Evidence from the air travel industry. *Information Systems Research*, *23*(1), 164–181. https://doi.org/10.20462/tebs.2017.10.18.5.51

Haitovsky, Y.; Salomon, I.; Silman, L. A. (1987). The economic impact of charter flights on tourism to Israel: An econometric approach. *Journal of Transport Economics and Policy*, *21*(2), 111–134.

Ippolito, R. A. (1981). Estimating airline demand with quality of service variables. *Journal of Transport Economics and Policy*, *15*(1), 7–15.

Jorge-Calderón, J. D. (1997). A demand model for scheduled airline services on international European routes. *Journal of Air Transport Management*, *3*(1), 23–35. https://doi.org/10.1016/S0969-6997(97)82789-5

Karlaftis, M. G.; Zografos, K. G.; Papastavrou, J. D.; Charnes, J. M. (1996). Methodological framework for air-travel demand forecasting. *Journal of Transportation Engineering*, *122*(2), 96–104.

Kim, S., & Shin, D. H. (2016). Forecasting short-term air passenger demand using big data from search engine queries. *Automation in Construction*, *70*, 98–108. https://doi.org/10.1016/j.autcon.2016.06.009

Luttmann, A. (2019). Evidence of directional price discrimination in the U.S. airline industry. *International Journal of Industrial Organization*, *62*, 291–329. https://doi.org/10.1016/j.ijindorg.2018.03.013

Metz, D. (2012). Demographic determinants of daily travel demand. *Transport Policy*, *21*, 20–25. https://doi.org/10.1016/j.tranpol.2012.01.007

Mumbower, S., Garrow, L. A., & Higgins, M. J. (2014). Estimating flight-level price elasticities using online airline data: A first step toward integrating pricing, demand, and revenue optimization. *Transportation Research Part A: Policy and*

Practice, *66*(1), 196–212. https://doi.org/10.1016/j.tra.2014.05.003

Smyth, M., & Pearce, B. (2008). Air travel demand. *IATA Economics Briefing*, *9*(April), 46. Retrieved from https://www.iata.org/whatwedo/documents/economics/air_travel_demand.pdf

Valdes, V. (2015). Determinants of air travel demand in Middle Income Countries. *Journal of Air Transport Management*, *42*, 75–84. https://doi.org/10.1016/j.jairtraman.2014.09.002

Xie, G., Wang, S., & Lai, K. K. (2014). Short-term forecasting of air passenger by using hybrid seasonal decomposition and least squares support vector regression approaches. *Journal of Air Transport Management*, *37*, 20–26. https://doi.org/10.1016/j.jairtraman.2014.01.009

APPENDIXES

APPENDIX A

Table A.1. Passenger totals and average ticket prices data.

Date	Turkish Airlines Passenger Totals	Turkish Airlines Average Ticket Price, Ruble	Aeroflot Airlines Passenger Totals	Aeroflot Airlines Average Ticket Price, Ruble
Jan-14	4348	7867,37	4 303	7430,88
Feb-14	5428	7492,87	3 879	6787,29
Mar-14	6671	7882,61	5 162	7393,56
Apr-14	7932	8513,88	5 406	8208,56
May-14	7125	8869,60	6 032	7979,38
Jun-14	6448	8549,74	5 947	7719,49
Jul-14	5638	7793,10	5 588	6944,47
Aug-14	6140	9228,71	4 991	7738,85
Sep-14	6579	9828,90	5 939	8283,67
Oct-14	6180	9389,10	6 060	8837,68
Nov-14	5967	9907,47	5 513	8885,59
Dec-14	5963	10153,46	5 264	10103,41
Jan-15	4979	11960,82	4 455	11852,36
Feb-15	5800	10829,35	4 662	9957,22
Mar-15	6636	9335,37	6 394	8900,06
Apr-15	7020	9371,82	5 428	10275,39
May-15	6883	9555,68	5 101	10543,15
Jun-15	5876	10773,07	4 968	10576,64

Jul-15	5083	10817,07	4 851	10052,84
Aug-15	5585	12217,59	4 392	10728,49
Sep-15	6352	12345,11	4 461	11240,71
Oct-15	6454	11143,77	5 020	10093,75
Nov-15	5868	10717,69	4 970	9994,06
Dec-15	3679	9134,46	2 391	10201,98
Jan-16	2527	9943,13	2 401	9698,97
Feb-16	2993	9745,82	2 001	10507,13
Mar-16	3115	9976,74	2 246	9486,20
Apr-16	3124	11271,29	2 160	9998,58
May-16	2963	12249,24	2 323	9511,94
Jun-16	2296	14050,00	3 224	9299,51
Jul-16	2421	13674,22	2 355	9597,09
Aug-16	2753	14002,93	2 354	10436,35
Sep-16	3352	13655,76	2 489	10636,76
Oct-16	3513	13024,60	2 793	10806,11
Nov-16	3110	12663,68	3 597	8695,19
Dec-16	2677	13319,71	3 159	8995,17
Jan-17	2297	9755,54	2 811	8152,88
Feb-17	2979	10543,36	3 291	8228,40
Mar-17	3196	12896,15	4 089	8239,83
Apr-17	4065	11208,60	3 827	8722,86
May-17	4280	10275,32	3 390	9756,89
Jun-17	3686	11368,68	3 663	8855,72
Jul-17	3708	12154,62	4 192	10321,61
Aug-17	4228	12080,43	2 202	10136,73
Sep-17	4112	12123,56	4 239	9818,46
Oct-17	3803	11811,69	3 493	10517,69
Nov-17	4024	10946,49	3 196	10872,18
Dec-17	2928	12245,23	3 173	10817,16
Jan-18	2644	10773,26	2 704	10406,38
Feb-18	3477	10469,68	2 913	10190,20
Mar-18	4680	12380,74	3 742	10930,79
Apr-18	5305	12335,83	3 820	13443,53
May-18	4959	11100,36	3 069	11966,72
Jun-18	4331	15482,83	4 740	11355,62
Jul-18	4701	16716,60	4 847	12885,94
Aug-18	4426	11816,06	3 052	11041,39
Sep-18	5609	12854,50	4 563	11314,11
Oct-18	4930	11961,36	4 450	10654,50
Nov-18	4244	13082,88	4 286	10028,23
Dec-18	3792	12060,02	3 942	9603,42

Source: MIDAS DOB Systems.

Table A.2. Moscow metro area per capita income data.

Date	Per Capita Income, US Dollar
Jan-14	1193,07
Feb-14	1290,26
Mar-14	1297,84
Apr-14	1500,24
May-14	1358,86
Jun-14	1497,55
Jul-14	1594,21
Aug-14	1477,57
Sep-14	1341,10
Oct-14	1481,93
Nov-14	1345,23
Dec-14	1600,35
Jan-15	677,08
Feb-15	897,31
Mar-15	1009,79
Apr-15	1224,29
May-15	1135,99
Jun-15	1106,94
Jul-15	1024,47
Aug-15	812,50
Sep-15	803,15
Oct-15	995,12
Nov-15	895,36

Dec-15	1289,05
Jan-16	546,68
Feb-16	688,78
Mar-16	815,53
Apr-16	931,05
May-16	824,71
Jun-16	893,43
Jul-16	901,21
Aug-16	866,37
Sep-16	886,28
Oct-16	998,67
Nov-16	936,46
Dec-16	1445,44
Jan-17	718,98
Feb-17	971,74
Mar-17	1068,69
Apr-17	1163,29
May-17	979,79
Jun-17	1113,03
Jul-17	1041,10
Aug-17	1019,21
Sep-17	1076,38
Oct-17	1124,63
Nov-17	1089,93
Dec-17	1577,32
Jan-18	601,26
Feb-18	819,06
Mar-18	939,88
Apr-18	958,98
May-18	914,79
Jun-18	922,15
Jul-18	932,89
Aug-18	877,91
Sep-18	857,55
Oct-18	889,75
Nov-18	887,49
Dec-18	1312,21

Source: Federal State Statistics Service, Russia.

Table A.3. Russia Services PMI index.

Date	PMI Index
Jan-14	53,60
Feb-14	50,20
Mar-14	50,80
Apr-14	47,70
May-14	46,80
Jun-14	46,10
Jul-14	49,80
Aug-14	49,70
Sep-14	50,30
Oct-14	50,50
Nov-14	47,40
Dec-14	44,50
Jan-15	45,80
Feb-15	43,90
Mar-15	41,30
Apr-15	46,10
May-15	50,70
Jun-15	52,80
Jul-15	49,50
Aug-15	51,60
Sep-15	49,10
Oct-15	51,30
Nov-15	47,80
Dec-15	49,80

Jan-16	47,80
Feb-16	47,10
Mar-16	50,90
Apr-16	52,00
May-16	54,20
Jun-16	51,80
Jul-16	53,80
Aug-16	55,00
Sep-16	53,50
Oct-16	53,00
Nov-16	52,70
Dec-16	56,50
Jan-17	58,40
Feb-17	55,50
Mar-17	56,60
Apr-17	56,10
May-17	56,30
Jun-17	55,50
Jul-17	52,60
Aug-17	54,20
Sep-17	55,20
Oct-17	53,90
Nov-17	57,40
Dec-17	56,80
Jan-18	55,10
Feb-18	56,50
Mar-18	53,70
Apr-18	55,50
May-18	54,10
Jun-18	52,30
Jul-18	52,80
Aug-18	53,30
Sep-18	54,70
Oct-18	56,90
Nov-18	55,60
Dec-18	54,40

Source: IHS Markit.

Table A.4. Crude Oil; Dated Brent, US dollar per barrel.

Date	US dollar per barrel
Jan-14	107,42
Feb-14	108,81
Mar-14	107,40
Apr-14	107,79
May-14	109,68
Jun-14	111,87
Jul-14	106,98
Aug-14	101,92
Sep-14	97,34
Oct-14	87,27
Nov-14	78,44
Dec-14	62,33
Jan-15	48,07
Feb-15	57,93
Mar-15	55,79
Apr-15	59,39
May-15	64,56
Jun-15	62,34
Jul-15	55,87
Aug-15	46,99
Sep-15	47,24
Oct-15	48,12
Nov-15	44,42
Dec-15	37,72
Jan-16	30,80

Feb-16	33,20
Mar-16	39,07
Apr-16	42,25
May-16	47,13
Jun-16	48,48
Jul-16	45,07
Aug-16	46,14
Sep-16	46,19
Oct-16	49,73
Nov-16	46,44
Dec-16	54,07
Jan-17	54,89
Feb-17	55,49
Mar-17	51,97
Apr-17	52,98
May-17	50,87
Jun-17	46,89
Jul-17	48,69
Aug-17	51,37
Sep-17	55,16
Oct-17	57,62
Nov-17	62,57
Dec-17	64,21
Jan-18	68,99
Feb-18	65,42
Mar-18	66,45
Apr-18	71,63
May-18	76,65
Jun-18	75,19
Jul-18	74,44
Aug-18	73,13
Sep-18	78,86
Oct-18	80,47
Nov-18	65,17
Dec-18	56,46

Source: US Energy Information Administration.

Table A.5. US Dollar to Russian Ruble Exchange Rate.

Date	Russian Ruble
Jan-14	33,78
Feb-14	35,24
Mar-14	36,20
Apr-14	35,67
May-14	34,83
Jun-14	34,45
Jul-14	34,64
Aug-14	36,10
Sep-14	37,90
Oct-14	40,80
Nov-14	46,22
Dec-14	55,77
Jan-15	65,15
Feb-15	64,52
Mar-15	60,36
Apr-15	53,22
May-15	50,47
Jun-15	54,45
Jul-15	57,18
Aug-15	65,42
Sep-15	66,78
Oct-15	63,25
Nov-15	65,03
Dec-15	69,70
Jan-16	77,93

Feb-16	77,33
Mar-16	70,42
Apr-16	66,68
May-16	65,84
Jun-16	65,22
Jul-16	64,34
Aug-16	64,94
Sep-16	64,56
Oct-16	62,62
Nov-16	64,31
Dec-16	62,09
Jan-17	59,63
Feb-17	58,54
Mar-17	58,01
Apr-17	56,44
May-17	56,95
Jun-17	57,89
Jul-17	59,69
Aug-17	59,61
Sep-17	57,74
Oct-17	57,70
Nov-17	58,93
Dec-17	58,57
Jan-18	56,50
Feb-18	56,81
Mar-18	57,06
Apr-18	60,77
May-18	62,23
Jun-18	62,77
Jul-18	62,86
Aug-18	66,08
Sep-18	67,67
Oct-18	65,85
Nov-18	66,36
Dec-18	67,34

Source: The Central Bank of the Russian Federation.