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ANALYSIS OF STIMULATED DOMESTIC AIR TRANSPORT DEMAND IN TURKEY

WHAT ARE THE MAIN DRIVERS?

Master Thesis

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“As in all other fields, in aviation too you are soon going to fill the high place that is waiting for you in the sky.
Our true friends will rejoice in this, and the Turkish Nation will be gratified.”

Mustafa Kemal Atatürk

Abstract

This paper investigates phenomenal growth of the Turkish domestic air transport demand in the last three decades. In the literature, air transport demand growth is associated with income, population, airfares and the introduction of deregulations. Based on the literature review, this study creates demand model for domestic air transport market. The model uses income, population, crude oil prices, alternative modes of transportation such as railroad and high-speed rail, consumption, expenditure and liberalization dummies as determinants of air transport growth. Ultimate model indicates that the most appropriate demand model consists of income, population, high-speed rail passenger number, crude oil prices and liberalization dummies as explanatory variables. In order to test the model, we use panel data approach with fixed effect specification model. Moreover, Bardsen (1989) error correction transformation applied. This lets analysis obtain short and long run elasticities of variables. As a result, income and population changes are determined as the main drivers of Turkish domestic air transport demand. Furthermore, the 2003 deregulations had a significant positive effect on demand changes. However, contrary to expectations, outcomes show that high-speed rail passenger number and crude oil prices are insignificant. Despite the high growth in the last ten years, Turkish domestic market is still immature market and has a high potential to grow further. We come up with this result by calculating elasticities of income and comparing the outcomes with the results of other related studies. As a result, study suggests income and population are important estimators for forecasting prospective traffic and passenger increases in domestic air transport sector. Lastly, for further research this study suggests to explore Turkish demand model by using time series approach. In addition to this, O&D city pair investigation is another important study that should be carried out.

Preface

With this thesis, I am finalizing my Master Economics and Business with specialization Urban, Port and Transport Economics. In this study, I project the knowledge and academic skills that I have gained during the one year of studies. In front of you lies the outcome of 4 months intensive and disciplined research.

First of all, I would like to express my gratitude to my supervisor Dr P. van Reeven for his insightful supervision in all respects from the first contact till the completion of the paper. Without his guidance, this process would be much harder to accomplish. I would also like to express appreciation to Olga Setinsone for helping me in the proofreading process. Finally, I have debt of gratitude to my parents who have encouraged me in all respects during my studies. I would never be able to complete my thesis without their moral support.

Foremost, I am dedicating my thesis to my grandfather Saim Demirsoy, who always wanted the best for me. Thought of him motivates me during the writing process, and I am happy to fulfill his will. Rest in peace.

Çağlar Demirsoy
Rotterdam
August 2011

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Chapter 1- Introduction

Parallel to the globalization process in the world, air transportation has become the most important, reliable and fastest mean of transport between and within countries. Increasing urbanization and better distribution of income let air transportation spread across all regions and countries of the world (Airbus, 2011). While World economy (GDP) is expected to grow at an average rate of 3.3% annually for the next 20 years, global air passenger traffic growth is forecasted higher than GDP growth according to Boeing Current Market Outlook (2011). It is projected to be around 5.1% annually between years 2011-2030; in other words air traffic will double in the coming 15 years. Despite the slow growth of air transportation in maturing regions like North America and Western Europe, emerging economies like China and regions like Middle East will enhance air transport growth globally. For instance, airline traffic growth rates are expected to be 7.0% in Asia-Pacific region and 6.8 % in Latin America, while it is projected to be only 2.3% for North America. BRIC (Brazil, Russia, India, China) economies and other emerging economies are anticipated to contribute 56% of world economic growth in the coming 20 years (Airbus, 2011), which means that these regions and economies will be the main growth driver of the air transportation in the coming decades.

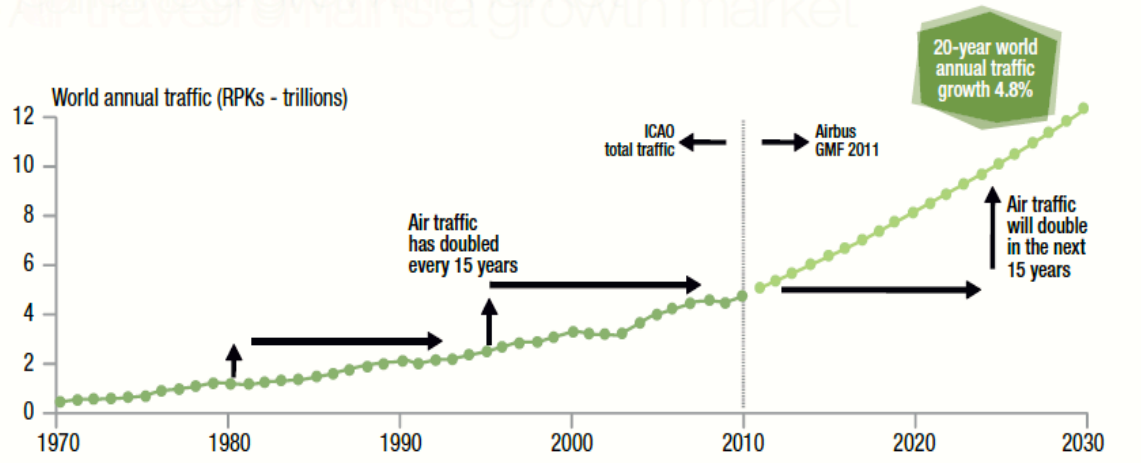

Figure 1. World Air Transport Demand Forecasts (Airbus, 2011)

Furthermore, liberalization process has promoted a birth of business model called low-cost carrier (LCC) all over the world. Low-cost carriers enable more and more people to fly by introducing considerably lower and more affordable airfares and thus targeting lower income population. Thanks to the success of the new price strategy, they started

to gain significant shares in air transportation industry in many countries especially after market liberalizations.

Turkey is a rapidly growing economy with 70 million inhabitants. As one of the emerging regions that will contribute to the world economic growth, Turkey is promising high demand growth in air transportation industry. Just a few years ago air travel was considered as a luxury mean of transportation and only small part of Turkish citizens had a chance to experience flying ever. During the last decade, the things have changed dramatically. According to OECD classification Turkey is an upper-middle income country. There is a substantial rise of middle-income class in the last decade, which is considered to be forming the backbone of air transport growth (Airbus, 2011). In addition to income increase, domestic air transport growth accelerated with the help of 2003 deregulation. This liberalization led to the emergence of new private airlines, new business models (such as LCC) and new infrastructure investments like new airports and the expansion of existing ones in order to provide a possibility for more people to fly.

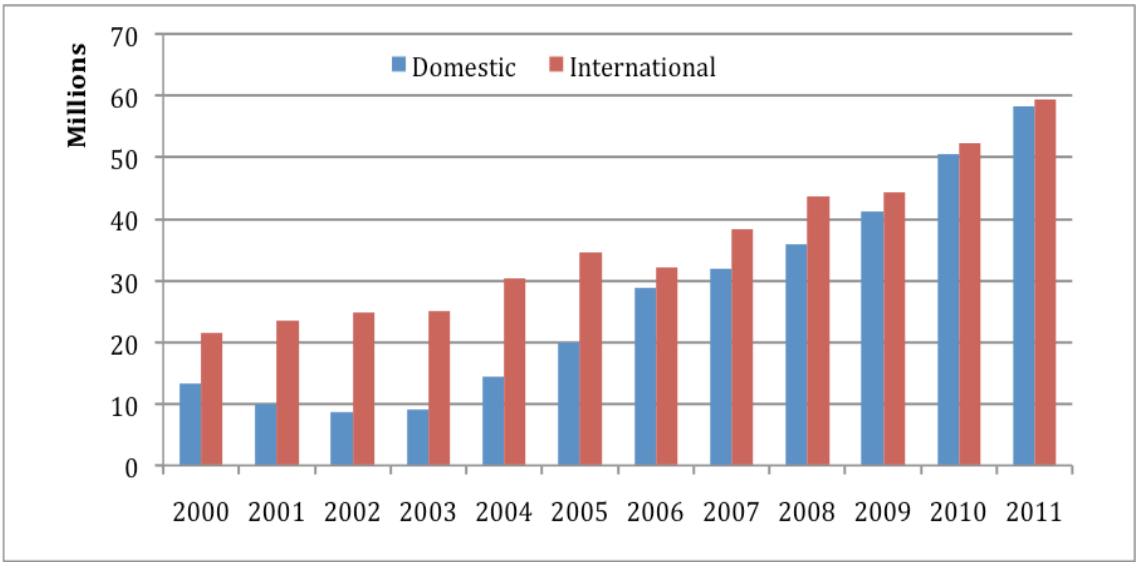

Figure 2. Turkish international and domestic passenger numbers 2000-2011

In the last 9 years, Turkey is the 4th country in the world in terms of air transport passenger growth. From year 2003 till 2010 total passenger number has grown by 198% while domestic passenger number has increased by 452%. Moreover, sector ability to create direct employment shifted from 50000 to 110000 during 9 years from 2002 till 2010 (GDSAA, 2010). International Civil Aviation Organization (ICAO) reported the forecast for Turkey anticipating that the number of 55 million domestic and

international passengers will be reached by 2015, however, in reality this number was reached already in 2005. After the global crisis in 2008, when aviation was shrinking sector in most of the countries, Turkey increased its total passenger number by 16% and 18% in 2009 and 2010 respectively. In 2011, Turkey's airports hosted 118 million passengers in total; 58 million of them were domestic passengers. As it is clearly seen Turkey has faced extremely high growth and thus development in air transport sector.

1.1. Research Focus

But what is driving the air transport growth? Airline passenger survey conducted by Airbus shows the most prominent reasons of increasing desire to use air transportation listed by passengers in order of importance. These are economic growth (especially in the emerging countries where wealth of citizens is increasing, and more people are able to benefit from aviation and to see more of the world), increasing desire to spend holidays and free time abroad and in different places of home country, globalization (leading people to migrate for working or living in different countries and cities), and finally time concerns (time is getting more and more valuable resulting in growing desire to take faster means of transport) (Airbus, 2011).

The drivers of air transport demand may differ for each country. It may depend not only on country's economic and social background or geographic location and size, but also on some important events like economic downturns or deregulations that could decrease or boost the demand. Forecasting the future demand for air transportation and understanding factors that are determining it is crucial in the aviation sector to form transport policies (Dargay & Hanly, 2001). With the help of in-depth analysis of the key determinants, airlines and airports can develop their market strategy[1] in order to increase the demand for their enterprise. They can decide whether to expand their fleet and flight network according to the demand forecasts, while airports use forecasts to decide if further capacity increase is necessary and profitable. In case of misleading forecast airlines and airports may suffer severe financial problems or even go bankruptcy.

Aforementioned statistics regarding Turkish air transportation growth constitute a significant field of research on this topic, especially for domestic market. Determining

[1] Market strategy consists of planning, marketing and operations in the industry.

factors of air transport demand is essential for the constitution of the national transportation policy. In this regard, examining historical statistics such as GDP and population trends and passenger numbers plays a crucial role in reaching this aim and drawing up accurate forecast. The major focus of this research will be set on investigating the drivers of domestic air transport demand. In order to do that the main research question is stated as follows, "What are the main drivers of domestic air transport demand in Turkey?" Can economic growth or income rises in the country serve as a partial explanation of air transport demand growth? Are there any other qualitative factors that are affecting passenger demand? How are deregulations influencing the domestic market? In order to explain these issues, two main activities will be carried out during the research process: extensive review of related literature and empirical analysis. Empirical analysis will be accomplished with the help of econometric demand modeling. The section entitled Statistical Analysis explains research strategy and data collection techniques that are used to obtain empirical results.

1.2. Overall Research Aim and Objectives

Overall aim of this research is to improve the understanding of impact of different factors on demand for Turkish domestic air transportation. However, to understand these factors it is necessary to dive into forces that are determining passenger demand. For this purpose, determining factors of air travel demand have been researched intensively in the literature.

Furthermore, maturity analysis of the domestic Turkish air transport market is another noteworthy objective of this research. In this regard, the research will explain whether Turkish domestic air transport is likely to face maturity soon, after strong growth for many years. In order to this, income elasticity of air transport demand is calculated. Elasticity analysis will also serve as a basis to propose policy recommendations for the Turkish domestic aviation sector.

This research will contribute to the development of air transportation economics in Turkey in the following ways - firstly, by providing international literature about the air transport passenger demand and adopting it to the Turkish domestic market; secondly, by creating a specific mathematical model of determinants of domestic passenger demand; thirdly, by carrying out a maturity analysis of the Turkish domestic air

transport to provide recommendations. This research is expected to be pioneer study since there are a very limited number of researches on this topic about Turkey.

Following this introduction chapter, the second chapter introduces the review of related literature on air transportation demand and its determinants. The third chapter continues with investigating the methodological approaches that will be used to explain passenger demand. The fourth chapter continues with a brief analysis of Turkish domestic air transportation industry and its history. The fifth chapter includes data collection methods, mathematical analysis and its result. In the sixth chapter, we discuss the outcomes of the regression analysis. Finally, the seventh chapter provides conclusion and recommendations regarding future of Turkish domestic air transport.

Chapter 2 – Determinants of Air Transport Demand

This literature review studies determinants of air transport demand, in other words the factors driving aviation industry to the growth. In order to provide a better insight to the reader we distinguish five main groups of determinants: economic factors, geographic and demographic factors, market structure, social factors and lastly maturity of air transport demand. This approach will help the reader differentiate clearly what is affecting air transport demand from different perspectives. Critical evaluation of carefully investigated literature holds considerable part of this chapter.

Analyzing previous studies related to this topic forms a significant part of the research and plays a crucial role in the evaluation of the empirical part and conclusion. The aim of the literature review of this research is to create a comprehensive knowledge of air transport demand and its determinants.

In the study of Graham (2000) definition of air transport demand determinants is stated briefly as *"Determinants are factors which make it possible for people to travel"* (p. 109). Although this is a correct definition, it is not complete. The reason is that determinants are not only the factors enabling (or making possible) traveling but also increasing traveling desire (propensity to fly), which means growing number of travels taken by each individual. More precise definition would be "*Determinants are factors which make it possible for people to travel and increase the number of travels taken by each individual*". But what are these determinants?

Table 1. Determinants of Air Transport Demand

Economic	Geographic	Demographic	Market Structure	Social	Maturity
• GDP • Income • Expenditure • Airfares • Inflation	• Size of the country • Topographic structure	• Population • Urbanization	• Liberalization level • Business model • Alternative modes	• Perception • Education • Immigration	• Income elasticity • Price elasticity

Extensive literature review helps to form the determinants of the air transport demand under five main topics. These main factors of air travel demand may be grouped as follows:

- Economic Factors
- Geographic and Demographic Factors
- Market Structure
- Social Factors
- Maturity

All above-mentioned factors summarize different agents that are affecting air transport demand. Economic Factors are one of the most influential drivers for air transport demand and factors such as GDP, GDP per capita, income, expenditure, airfares and inflation can be listed in this category. Geographic and demographic factors stimulating air travel demand are population, size of the country, topographic structure of land, and urbanization level. Regulated or deregulated markets and the business model of airlines can be mentioned as components of market structure. Social factors include such factors as psychological perception of public –e.g. unfamiliarity to flying, education, and immigration. Lastly, maturity is a key notion that is determining the relation and magnitude of the relation between determinants and the air transport demand. In-depth analysis of these factors is conducted in the following sections.

2.1. Economic Factors

This part explains the main economic factors and their interaction with air transport demand. Economic activity, income, and airfares are the components of the economic factors.

2.1.1. Economic Activity

Air transportation generates an economic activity by creating employment and by its enabling effect. Enabling effect defined by Ishutkina and Hansman (2008) as "*The total economic impact on employment and income generated by the economic activities which are dependent on the availability of air transportation services"* (P. 2). Air transportation enables access: to markets, to people, to capital, to ideas, to knowledge, to labor supply, to skills and to opportunity and resources (Ishutkina & Hansman, 2008). Air transportation and economic activity are interrelated and have reflexive affect on one another. In other words, these economic activities are somewhat stimulated by air transportation, and they, in turn, generate demand for air transport services. Air transport makes markets and people closer; it also secures significant part

of country's GDP. For instance, on average air transportation revenues constitute 1 % of the country's GDP regardless of the size of economies (Boeing, 2011). Consequently, there is a mutual relationship between economic activities and air transportation where correlation is a result of this mutuality. For example, Marazzo et al. (2010) found interaction between GDP and passenger number albeit reaction times to the changes are different. Above-mentioned interaction between air transport and economic activity can be explained by the following figure.

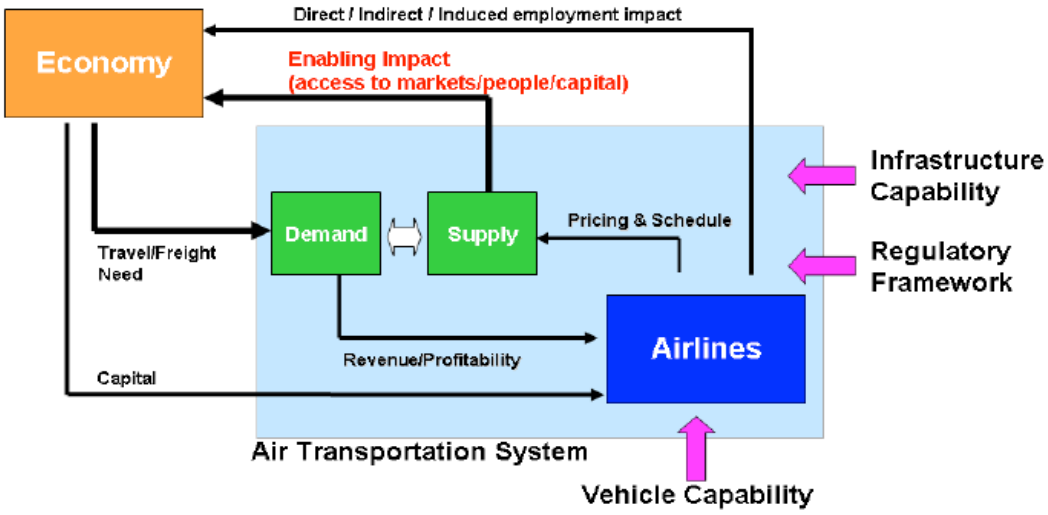

Figure 3. Interaction between Economy and Air Transportation (Ishutkina & Hansman, 2008)

According to figure 3, airlines, airports and related services create direct/indirect employment for economy. Moreover, the services that are supplied by air transport firms enable economic activities as explained above. In return economy provides capital and demand for the air transport firms. Power of this relationship is determined by exogenous factors such as infrastructure capability, regulatory framework, and vehicle capability.

Upon investigation of the related literature, one of the most cited economic factors influencing air transportation is economic activity in the region. Bhadra and Wells (2005) concurs that growing regional economic activity increases the demand for air transportation in this region. For the United State O&D (Origin and destination) interstate market, they find that increases in GSP (Gross State Product) by 1 % affect O&D demand by 0.75 % and 0.95 % positively in two different regressions. Therefore, the US is regarded as one of the most mature air transport markets. Conversely, demand

reaction to the GDP (or GSP) changes is expected to be higher in the developing or emerging countries (regions). In other words in the developing regions economic growth (income) is playing a more influential role in increasing air transport demand.

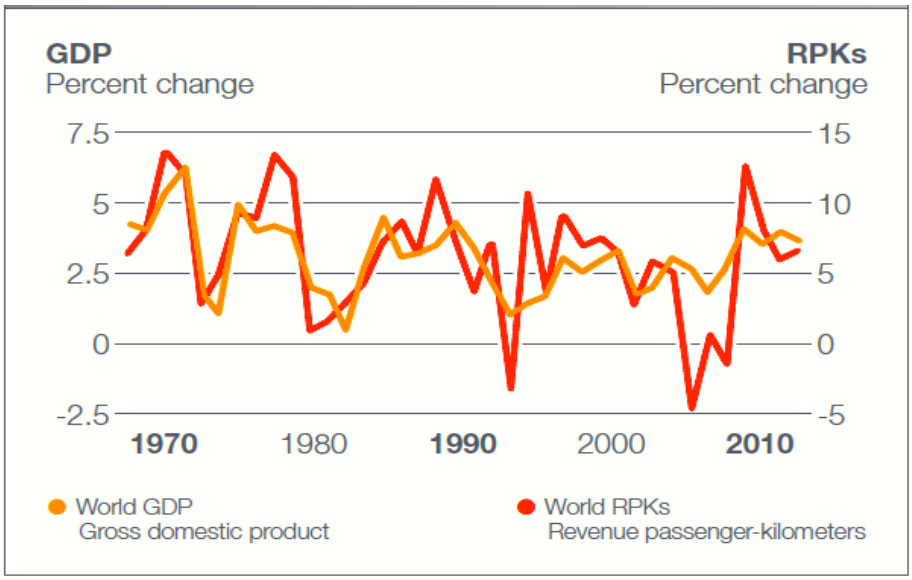

Figure 4. Close relation between GDP and air transport passenger demand (Boeing, 2011)

In addition, interest rates and exchange rates may have a strong influence on growth of passenger demand but only in short-term (Department for Transport, 2010). Exchange rates can be valid determinants of air transport demand but mainly in international routes. If one country's currency is evaluated stronger in comparison to another currency, then this country's citizens can buy more foreign currency than before with the same amount of money. This provides relatively cheaper prices for this country's citizens and may increase the desire to go to that country where the prices are cheaper than before. For instance, Dargay and Hanly (2001) obtained positive exchange rate coefficients for UK citizens. This means that if UK citizens can get more local currency of other country with the same amount of £ (pounds) than their desire to travel to that country would increase.

2.1.2. Income

The growth in air travel can be explained by rising incomes (Dargay & Hanly, 2001). Per capita income (or GDP), disposable or discretionary incomes and consumer expenditure are widely discussed income types in the literature. Steiner (1967) concludes that, beside the changing habits, discretionary income is the most important

factor that is causing air traffic growth. However, in some studies (e.g. Graham, 2000) GDP is referred to as an alternative measure of income together with disposable income and consumer expenditure. For instance, CAA (UK Civil Aviation Authority) uses consumer expenditure as the main determinant of long-term air transport demand.

Shafer and Victor argued that time and income shares allocated to travel are constant over time and space (as cited in Ishutkina & Hansman, 2008, p. 8). When the individuals' incomes increase, they do not raise the proportion of expenditures for transportation, but along with the income increase their budget for the transportation expenses automatically grows. Thus, air transportation is becoming more desirable once higher income levels are achieved by individuals, prompting them to shift from slower and cheaper means of transport to the faster ones like air travel (Ishutkina & Hansman, 2008). These statements explain why air transportation demand changes moves together with income or GDP per capita growth. The disaggregate approach shows that lower income groups would have low participation in air travel, while middle income groups represent high growth, but higher income groups reflect the maturity in the air transport (Graham, 2000). This statement clearly interprets the S-shaped growth curve in figure 9 in section 2.5.

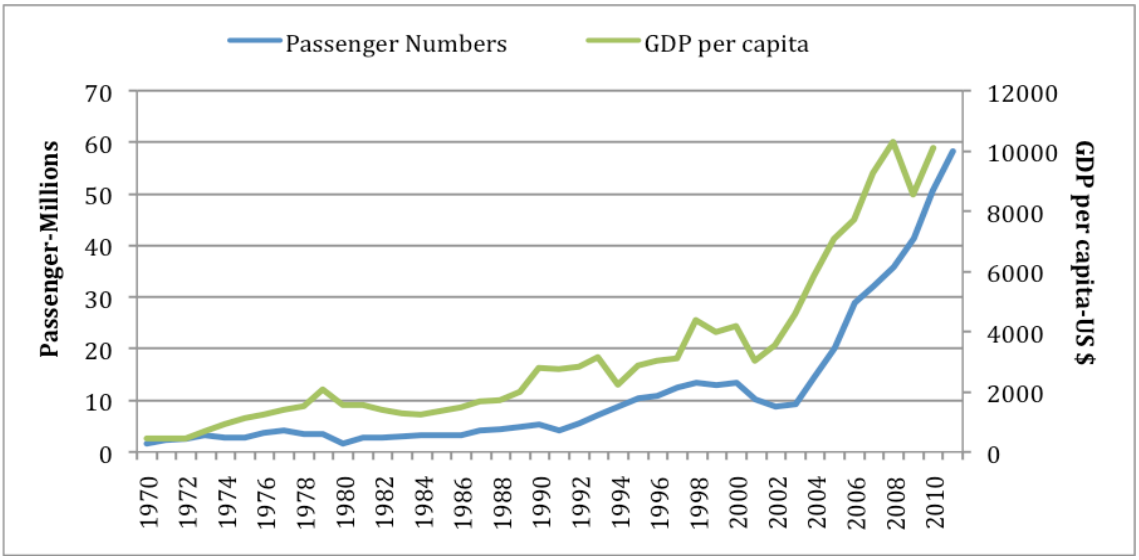

Figure 5. GDP per capita and air passenger growth relation in Turkey from 1970 till 2011

Alternatively, wealth can be a determinant of air transport demand (Alperovich & Machnes, 1994). The authors use financial and non-financial assets as determinants of

wealth to understand air transport demand changes. However, wealth can be assumed as an accumulative sum of income of the individuals, which can lead to biased results[2].

2.1.3. Airfares

Airfares and prices of alternative modes of transportation are a crucial determinant for air transport demand (Alperovich & Machnes, 1994). Previous researches show that deregulation have generally positive effect on air transport demand by enabling lower cost and stronger competition in the market (Isthutkina, 2009). Thus, passenger demand for air transportation has a tendency to increase. Dargay and Hanly (2001) argue that for the UK leisure market fares are the most salient factor prompting an increase of air travel while growth of incomes has the biggest impact on the business travel market. Referring to the outcome of the mentioned research, leisure travelers are more sensitive to price changes, however, for business travelers - prices are considerably less salient attribute.

Some alternative parameters may be mentioned instead of airfares because generally it is hard to come by average airfares for specific countries. As Alperovich and Machnes (1994) suggest, aggregate CPI or CPI of communication and transportation can be used as an alternative variable to overcome problems arising from obtaining information about airfares. Economic theory suggests negative relationship between price and demand for the most of the goods and services. However, especially for the last decade overall inflation rates are more likely to have positive relation with demand rather than negative. Liberalization trend (or deregulations) and consequent emergence of LCC made a declining impact on airfares, which affect significance and sign of the inflation coefficient conversely.

2.2. Geographic and Demographic Factors

Demographic size and distribution, as well as geographic conditions of the land are amongst other factors effecting air transport demand. These factors are studied and their effects to the demand of air transport are explained in the following subsections.

[2] Authors used both wealth and income in the same equation.

2.2.1. Demographic Factors

Demographic factors are the second most widely mentioned notion that is influencing air transport demand following the economic factors in the first place. Considering current growth of the world population, it is forecasted that 6 billion will double in around 70 years leading to 13 billion inhabitants on earth. This statement alone promises dynamic growth for the air transport demand. Even though, the relationship between economic factors and air transport growth becomes less inter-dependent[3], population changes continue to stimulate part of the growth in the air passenger demand. On the other hand, we may assume that there would be a maximum proportion of the population that uses air transportation, and when this greatest proportion is reached, air traveler/population ratio is likely to be constant and is expected to be unresponsive to the further changes in the income and airfares (Graham, 2000). Decreasing responsiveness of air transport demand to GDP, income and airfares is explained in the coming section 2.5.

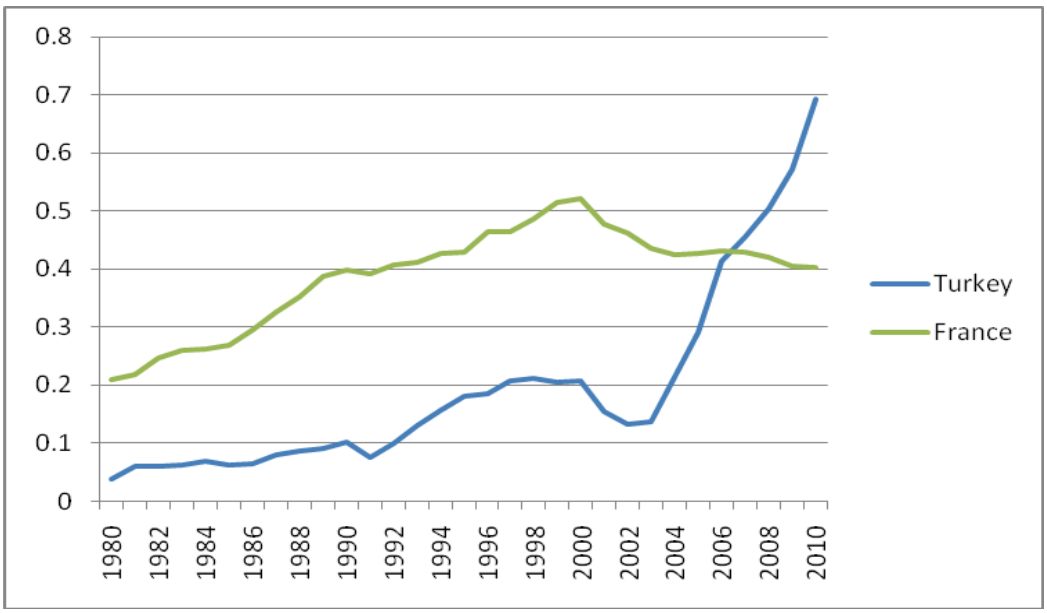

Figure 6. Domestic passenger ratio to population for Turkey and France from 1980 till 2010

Increasing population itself has enough dominance to allow air passenger travel to grow for years (Steiner, 1967). Despite the fact that population number is an important factor influencing air travel demand, there could be still substantial travel between less

[3] Maturity phenomena explained in the section 2.5.

populated cities and remote areas with little population (Bhadra & Kee, 2008). Furthermore, using purely population as a determinant of air transport demand is also criticized in some researches. For instance, using the ratio of passenger volume to population is recommended to avoid problems especially such as multicollinearity that is caused by using only population number (Alperovich & Machnes, 1994).

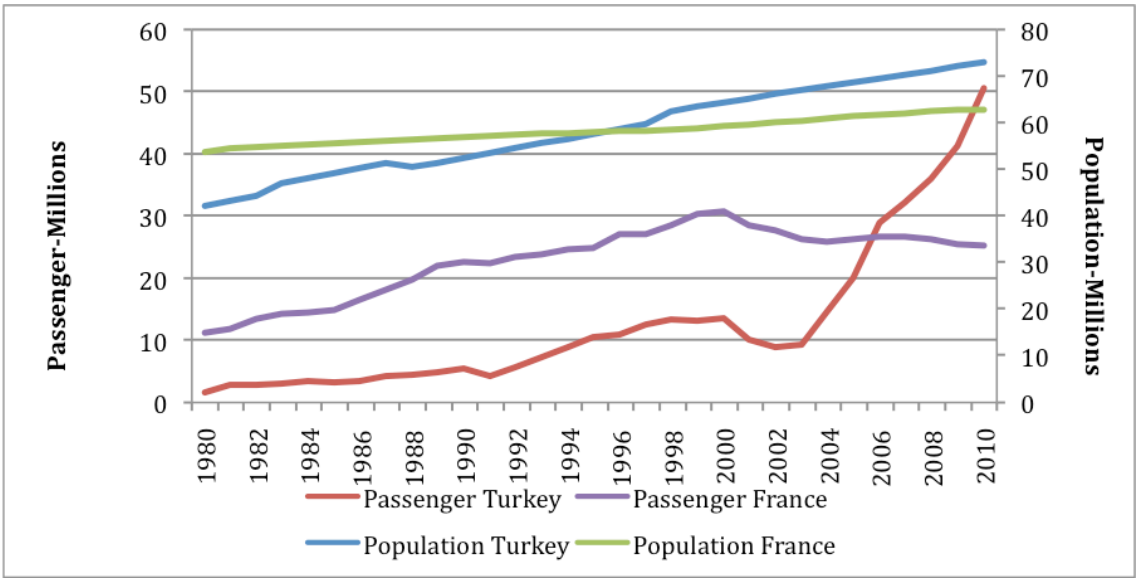

Figure 7. Population in relation with passenger numbers in France and Turkey from 1980 till 2010

Air passenger demand depends on population size and density to a certain extent. Bhadra and Wells (2005) underline this fact, *"Passenger demand and the location of airport facilities are shown to be heavily influenced by the location of population and economic activities"* (p. 119). As a result, air transportation demand concentrates on these highly populated and urbanized regions, which is also effecting the location selection of the airports.

Globalization has a significant effect on air transportation since it has triggered urbanization process. Urban areas are accommodating most crucial factors of air transport demand: high and densely populated cities, economic magnitude and necessity of being mobile. Dobruszkes et al. (2011) find a link between population density and proximity of airports to these densely populated areas. Moreover, due to globalization the urbanization process has prompted immigration from rural to urban areas. This study assumes immigration as a social phenomenon and this is examined in the social factors part.

2.2.2 Geographic Conditions

Various studies relate air transport demand to geographic conditions of the countries. Geographic factors such as location, size, and distances play a pivotal role in determining air transportation demand (Ishutkina & Hansman, 2008). Bhadra and Wells (2005) clarify that in the U.S. domestic market when the state is larger there is more demand for air travel within this state. This conclusion can be also applied in a wider sense if we think of each state as one country.

On the other hand, the countries, which have improved infrastructure of ground transportation, tend to have less than average air transportation per capita (e.g. France). Especially high-speed trains have become an indispensible substitute for the air transportation. On the other hand, distances in a straight line between cities are not so long in some countries like Norway, for example, but it takes long time to commute by alternative modes like train or road or some regions are not connected to alternative modes (Fridstrom & Larsen, 1988). There could be two explanations of this fact - either an inadequate infrastructure of alternative modes or the topographic conditions of the countries. This observation could also be applied to Turkish case due to poor infrastructure of railways and driveways and formidable topographic conditions in the east part of the country. These factors increase demand for air transportation. High-elevated countries (e.g. mountains) are more likely to have higher per capita air transportation than flat countries. Domestic air transportation demand can boost as a result of above-mentioned geographic characteristics of countries.

2.3. Market Structure

New business models like LCC, liberalization in international and domestic market, competition and bilateral agreements continue to stimulate air travel demand. All of these are result of deregulations in air transportation sector. Deregulations are the milestone of the aviation industry in many countries, and they trigger the increasing demand for air transport by letting new airlines enter the business (increasing competition) such as low-cost carriers, for example. For instance, in Europe low-cost carrier traffic stimulates major proportion of European passenger demand especially after enlargement of the EU member states (Steiner, et al., 2008). What is more, prices decrease significantly as a result of deregulation and emerging competition (Dargay &

Hanly, 2001). Consequently, more people are able to afford flying because it is no longer a luxury good.

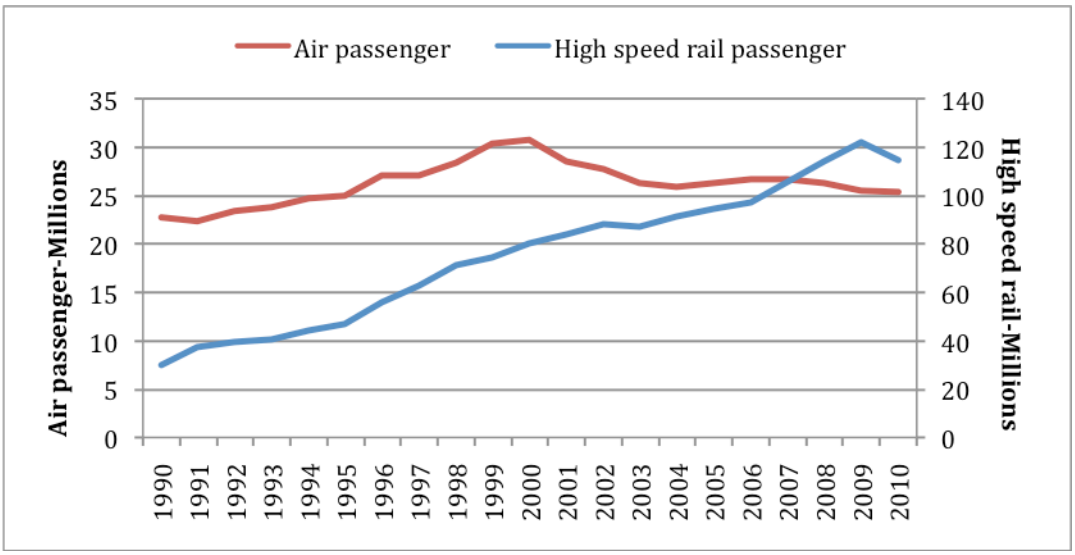

Figure 8. High-speed train passengers vs. Air passengers in France from 1990 to 2010

Also, usage and provision of alternative modes are directly related to the demand of air transportation. However, provision of alternative modes is not the only factor; also service quality, speed and reliability of these modes are important aspects influencing passengers' decision to shift from air transport to other modes (or vice verse). For instance, high-speed trains have started to compete with the airways (Department for Transport, 2010) in terms of speed and quality of services, especially in the Western Europe. However, as it is already mentioned in the previous section topographic structure of some countries and their geographic sizes do not allow substitute flying with any other more competitive (efficient) mode of transport

2.4. Social Factors

Social factors are generally very hard to quantify. Psychological, environmental (from a social perspective), immigration issues and changing lifestyles (habits) are part of social factors.

Graham (2000) underlined that people are taking longer and more holidays than before. Every extra holiday means additional journey where some proportion of it may be traveled by airway. The same logic is applied for longer holidays; people may want to divide their holidays into parts, in this case there is more demand for air travel too.

Steiner (1967) concludes the following statement "*Travel habits or patterns are rapidly changing as young people who have grown up in an environment of safe and reliable air travel regard flying as a normal means of extending their social and educational horizons"*(p. 86). This statement shows that social factors can play a vital role in the demand for air transportation by increasing desire to be mobile. Despite the fact that this study was carried out in 1967, this pattern is still up to date and incrementally continues. For instance, new generation is living in the age of globalization, so thinking of being mobile is even much more strong and the size of the world become smaller because of new technologies, possibilities and new way of thinking.

Leisure air transport market is experiencing growth as a result of influence of social factors. For instance, growing desire to travel, increasing international education and changing family structure (Department for Transport, 2010) are inducing increasing travel needs of individuals. Average education year of individuals may also affect air travel taken by individuals. For instance, Steiner (1967) claims the higher is the education level, the more air travel taken by these individuals. One can expect that highly educated societies have higher propensity to fly.

In addition to these factors, considerable part of the citizens of urban settlement comes from different locations. This means there is migration from rural to urban areas. In emerging countries there is a strong flow of migration from rural to urban areas; people try to find a better job, to move to areas with higher standard of living. These people usually leave a lot of relatives and friends behind. As a result of this, one can expect that migration plays a considerable role in determining air travel demand, because migrants tend to travel in order to see their hometown, friends and relatives few times a year. Often this type of travelers is called visiting friends and relatives (VFR) travelers.

2.5. Maturity in Air Transport Demand

Maturity is a very influential notion in the aviation industry that has been discussed for four decades[4] already; moreover, it is directly related to changes in the air transport demand. Many researchers have noticed the close correlation between air transport growth (air traffic or air passenger) and economic activity; as a result, air transport maturity is often related with economic growth (Graham, 2000). Roughly, maturity is

[4] J. E. Steiner (1967) discussed airline maturity in his paper.

explained with such a situation in the market; when growth of the air transportation sector is less then GDP or income growth. Graham (2000) describes maturity and saturation concept as follows: "*Maturity will then be considered to be setting in if there are declining changes in growth whilst saturation could be considered to exist if there is no growth anymore"* (p. 112).

Figure 9 shows the growth curve of the air transportation. After the development phase in the industry -where in most of the cases there is only one carrier that is publicly owned- liberalization or deregulations kick off the growth phase in the industry by allowing private companies to provide regular or charter flights within a country and also letting prices be determined by companies themselves without government intervention.

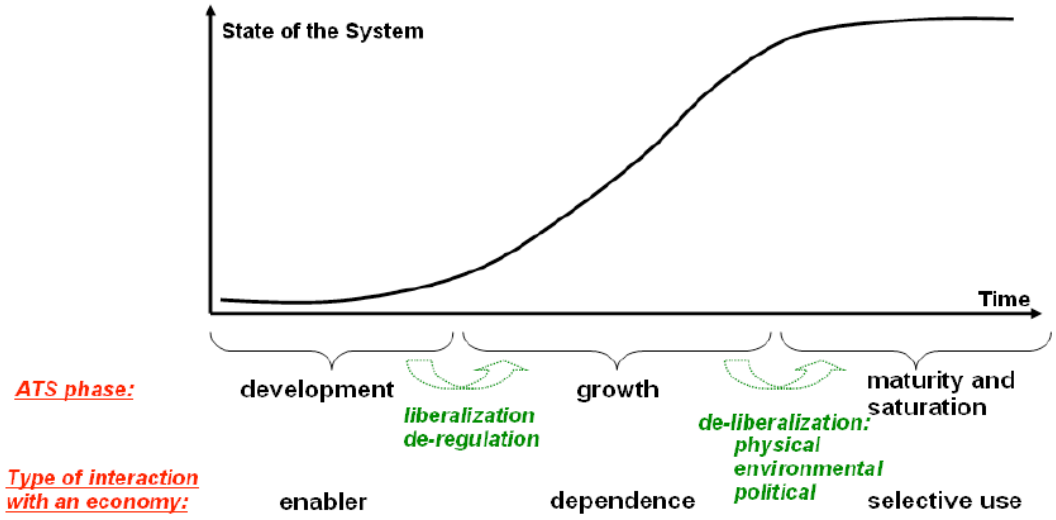

Figure 9. Evolution of the air transportation and its interaction with economic activity (Ishutkina & Hansman, 2008).

It is not possible to expect endless growth of air transportation demand, but it is very likely to see an S-shaped growth structure where growth is remarkably fast in the early phase, and then slows down gradually (Ishutkina & Hansman, 2008). These phases could be named as development phase, growth phase and saturation phase. In many cases sudden changes in the S-shaped curve are influenced by changes in regulatory framework such as deregulations and liberalizations (Ishutkina & Hansman, 2008).

In practice, falling growth rates of the U.S. domestic passenger air transport from 15% in the 1950s to 5% in the 1980's are considered as an indication of market maturity (Graham, 2000), however, in theory there are also other explanations of the decreasing growth rates. One of them is the income elasticity. Such an approach is used by Department for Transport[5] to calculate maturity level of UK air transport market. Income elasticity indicates the response of air transport demand to changes in the individual's incomes. For instance, if the air transportation demand starts to get less sensitive to income changes, in other words, if increases in the income do not cause proportionally higher increases in passenger numbers, than this market is considered as a mature. On the other hand, instead of using airline traffic or passenger numbers as a dependent variable in some cases, revenues are used to determine maturity (Graham, 2000). Essentially all these approaches are using the same fundamental to identify maturity levels by substituting different variables.

Table 2 shows the stage of maturity/saturation explicitly in the light of income elasticity values.

Table 2. Stage of maturity/saturation

Income elasticity value	Maturity/saturation stage
Constant and substantially greater than 1	Stage 1 (Full Immaturity)
Decreasing but still greater than 1	Stage 2
Approaching 1	Stage 3
1 or below	Stage 4 (Full Maturity)
0	Stage 5 (Full Saturation)

Source: (Graham, 2000)

Different countries tend to have different air transport growth rates. For instance, some economies have experienced air passenger growth of more than 10 %, to mention as an example such countries as Vietnam, United Arab Emirates, China, Chile, and Turkey (Ishutkina & Hansman, 2008), while the growth in other countries has been considerably slower. This is explained with different income elasticity of air transportation demand, in other words these countries are experiencing different phase of S-shaped curve as demonstrated in figure 9.

[5] Department of Transport is a public institution in the UK.

It is necessary to mention that maturity level within a country also may differ with regard to different markets and different O&D routes. The study is conducted by Department for Transport (2010) in UK exhibits that different markets are in the different level of maturity. For instance, in the UK short-haul market shows a sign of maturity while long-haul market is still promising considerable growth.

Next chapter continues with brief description of the empirical studies about air transportation demand determinants.

Chapter – 3 Empirical Approaches on Determinants of Air Transport Demand

In many researches, mathematical methods are used in order to explain the relationship between different factors that are mentioned in the previous chapter and air passenger demand. Majority of these researches consist of two different approaches: demand forecast (determinants) and demand elasticity (maturity) analysis. Nevertheless, the main focus of the researches and the variables that are used by these studies significantly vary. Thus, there is a need for a brief summary of these researches and their outcomes. Investigation of empirical approaches and the literature review are forming the cornerstone for this study's empirical research and they provide guidance in choosing variables to be used and explaining outcomes of the econometric model.

Dargay and Hanly (2001) use income, airfares, foreign trade, exchange rates and domestic price levels to find out the factors that are affecting air transport demand to and from UK. In the empirical part, this research uses pooled time-series cross-section approach (panel data) with Fixed Effects Model specification, which allows them to have country specific evaluation. Panel method is used for leisure trips/business trips to 20 countries and non-UK residents' leisure/business trips to and from the UK. The authors prefer to use pooled time-series cross-section approach because of the limited number of observations for time-series model. Eventually, the results clarify that fares have a negative effect on passenger demand while income has a positive effect on it in the UK air transport market. Moreover, income elasticity of UK international leisure air travelers is determined to be 0.43 in the short-run and 1.05 in the long-run which means that one unit change in the income drives number of air travel to increase by 0.43 and 1.05 units respectively.

Study of Alperovich and Machnes (1994) focuses on deficiency of inclusion of wealth variables in the demand models for air transportation. In this research, the authors found that many time series studies have an autocorrelation problem in the errors term. The study mentions that autocorrelation problem may be the result of model mis-specification in previous studies as a result of the way income is represented. Therefore, they use permanent income instead of current income as a determinant of wealth of individual. They underline that "*This practice, however, is at odds with economic theory which suggest that permanent rather than current income is the relevant variable which*

determines demand" (p. 163). Inclusion of the wealth variables (permanent income) in their time series model solved the autocorrelation problem in errors term. Their model includes airfares, financial assets, non-financial assets, wage per employee, CPI as determinants of passenger demand. Notwithstanding the study tried to include percentage change in CPI, percentage change in GDP, family size, these variables appeared to have insignificant coefficients and were removed from the model. According to the results of this research, Israel international air travel income elasticity varies between 1.55 and 2.06, which means income changes have a positive effect on total passenger number.

In the similar studies made by Abed et al. (2001) and Ba-fail et al. (2001) the authors establish time series model for the domestic and international air travel demand for Saudi Arabia. The authors use passenger numbers as a dependent variable and non-oil gross domestic product, consumer price index, imports of good and services, population size, total expenditures and the total consumption expenditure as explanatory variables. In both studies, they use four different model specifications in order to see forecasting performance of each model. As a result, they found out that the model with population size and total expenditure is the best model to explain passenger demand for both domestic and international air transportation. It means that increasing population and expenditures drive the increase of international and domestic air transport demand. However, the model they built up has deficiencies. Despite the fact that they have considered different models, they do not try to create a model with more explanatory variables.

Some empirical studies focus on air transport demand in regional patterns. In the empirical study of Bhadra and Wells (2005), which focuses on the U.S. interstate air transport demand factors, the authors use O&D passenger number as a dependent variable and average fare, gross state production, population and number of hubs as an independent variable. Result shows that there is a close relation (unit elastic) between GSP and passenger numbers with a coefficient of GSP 0.95. In other words, increase of 1% in the state product results in 0.95% increase in passenger number. Furthermore, passenger demand and location of airports are strongly affected by population and economic activities. Subsequent research of Bhadra and Kee (2008) replaces the model for determining passenger demand in O&D routes by using personal income instead of gross state product and distances between two O&D destination instead of the number

of hubs. They segment the markets according to market type. These markets are super-thin, thin, and semi-thick and tick markets. However, population turns out to have a correlation with other sub-samples and has to be removed from the model. The model that this study built, explains 60% of variation in the thick markets demand. In conclusion, fares, real personal incomes, and distances are strong determinants of air transport demand according to the outcome of this research.

Urban regions are the main supplier of passengers to air transport market; therefore it has also attracted some studies to investigate this relationship. Dobruszkes et al. (2011) explores determinants of air transportation in major European urban areas. Study uses total air service as a dependent variable and step-wise approach applied to decide which variables are significant to determine air transportation demand in urban regions in Europe. From population, gross domestic product, national administrative function, international administrative function, economic decision-power, knowledge and scientific research, tourism and distance to the nearest main air market, only GDP, economic decision-power, tourism and distance to the main air market turned out to be significant. Consequently the model with four independent variables explains 70% of variation in the changing air transport service demand where GDP is the strongest determinant. This study finds relatively small GDP coefficient with respect to other researches. Regression shows that GDP has a 0.39 coefficient while standardized coefficient of economic decision power is 0.29. Moreover, distance to the nearest main air market and tourism have positive influence on total air services respectively 0.27 and 0.23.

The research of Fridström and Thune-Larsen (1989) focuses on forecasting air traffic volumes in Norwegian domestic air transportation network. They use pooled cross-section time series data, and fares, travel time, income and population taken as independent variables in the model. Fares and travel times variables are used for air travel and for the fastest surface transportation mode. The results are as expected. Population and income have positive demand elasticities while time fare and travel time have negative demand elasticities. Magnitudes for population and income are 1.46 for each variable. On the other hand, fare and travel time are respectively -1.23 and -0.94 for the long run.

Table 3. Summary of Empirical Approaches on Determinants of Air Transport Demand

Author and Date	Theme	Model	Dependent Variable	Independent Variables/Coefficients	Region/Country Focused
Abed at al. (2001) and Ba-Fail (2000)	Domestic and International air travel demand	Time series analysis-Step wise regression procedure	Passenger Numbers	Non-oil gross domestic product (0.01), consumer price index (0.02), imports of good and services (0.08), population size (0.39), total expenditures (0.02) and total consumption expenditure (0.01)	Saudi Arabia
Alperovich & Machnes (1994)	International Air Travel	Times series analysis	Air travelers ratio to population	Airfares (-0.26), financial assets (0.38), non-financial assets (0.56), wages (2.06), CPI	Israel
Bhadra & Wells (2005)	Regional O&D demand determinants	Cross section analysis	O&D passenger number	Average fare (-1.13), Gross State Product (0.75), population and number of hubs (0.4)	US
Bhadra & Kee (2008)	Domestic O&D air transport passenger demand	Panel Data analysis	O&D passenger number	Personal income, O&D distances, population, fares	US
Dargay & Hanly (2001)	Demand determinants	Pooled time series-cross section analysis	Air trip numbers between countries	Income (0.43), airfares (-0.24), foreign trade, exchange rates (0.39), domestic prices (-0.32)	From and to UK
Dobruszkes (2011)	Urban areas and passenger demand	Linear multiple regression analysis	Total air service	Population, gross domestic product (0.39), economic decision-power (0.29), knowledge and scientific research, tourism (0.23) and distance to the nearest main air market (0.27)	European urban regions
Fridström & Thune-Larsen (1989)	Forecasting air transport demand	A direct demand intercity gravity model	Traffic flows	Fares (-1.63), travel time (-0.94), income (1.46) and population (1.46)	Norway
Marazo et al. (2010)	GDP PAX relationship	Time series analysis	Passenger-kilometer	GDP (0.8)	Brazil

Note: Coefficient of the variables that are used in the studies is given in the parentheses.

Amongst many others, Graham (2000) has made a case study on income elasticity of UK leisure air travel market. According to this study, air travel segments in UK are facing lower income elasticities than before. For instance, according to the outcome of this study, income elasticities of international holidays decreased from 0.74 during period 1970-1988 to 0.55 during period 1984-1998. Also, R-square (explanatory power of model) of the elasticity models decreases, which means that the relationship between income and passenger numbers is diminishing. Accordingly, this leads the author to draw conclusion that the UK leisure air travel market is facing maturity.

Another methodological approach on air transport demand is researched by Marazzo et al. (2010) about Brazilian air transport market. Study investigates only inter-related relationship between GDP and passenger numbers. Research results show that passenger number is reacting strongly to changes in the GDP, but GDP reacts to changes in the passenger number slower.

Next chapter is explaining the historical development of Turkish air transport industry in the light of deregulations.

Chapter 4 - Growth of Turkish Domestic Air Transport from Historical Perspective

In order to understand the current situation and prospect of Turkish air transportation, it is essential to investigate historical development of the industry. This chapter studies Turkish civil aviation history in the light of the 1983 and 2003 deregulations, which are the milestones of the Turkish domestic air transportation.

In order to give a better insight to the reader, Turkish civil aviation history and development are divided into 4 parts These parts consequently are period before the 1983 deregulations, period between 1983-2003, period after the 2003 deregulations and, lastly, present days. Turkey experienced strictly regulated air transport market until 1983; it was partially liberalized from 1983. However, the 1983 deregulations did not constitute fully liberalized market. Starting with the 2003 deregulations the Turkish domestic air transportation evolves into fully liberalized market. Year 2003 is considered to be late for liberalization comparing with time periods when other deregulation processes took place in the world. However, due to economic and sociologic background of the country it was not possible to introduce complete liberalization in air transportation until 2003.

4.1. Period before the 1983 Deregulations

Until 1983, Turkish aviation sector ruled solely by Turkish Airlines (the first and the only airline at that point, owned by the state), who was only provider of domestic and international air transportation services. Notwithstanding a few unique attempts to found a private airline before 1983, existence of these airlines did not last long. This was mainly because of the strict regulations and prohibitions in the legislation that made the entrance of the new airlines to the market almost impossible and unfeasible. The first attempt to found a private airline was realized in 1977; it was only serving in one route and non-scheduled service. This attempt did not last long and the first and unique attempt failed just a few years after foundation and ceased operations in 1980. At that time strictly regulated market was not allowing private airlines to run regular services and to control fares. What is more, political outlook towards private enterprises was poor during these years and partially closed economy was inhibiting potential success of private airline companies. Thereby, above mentioned facts were making it impossible to

establish a private airline. As a result, Turkish Airlines was the monopoly in the market during these years with limited routes and services.

Furthermore, economic and politic constitution and socio-economic characteristics of the country were not ready to create sufficient demand to stimulate growth of domestic air transport. During these years, Turkish economy was struggling with macro and micro economic problems. By the end of 1982, per capita income was only 1.397 dollars and economy was deeply suffering from high inflation, which was around 31 %. All these circumstances together (high airfares, low-income levels and inflation) were hindering the demand for domestic air transport services.

4.2. Period from 1983 to 2003

Academic researches underline that economic advancements and development of air transportation move together. After national economic policies had started to change in 1980's, Turkey opened its economy to the world in order to articulate itself to the capitalist world economic system. This resulted in expansion of foreign trade, increase in personal and national incomes, industrialization, and migration from rural areas to cities. The above-mentioned developments triggered air transportation demand in the end of the 80's. Following the liberalization progress in Turkish economy, first step was made in 1983 in order to de-regulate civil aviation sector. A new law was introduced, which allowed private airlines to operate in the domestic and international routes. Despite fully liberalized market entrance, price mechanism and timetables were controlled by Ministry of Transportation. Airlines had to receive approval from Ministry for fares and timetables and beside this, fares and timetables had to be announced to the third parties 15 days in advance. From the above mentioned, we may draw a conclusion that the aviation sector was partially liberalized although the entrance into the market was fully liberalized, the prices were still under control of Ministry of Transportation.

Following to the de-regulations 22 new airlines started their operations during the period from 1983 to 1992. However, most of them did not succeed and did not operate long – the most long-lasting airline operated for 11 years. During this period, newly formed airlines did not have enough experience and market knowledge to stay in the market. In addition to this factor, seasonal demand changes, high operating costs, lack of skilled labor force, high taxes, and political instability dragged them to the

bankruptcy or forced to change business model to charter airline (Ozsoy, 2010). The ones that able to continue business, they changed the business model to charter airlines, which requires less complicated management regime. Moreover increasing tourist demand to Turkish holiday destinations was also another factor to birth of charter airlines.

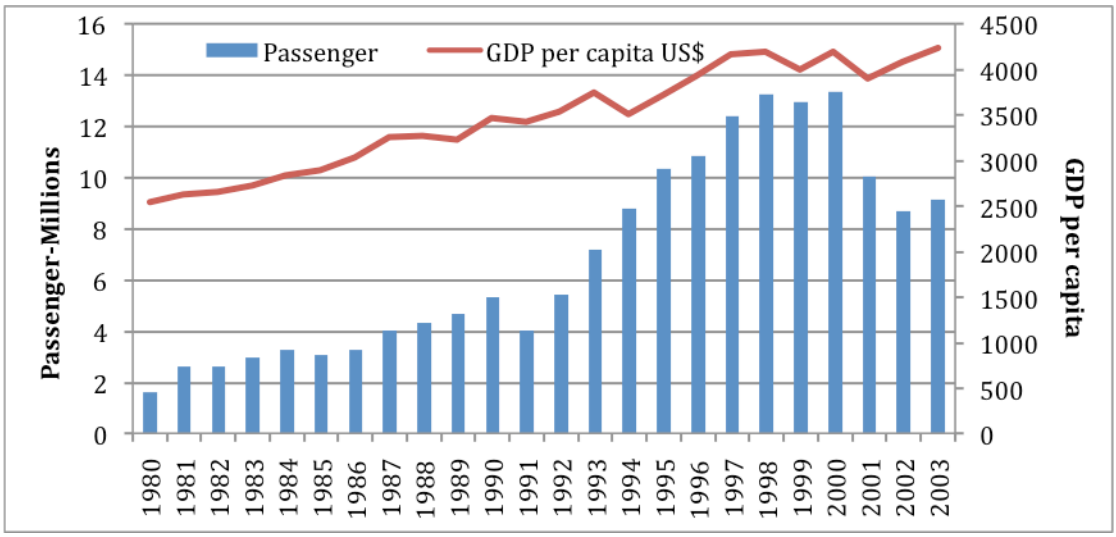

Figure 10. 1980-2003 passenger numbers and GDP per capita in constant US dollar in Turkey

Privatization is a necessary precondition for market liberalization in air transport sector because state owned airlines often have privileges and they are protected by regulations, which make competition conditions unfair for the private airlines. In 1990, the flag carrier Turkish Airlines included in the privatization process. Despite the attempt of liberalization in 1983, some adjustments in legislation precluded the private enterprises to operate airlines in the domestic market (Ozsoy, 2010). These adjustments were related to privileges provided by the government to the Turkish Airlines. After the 1983 de-regulations, new entries to the market forced Turkish Airlines to face with competition. To protect Turkish Airlines from this competition new arrangements to the 1983 de-regulation have been added in 1992 and entry rules and market regulations tightened again(re-regulated). As a result most of the private airlines failed to continue operation in domestic market and they head for foreign leisure travel (tourist) market for Turkish holiday destinations (as mentioned in previous paragraph). Turkish private airline companies change their business model and they were providing only international services as a charter airline after 1992. Thus, Turkish Airlines was still monopoly in the domestic market

During this period existing inflation problem soared, in the year of 2000 inflation was 65% while per capita income increased to 4.189 dollar. However, inflation rates were eroding income growth and appropriate economic environment for increasing demand for air transport has not been sustained yet in this period.

Consequently, although the 1983 deregulation has not provided a fully liberalized market, it was the first step and preparation for the wider and consistent liberalization process in 2003. With the help of the 1983 liberalization private sector was able to experience operating airline and gain a precious experience about the business, which served has helpful reference for the upcoming airlines after the 2003 deregulation. Nevermore, one can hardly say that, 1983 de-regulation had positive impact on domestic demand as market re-regulated in 1992 again.

4.3. The 2003 Liberalization

The 1983 deregulation did not bring fully liberalized market, and this reflected on customers as a low service quality and high prices. As a result of high prices, expected growth rates of domestic passenger numbers were not achieved. Before the 2003 liberalization, only national flag carrier Turkish Airlines was serving in domestic routes and other 13 charter airlines were providing limited unscheduled services (mainly international). By the end of 2002 only 9 million domestic passengers traveled by air.

During 2000's many entrepreneurs were trying to convince and influence Ministry of Transportation in order to abolish restrictions for private airlines to operate in the domestic market. Finally at the end of 2003 comprehensive de-regulations were introduced. In addition to deregulations Ministry of Transportation announced incentives to encourage private entrepreneurs to enter the market. Following this announcement, General Directorate of State Airport Authority reduced airport rates and taxes and government abolished substantial taxes that were included in the airfares. These practices helped airlines to reduce the operating costs and enabled them to offer lower rates to the customers. Moreover, privatization process in economy accelerated during these years, state shares in Turkish Airlines reduced below 50% and Turkish Airlines became an incorporated company. Furthermore, government initiated a project to increase capacity of the airports and improve their infrastructure by using Build-Operate-Transfer model. In this model new terminals and infrastructure improvements were built by private companies and correspondingly operation rights of the terminals

were given to these companies for a certain period of time. Major airports in Turkey are now privatized in the framework of this model and they are contributing to capacity increase and liberalization process of the Turkish civil aviation sector.

4.4. Evolution of Current Situation

In the last ten years Turkish air transport industry has evolved from small-scale industry to giant with more than 100 million domestic and international passengers, 156 aviation enterprises (airlines, air taxis, general aviation etc.) and 12 billion American dollar turnover. In 2002 domestic passenger number was only 8.7 million and international passengers amounted up to approximately 25 million. However, the 2003 deregulations launched a new phase for the Turkish civil aviation industry. This deregulation stimulates the growth in the industry and forecasts for Turkey's passenger number for 2015 had been reached 10 years earlier.

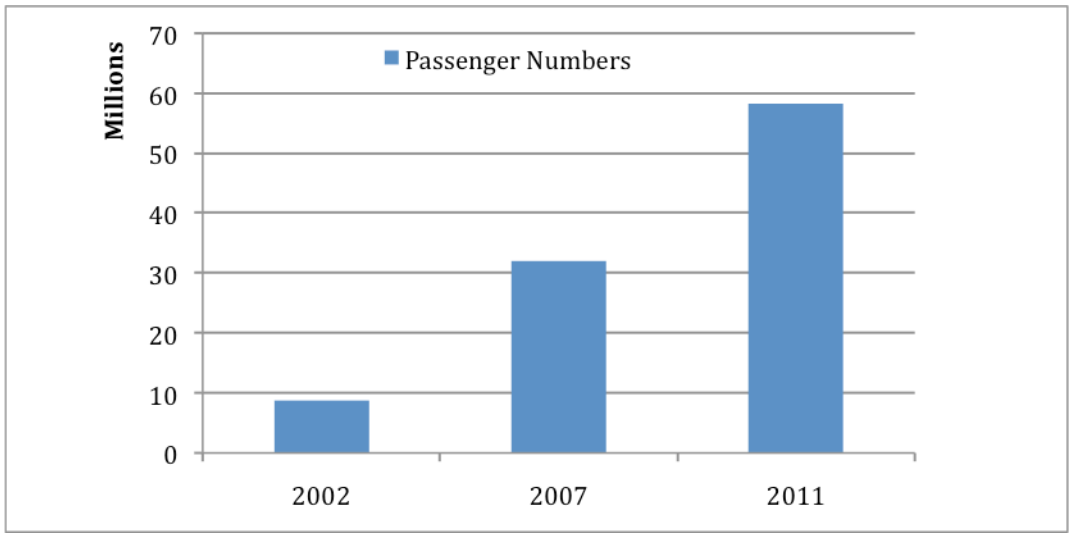

Figure 11. Domestic passenger numbers before and after 2003 de-regulation

Pre-2003 regular domestic services were concentrated in 8 main airports while the remaining 30 airports were left in idle position. Nowadays 45 airports are in active operation and more are under construction. At the moment, 8 out of 45 airports are run by private enterprises and the General Directorate of State Airport Authority operates the rest. Parallel to the developments in the last ten years, airports passenger number grew steadily by 3.5 times and aircraft number increased by 2.4 times between 2003-2010. In 2011 Turkish airports handled 58 million international and 59 million domestic passengers. The Turkish Airlines have 54% share in the domestic services and 28% in the international routes. Private airlines are continuing to increase their share in both

domestic and international routes steadily. Turkish Airlines is one of the fastest growing airlines in the world and it increased its passenger number by 12% in 2011 and compound annual growth rate is 12 % from 2003 to 2011. Moreover, by the end of 2011 Turkish Airlines has one of the biggest route networks in Europe, serving 44 domestic and 144 international routes, which makes the Turkish Airlines 3rd in Europe and 7th in the world according to the network size.

Despite the stimulated growth in the last ten years, Turkish air transport passenger/population ratio is still under the EU average level. The passenger/population ratio for total (domestic and international) passenger is 3.08 for EU-15 and 2.12 for EU-27 while it is only 1.39 for Turkish air transport (Tekfen, 2011). These statistics show that Turkish air transport market is promising a steady growth. Moreover, there are still some other advantages for Turkish market to grow further. For instance, Turkey is the 6th biggest economy and has the youngest and second biggest population in Europe. Also, aggressive growth strategies of Turkish airlines and unexploited regional aviation are some of the reasons why Turkish market has potential to develop more. For instance, forecasts for the air transport industry are expecting 5% increase in the passenger traffic until 2020 (Transport Report Turkey).

Another important factor of growth is the presence of new business models in the industry. Regulatory framework changes in Turkish air transport industry have stimulated the growth and enabled development of low-cost carriers (Ishutkina, 2009). As a result, after the 2003 deregulations low-cost carriers have captured major share of the passenger increase in domestic routes. On the other hand, despite the fully liberalized market the growth of private airlines in international routes is hindered by bilateral agreements. These bilateral agreements often allocate routes completely in favor of national carrier (Ishutkina, 2009).

Growth in Turkish domestic air transport sector is highlighted by some international researches. In the study of Steiner et al. (2008) it is acknowledged that "*strengthening of domestic air transport market in Turkey*" influences the air traffic growth in Europe. This is a congruent evaluation as Turkey is one of the fastest growing air transport market in Europe.

To summarize, strong economic growth, in 90's and after economic crisis in 2001, increases the income of individuals and stimulates private consumer demand

(Isthutkina, 2009). Specifically, air transport growth is triggered by both economic growth and the 2003 deregulations. Moreover, these stimulating factors can be listed as follows (as adopted from Ishutkina (2009)):

- Implementation of the 2003 deregulations to the domestic market prompt low-cost carrier developments
- Airport capacity investments
- State support to national carrier (Turkish Airlines)
- Aggressive expansion strategy of airlines
- Economic liberalizations
- Increasing consumer demand

Next chapter continues with empirical analysis of Turkish domestic air transport demand.

Chapter 5 – Empirical Analysis

This chapter aims to explain empirical analysis step by step. Chapter starts with hypotheses and continues with description of the dataset and how it is obtained. Section 5.3 elaborates demand model of domestic air transport and its steps. Finally, the chapter ends up with outcomes of the regression and their interpretations.

5.1. Research Question and Hypotheses

This study's research question is: "What are the main drivers of domestic air transport demand in Turkey?" In order to answer the research question, the author propounds 6 hypotheses. These hypotheses are expressed as follows:

H1: Income changes have a significant effect on domestic air passenger demand.

H2: Population constitutes an important part of explanation of changes in domestic air travel demand.

H3: Deregulations are triggering air passenger demand.

H4: Oil prices have a significant effect on air transport demand.

H5: Maturity is a threat in upcoming years for the domestic air transport industry.

H6: Alternative modes, such as high-speed rail transportation, show substitute behavior for air transport.

The coming sections analyze and answer the above-mentioned hypotheses and the main research question by the help of regression analysis.

5.2. Variable Selection and Description of Dataset

Selection criteria of dependent and independent variables in the regression model bases on theoretical and empirical literature, which is reviewed in the Chapter 2 and Chapter 3. Different studies used embarked passenger, passenger-km (or miles), passenger population ratio and terminal passenger numbers as a determinant of air passenger demand. In this study, domestic terminal passenger numbers are preferred to indicate air travel passenger movements. Domestic terminal passenger data describes the number of arrived and departed passengers in the airports. In this method, one passenger is counted

twice (one time in departure airport and once in arrival destination) only if the passenger travels between two airports within the same country (domestic routes). Civil Aviation Authorities in many countries, for example, such as Turkey, United Kingdom and France use terminal passenger numbers to analyze air transportation trends. In most of the countries the National Civil Aviation Authorities or State Airport Directorates are responsible for collection and publishing of the data about terminal passenger numbers. We use panel method to determine the relationship between passenger demand and selected independent variables. For this reason, we choose 3 more countries together with Turkey. These countries are Brazil, France and the United Kingdom. First of all, the countries are chosen according to their size, since domestic air transport demand conditions require relatively large countries. For instance, Bhadra and Wells (2005) express that the larger the state, the higher domestic air transport demand. These three countries correspond to this argument. Secondly, in order to have countries with different incomes, we also consider income levels of each country. Rather than having countries with similar income level, countries with different income levels are chosen. This helps to balance too big or too small coefficients, which may cause biased results. In the dataset, Turkey and Brazil represent upper-middle income level while France and the United Kingdom represent high-income countries. In this study's dataset, Turkish passenger numbers are obtained from General Directorate of State Airport Authority (GDSAA) upon request. Annual reports of civil aviation authorities in Brazil and the UK are used to calculate passenger numbers from 1980 to 2010[6]. Lastly, French passenger data is derived from the Transport Statistic Annual report published by French Statistical Bureau (INSEE). Data for different countries are consistent, and methodology used to calculate is the same for each country. Numbers represent total of arrival and departure passengers in the airports including both scheduled and chartered flights.

In order to comprehend the main determinants of the domestic air travel demand, we choose several control variables, which are income, population, consumption, expenditure, railroad passenger numbers, high-speed railroad passenger numbers, crude oil prices and several dummies as relevant independent variables. Among these independent variables population, income and usage of alternative modes are the most

[6] Brazilian Civil Aviation Authority is ANAC and United Kingdom Civil Aviation Authority is CAA.

common variables in the literature to estimate passenger demand. As a result, basic equation is created for the first step. Preliminary model can be expressed as:

$$Pax=f\,(I,P,C,E,R,HS,O,dummies) \quad (1)$$

More specifically, on the left hand side *Pax* is passenger number and on the right hand side *I* is income, *P* is population, *C* is consumption, *E* is expenditure, *R* is rail passenger number, *HS* is high speed rail passenger number and *O* represent oil prices. Moreover, Turkey 1983 and 2003 deregulations and 2001 crisis, Brazil 2001 and European Union 1997 liberalization used as a dummy variables.

Independent variable, *I*, is expressing income, and it is derived from IMF World Economic Outlook database published three times a year. Income is measured as expenditure based on gross domestic product per capita in terms of constant prices and is expressed in national currency. IMF collects income data from national statistic offices of each country. The differences in data collection methodologies among countries do not create a problem in the fixed-effect specification (Van Reeven, 2011), which is discussed later on. Some of the studies use GDP, however, GDP calculation also includes the effect of population, which may lead to biased results; due to this, this study prefers to use GDP per capita in the regression model as a better predictor of passenger demand. Independent variable, *P*, represents the total population of the country. The total population of the country consists of all persons falling within the scope of the census. Demand for air transport is concentrated in densely populated areas, in other words, in urban regions (Dobruszkes et al., 2011). Based on this, the study intended to use urban population numbers as a better explanatory variable for passenger demand; however, this variable creates insignificancy problem in regression results. The reason is that urban population numbers depend on predictions and estimates of World Bank (not absolute numbers), which may cause urban population to fall into insignificancy problem.

In addition to income and population (model's main explanatory variables), railroad passenger numbers, *R*, and the crude oil prices, *O*, are included. We use OECD database for rail passenger numbers for all countries except Brazil. Brazilian rail passenger data is obtained from Brazilian National Statistic Office (IBGE). Calculation methods are the same for each country and rail passenger number is expressed in terms of passenger-

km[7] (PKM). However, rail passenger numbers face correlation problem and the variable is removed from final regression model (as discussed later in this chapter). Another rail related variable, *HS*, indicates high-speed rail passenger numbers. This data is only valid for France; high-speed rail networks are still under construction in Brazil and Turkey. High-speed rail data are obtained from French Statistical Institute (INSEE). They represent passenger numbers that use high-speed rail. IMF World Economic Outlook (WEO) database is used to obtain crude oil prices. Crude oil prices are reflecting the UK dated Brent petroleum prices expressed in US dollars per barrel. Crude oil prices are the same for each country since it is an international commodity traded in stock markets. Finally, two last variables, which suffered from correlation problem and were later removed from dataset, are consumption (*C*) and expenditure (*E*). World Bank database was used to collect data for variables *C* and *E*. Consumption defines household final consumption expenditure in current US dollars and expenditure is gross national expenditure in current US dollars.

Furthermore, as it is discussed in the Chapter 2, liberalization (or deregulations) affects passenger movements significantly. In order to estimate the effect of deregulations, dummy variables are created for Turkey, Brazil and European Union (in this case for France and the UK), where the most significant changes in air transport passenger transport are triggered by deregulations. The 1983 and 2003 deregulations and 2001 economic crisis dummies are used for Turkey. Dummy for the 1983 deregulation represents years between 1983-1992 and the 2003 deregulation dummy indicates year 2003 and onwards. 1992 is taken as an ending date because in this year Turkish domestic air transport market was reregulated. The 2001 economic downturn dummy covers only 2 years that is from 2001 to 2002, when the effect of economic crisis is perceived. Later, dummy variable for Brazil is created for the 2001 liberalization. Finally, the 1997 deregulation in European Union is also taken into account as it has a significant impact on inter-country European air transport. This study adds the EU 1997 liberalization to see, if the1997 deregulation has a significant effect on domestic air travel demand in the given EU countries. Afterwards, the complete data set is

[7] Unit of measurement representing the transport of one passenger over a distance of one kilometer.

transferred to STATA statistical package and further settings and arrangements are made.

5.3. Demand Model of Domestic Air Transport

This section explains the steps this study follows to designate the relationship between dependent and independent variables in the demand model of domestic air transport. In order to do that, we run a regression analysis, which is a strong tool to assess this relationship. One should acknowledge that the main focus of this research is kept on Turkish domestic air transport demand. As it is explained in the coming section, the study uses different countries as a control variable in the fixed effect model. While this approach has several advantages such as increasing the robustness of the outcomes, it has also some deficiencies. In particular, it does not allow having country specific elasticities. As a result, discussion and conclusion about Turkey is based on the fixed effect estimator outcomes showing the average effect of each independent variable within countries. It is important to note these deficiencies, and conclusion and discussion should be reviewed taking this into consideration. Beside this, regression analysis assumes:

- A linear relationship between variables
- Usage of appropriate variables (dependent and independent)
- No highly correlated independent variables which leads to a colinearity problem
- Constant error terms, in other words no heteroskedasticity

Moreover, the model assumes that all variables are endogenous except the dependent variable. Time series models are the most widely used in the empirical researches for demand and elasticity analysis of air transport. Notwithstanding, time series method is not the preferred method in this study since we have 40[8] observations for Turkey. Instead, we employ cross-section time-series approach (Panel data) to explain the determinants of the air transport demand in Turkey. Model uses panel of four countries, where each country is a control variable for other countries. Dataset includes annual observations for the period from 1980 to 2010. The four countries included are Brazil, France and the United Kingdom and Turkey. As a result, panel data approach increases

[8] In case of time-series analysis of Turkey, we have 40 observations, however, inclusion of different countries restricts time-series observation to 30.

the possible sample size from 40 to 120 with respect to time series. In this case, significance of the estimated parameters is expected to increase (Dargay & Hanly, 2001). These countries are chosen according to their relevant characteristic. For instance, Brazil shows characteristics, which are remarkably similar to Turkey from economic and social perspective, where they both are considered as upper-middle income economy. On the other hand, the United Kingdom and France are upper income countries where air transportation is actively used for decades. These countries indicate diversity with respect to income, population, land size and social factors.

After establishing the equation (*1*), we adjust this model by taking natural logarithm of all variables. Thus, this allows us to make elasticity estimates (Van Reeven, 2011), and compare the result with prior elasticity studies. In the equation (*2*), *i,* represents countries and, *t,* expresses years. After these adjustments on the preliminary model *(1)* the second step of the model can be expressed as:

$$LnPax_{it} = \propto_{it} + \beta_1 LnI_{it} + \beta_2 LnP_{it} + \beta_3 LnC_{it} + \beta_4 LnE_{it} + \beta_5 LnR_{it} + \beta_6 LnHS_{it} + \beta_7 O_{it} + dummies + \varepsilon_{it} \quad (2)$$

Table 4. Correlation between variables and their significance level

	lnpax	lnincome (I)	lnpop (P)	lnrail (R)	lnhst (HS)	lncons (C)	lnexpen (E)
lnpax	1						
lnincome (I)	0.5493	1					
	0						
lnpop (P)	0.6493	-0.0467	1				
	0	0.6065					
lnrail (R)	0.3079	0.7923	-0.6051	1			
	0.0013	0	0				
lnhst (HS)	0.0214	0.5441	-0.3032	0.6408	1		
	0.8153	0	0.0006	0			
lncons (C)	0.7685	0.8248	0.0758	0.7323	0.3766	1	
	0	0	0.4027	0	0		
lnexpen (E)	0.7496	0.8429	0.0587	0.7593	0.4109	0.9977	1
	0	0	0.5171	0	0	0	
lnoil (O)	0.2881	0.0664	0.0995	0.1598	-0.0362	0.3316	0.3273
	0.0013	0.4636	0.2716	0.1002	0.6896	0.0002	0.0002

One can expect multicollinearity problem in the models with many variables. Multicollinearity indicates that, variables may be correlated within each other, which may cause biased results. To see if selected variables have multicollinearity problem or not, variance inflation factor test (VIF) is carried out. In order to run VIF test, first the

equation (*2*) is run by OLS estimation method and then VIF test is carried out. Variance inflation factor test indicates a multicollinearity problem[9]. Therefore, we run correlation test in order to see these interactions between variables. Correlation test shows all the pairwise correlations coefficients between the variables with their significance level. The results are shown in the table 4. Numbers close to one (negative or positive) represent strong correlation between these variables. Some degree of correlation between variables is acceptable; however, there is no straightforward rule what it should be. In this study, we assume that correlation over 0.65-0.70 is representing strong correlation and these variables should be removed from dataset. From results it is clear that, consumption (lncons), expenditure (lnexpen), rail passenger number (lnrail) are highly correlated within each other. Consumption (lncons) and expenditure (lnexpen) are highly correlated with income (lnincome), as well. This level of correlation is expected, since expenditure and consumption have very similar methods for their calculation. One can say that consumption and expenditure calculations are derived from income (GDP is base point for their calculation). High correlation between railway passenger and high-speed rail passenger is also expected since high-speed lines are substitute of regular rail lines (or the other way around). As a result, we remove lncons, lnexpen due to their mutual correlation. Railway passenger number is also extracted from demand model since it is highly correlated with consumption (lncons) and expenditure (lnexpen).

After correcting multicollinearity problem by selecting appropriate variables to be used in the model, the next step is deciding what panel model to use. Fixed Effect and Random Effect Model specifications are widely used approaches in panel data regressions. We regress the equation (*2*) with fixed effect and random effect model and then apply Hausman test. Hausman test indicates which model is preferable to use. The null hypothesis specifies preferred model is the random effect. Hausman test's result[10] suggests that unique errors are correlated with regressor, which means that fixed effect model specification is the preferable approach for the model specification. Fixed effect investigates the relationship between predictor and outcome variables within an entity like country, person. Each entity has its own individual characteristics that may or may

[9] More detailed result about VIF test is in Appendix A.

[10] More detailed result can be found in Appendix D.

not influence the predictor variables (Torres-Reyna, 2009). Moreover, fixed effect model specification represents differences between countries and allows country-specific intercepts (Dargay & Hanly, 2001). It absorbs all the between-cluster variations and effects of independent variables are completely within-cluster effect (Bartels, 2008). This feature of fixed effect model is abolishing the concern about using income expressed in local currencies. Same study (Bartels, 2008) explains how to interpret results in fixed effect model: "*For a given country, as X varies across time by 1 unit, Y increases or decreases by β units*" (p. 6). In this definition *X* specifies independent variable, *Y* indicates dependent variable and β is the coefficient of independent *X*. Basically, it means that the coefficient of each independent variable tells the average effect of predictor across the groups. The drawback of this approach is that it assumes that demand relationship and the elasticities are the same for all countries (Dargay & Hanly, 2001). In other words, in fixed effect model it is not possible to add cluster specific independent variables.

Finally, last step is consisting of specification of our model. Static model specification's inferences are limited to short-run effect. Such as specification fail to provide long run impact of independent variables (De Boef & Keele, 2005). In order to obtain long run effect of exogenous variables we use dynamic model specification, which includes lagged variables on the right hand side of the model (De Boef & Keele, 2005). As a result, dynamic model specification let us to understand effect of changes in explanatory variables on dependent variables in both short and long run. We use auto-distributed lag (ADL) specification of general dynamic model. As a result, we can simply specify ADL model as following:

$$Y_t = \propto_0 + \propto_1 Y_{t-1} + \beta_0 X_t + \beta_1 X_{t-1} + \varepsilon_t \quad (3)$$

In this model, β_0 and β_1 gives the short run effects of the independent variables. In other words, they represent immediate effect of changes in independent variables on dependent variable. Moreover, there are two different transformation of ADL model. These are Bewley (1979) and Bardsen (1989) where they called as an error correction models (ECMs). This study use Bardsen (1989) ECM since it allow for more convenient testing of long run effects than the ADL and it is most useful form of the error correction model (De Boef & Keele, 2005). As Bardsen error correction model

specify, we take the first difference of dependent variable and made the required arrangements. The model can be express as:

$$\Delta Y_t = \propto_0 + \propto_1 Y_{t-1} + \beta_1 \Delta X_t + \beta_2 X_{t-1} + \varepsilon_t \quad (4)$$

By using levels and first differences of the time series one can easily estimate error correction rate, $\propto_1$. Moreover, long run multiplier (k_1) is specified as from equation *(4):*

$$k_1 = \frac{\beta_2}{\alpha_2} \quad (5)$$

We apply Bardsen error correction transformation in our demand model in the light of the above mentioned model specifications. In this model, coefficients of the differenced independent variables denote the short-run elasticities of independent variables. The lagged value of passenger numbers in the model is an error correction rate (Van Reeven, 2011). One can obtain long-run elasticities of the independent variables by dividing the lagged values of independent variables by error correction rate (see appendix C). The ultimate version of the demand model of domestic air transportation is:

$$\Delta Pax_{it} = \propto_{it} + \beta_1 \Delta LnI_{it} + \beta_2 \Delta LnP_{it} + \beta_3 \Delta LnHS_{it} + \beta_4 \Delta O_{it} +$$
$$\beta_5 LLnI_{it} + \beta_6 LLnP_{it+} \beta_7 LLnHS_{it} + \beta_8 LO_{it}\ dummies + \varepsilon_{it} \quad (6)$$

This equation *(6)* embraces the most important determining factors of air transport demand that are suggested in literature. Income indicates individual's capacity to spend, where part of the income is rebounded as an air travel demand. Population illustrates both the size and the growth of the number of the country population. In fact, income and population are interrelated with each other. For instance, higher income levels express higher proportion of the population willing to use air transportation. On the other hand, regulated domestic markets suppress potential demand increases, in other words, neither income nor population can have triggering effect without deregulation. To investigate this relationship we run equation (*6*) with fixed effect estimator and outcomes are discussed in the section 5.4 and

5.4. Results

In the light of the assumptions and specifications listed in the section 5.2 and 5.3, we run the regression with fixed effect estimator model. As it is stated before, we purge the

variables from collinearity problem. Moreover, the outcome of regression is without hetereoskedasticity problem[11]. On the other hand, serial autocorrelation is a common problem in the cross-section time-series pooled models. Reasons and correction of this problem is still under debate. Relatively high correlation between population and passenger number may lead the model to have autocorrelation problem as it is stated in the study of Alperovich and Machnes (1994). Another common problem in the variables is having stochastic trend. Stochastic trend in a series mean that there is a more than one trend in the series. One way to deal with non-stationary data is by taking first difference of variables (Torres-Reyna, 2009). Since our model specification includes first difference of each variable, stochastic trend is not a concern in our dataset. Outcomes of the ultimate model are presented in the table 5.

Table 5. Estimation Results

	ΔDomestic Passenger		**ΔDomestic Passenger**
Short run elasticity		**Long run elasticity**	
Δ Income$_t$	1.3 (0.00)	Income	2.6 (0.00)
Δ Population$_t$	0.99 (0.00)	Population	1.3 (0.44)
Δ High speed rail$_t$	0.0004(0.67)	High speed rail	0.002 (0.79)
Δ Oil prices$_t$	-0.02 (0.47)	Oil prices	-0.15 (0.24)
Dummies		**Lagged variables**	
Turkey1983	-0.06 (0.03)	Income	0.54 (0.00)
Turkey2001	-0.25(0.00)	Population	0.26 (0.49)
Turkey 2003	0.16 (0.02)	High speed rail	0.0004 (0.80)
Brazil 2001	0.14 (0.07)	Oil prices	-0.03 (0.22)
EU 1997	-0.05(0.26)		
N	116		
R^2 (within)	0.47		

Notes: Significance levels are presented in parentheses. Detailed STATA outcome is available in appendix D.

Regression results indicate that, in the short-run, both population and income have a significant effect as expected. Income, as powerful variable to explain air transport demand, has positive affect under 1% significance level, and its coefficient is 1.3. In other words, 1% changes in population size cause 1.3% increase in the passenger demand in the short-run. Moreover, population shows similar characteristics as income. It is significant in 1% significance level and magnitude of the coefficient is 1. Every 1% positive changes in population stimulate passenger demand by 1% in the short-run. Oil

[11] Heteroskedasticty is corrected by using the command vce(robust) in STATA

prices and high-speed rail passenger number are not significant in the short run, according to outcomes.

In order to obtain long-run elasticities of independent variables, lagged values of independent variables are divided by lag value of dependent variable. We use special STATA command[12] to gain these numbers. As economic theory suggests, long-run effects are expected to be larger than short-run. Income is significant in 1% significance level and magnitude of its coefficient is 2.6. It shows that income's impact in long run on domestic air travel demand is bigger than short run effect. When economic growth stimulates air transport demand together with liberalization the magnitude of coefficient is not surprising. Also, population has a larger magnitude in the long run. Population increases by 1% result in 1.3% increase in the domestic passenger numbers but estimated parameter turns out to be statistically insignificant. Once again high-speed rail passenger number changes and crude oil prices are insignificant in the long run.

Furthermore, we add different dummy variables in the demand model of domestic air transport to check the effect of specific events like deregulation or crisis. Rationale behind selection criteria of dummies is explained in the section 5.2. Dummies are created for the 1983 and 2003 deregulations and 2001 crisis for Turkey. As it is expected, the coefficient of dummy variable for the 2003 deregulations is positive in the 5% significance level. This indicates that the 2003 liberalization process triggers the demand for domestic air travel in Turkey in 2003 and onwards. Contrary to this outcome, the 1983 liberalization is statistically significant but has very small negative effect (coefficient) on domestic air travel demand as expected. Also, economic crisis in 2001 affects air transport demand negatively. For Brazil, the 2001 liberalization has negative influence on domestic air transport demand. Lastly, the European Union air transport deregulation in 1997 has no effect in given countries.

All outcomes of the regression are discussed in-depth in the chapter 6.

[12] nlcom, outcomes are available in the appendix C.

Chapter 6 – Discussion

This chapter is discussing the outcomes of the regression analysis of domestic air transport demand model. In the explanation and argumentation of the outcomes we take into consideration literature, economic theory and rationale behind economic structure of countries. The literature establishes three major factors effecting air transport demand. These factors are individual income levels, the size and growth of the population and regulatory framework of the air transport market. Nonetheless, income and population elasticities vary significantly in the reviewed literature as a result of economic and social characteristics of different countries. Beside economic and social characteristics, the level of regulation (or deregulation) is an important factor influencing elasticities and thus demand. The level of elasticity can easily determine country's place in the S-shaped curve. If the relation between income and air transport demand is low, this market may be considered as a mature and it corresponds to the upper side of the S-shaped curve (see figure 9). For instance, one can expect a weak relation between air transport demand and income (or population) in France and the UK. On the other hand, for the countries with stimulated air transport growth, the correlation between income and air transport demand is expected to be high (High coefficients). The same logic applies for population as well. In order to compare elasticity results of different studies, the following table is created. Table 6 provides elasticity results of selected studies.

Table 6. Elasticities estimated in various travel demand models

Author	Country	Elasticity Type	Short run	Long Run
Dargay & Hanly, (2001)	United Kingdom	Income	0.43	1.05
Quandt & Baumol, (1966)	USA	Population		2.05
		Income		6.36
Young, (1969)	USA	Population		1.74-2.14
		Income		2.48-5.50
Fridstrom & Larsen, (1989)	Norway	Population	1.46	1.46
		Income	1.46	1.46
Our results	Turkey, Brazil, France, UK	Population	***0.99***	***1.3****
		Income	***1.3***	***2.6***
Graham, (2000)	United Kingdom	Income (Leisure Travel)	1970-1988	1984-1998
			2.27	1.69

Note: Results are significant in 5%. * Indicates insignificant coefficient. The results of Quandt and Baumol (1966) and Young (1969) are taken from Fridstrom and Larsen (1989).

In the literature it is widely accepted that the growth of domestic air transport in the last decades significantly fell (became more mature) in the upper-income countries. However, in the 1970's and 1980's when these markets were still immature, passenger numbers were increasing at higher rates thus relation with income was higher. Comparing present air transport demand elasticity data of the United States and the United Kingdom with Turkey may provide biased results, because these countries are often mentioned as markets with mature domestic air transport in the literature. Therefore, we intentionally include elasticity results from earlier periods in the table 6. We believe that if we compare Turkish domestic air transport demand elasticities with 1970's and 1980's elasticities of the UK and the USA, this would give a better insight into the current situation of Turkish domestic air transport industry.

In the table 6, short run elasticities of income vary between 0.43-2.27 while those of long run vary from 1.05 to 6.36. Result of this study falls within this gap in both short and long run respectively 1.3 and 2.6. There are different explanations of maturity as it is discussed in the section 2.5. In this part we take into consideration unit elasticity level to determine maturity as Graham (2000) explains. In other words, if income elasticity of demand is higher than 1, this market is assumed to be immature. Especially, the study of Graham (2000) indicates how maturity affects income elasticities. Graham's study shows that from 1970 to 1988 income elasticity of UK leisure air transport market was 2.27. In the later years income elasticity fell to 1.69 between 1984-1998. As the study of Graham (2000) states, elasticity of income (or other related factors with demand) tends to fall when market starts to mature. As represented in the results of this study, Turkey has high short and long run elasticities of income, which can be interpreted as an immature market feature. Figure 12 shows the relationship between income and passenger growth in the last decade. It is clearly seen that income elasticity of domestic air transport demand is very high[13]. On the other hand, in order to reach high level of income elasticity, demand needs to be stimulated by some exogenous factors (Isthutkina, 2009). This exogenous factor for Turkish air transport industry was the 2003 deregulation.

Firstly, the outcomes of domestic air transport demand model demonstrate that domestic passenger demand is strongly influenced by income levels. This is expected result as

[13] More detailed elasticity result for Turkey can be find in Appendix E.

economic theory suggests income and demand have a positive relation. Magnitude of this relation depends on maturity of the market. For instance, Dargay and Hanly (2001) point out that income elasticities are 0.43 and 1.05 in the UK in the short-run and long run respectively. The authors highlight that elasticity values are a sign of mature market because they are very low. One can say that in Turkey civil aviation is experiencing considerable growth only in the last decade (see chapter 4). Turkey as a middle-income economy is in transition from high dependency on agriculture and heavy industries to the service-based economy (Ishutkina, 2009). In the last decade, individual income levels (GDP per capita) more than tripled from 3000 dollars to over 10000 dollars in Turkey. It should be kept in mind that before the 2003 deregulations Turkish air transport industry was only partially liberalized, and considerable part of it was still controlled by government. Strictly regulated air transport markets suppress income increases. Therefore, the 2003 liberalization together with increasing income levels are the main explanation behind large elasticities of income, especially in the long run. Lastly, decreasing airfares (as a result of deregulations and government incentives) increase the effect of income changes on domestic air transport demand. As it is explained, regression outcomes reflect average within effect of the countries. In the sample we have 2 different country types where UK and France are assumed to have mature domestic market while Brazil and Turkey not. Due to this one can expect that outcomes are balanced as a result of this feature of model. That is to say, if only Turkey or Brazil is taken into an account, the income elasticity may be much higher than eventual result. Figure 12 explains this fact clearly.

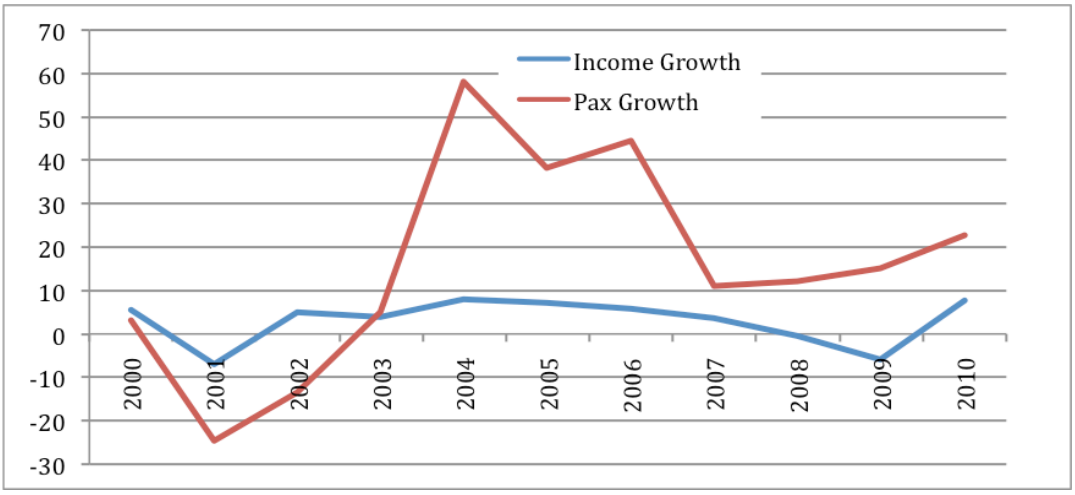

Figure 12. Relationship between income growth and passenger growth in the last decade in Turkey.

Secondly, the results presented in table 6 show that population elasticity for given countries is 0.99 in the short run. This result represents that population has a positive effect on domestic passenger demand in the short run, like income levels. On the other hand, long run population elasticity of demand is insignificant. There are several reasons that explain this. First of all, population numbers depend on the censuses that are carried out once in a couple of years. The population numbers between two census years are predicted depending on calculations. As a result, population statistics are not absolute numbers, which may cause a significance problem. Moreover, within the population of the countries, there are many different consumer life styles or life stage segments, which have different level of air transport participation (Graham, 2006). For instance Nielsen (2001) mentioned that younger to middle age population tends to fly more than their previous generation. Taking this into account, one may expect that, for instance, population between 16-50 years or different lifestyle groups may reflect better relationship between passenger demand and population changes.

Thirdly, the results related to high-speed rail passenger numbers and oil prices need clarification. In both short and long run effect, high-speed rail passenger numbers are insignificant determinant of air transport demand. However, one should note that high-speed railways are intensively in use only in France (TGV). Figure 8 shows how air passenger numbers and TGV passenger numbers evolve in the last two decade. Moreover, high-speed railway passenger number may be biased as a result of insufficient observations. Literature suggests that high-speed railways will be serious substitute and competitor of the air transportation in the coming years. The new high-speed network is in process of construction in Turkey. By the 2023 Turkish government aims to connect all main metropolitans by high-speed rail network. This is an important development to provide alternative mode to air transportation and the possible impact of the high-speed rail network to air transport demand should be seriously taken into consideration in the policy development processes of airlines and airports.

Fourth, crude oil has insignificant coefficient in the short and long run. Fuel prices are the main component of airlines costs. Fuel currently represents more than 30% of airlines operating expenses (Airbus, 2011). Increase in the crude oil prices automatically reflects on the airfares and so on passenger demand. However, despite the fact that the economic theory suggests negative relation between oil prices and demand of air transport, in the last decade these increases have not reflected too much on airfares.

There were substantial decreases in the airfares as a result of deregulations and entrance of new low-cost carriers. Moreover, there is a substantial technology development on fuel-efficient engines. Finally, governments have realized enabling effect (see chapter 2) of air transportation and in many countries government exempt airlines to pay fuel taxes. All the above-mentioned factors lead crude oil to have statistically insignificant coefficient in relations with domestic air transport demand.

Finally, outcomes indicate that different deregulations have a different effect on air transport demand. To start with Turkey 2003 deregulation, we found out that it has a positive effect on demand. This is an expected result and may be considered as a turning point for Turkish civil aviation. In other words, it expresses that in the period of 2003-2010 Turkish air transport demand grew more than during 1980-2003 period. Conversely, the 1983 liberalization did not trigger growth of the demand as expected. There are two main explanations of this negative but very small effect. Firstly, economic conditions in the country were not ready to stimulate demand (e.g. low income, political instability etc.). Secondly, the 1983 deregulation did not fully liberalize the domestic air transport market. Only entrance rules were facilitated, but price and supply of private airlines were still under control of government bodies. As a result, the 1983 liberalization process did not increase the demand. In addition 2001 economic crisis in Turkey had a negative effect on domestic passenger numbers when purchasing power of individuals decreased significantly and so did the demand.

Next chapter continues with the conclusion of the research and results of the tested hypotheses. Moreover, recommendations and the limitations of the research are discussed in the forthcoming chapter.

Chapter 7 – Conclusion

This study is aimed to answer the following question: "What are the main drivers behind domestic air transport growth in Turkey?" In order to answer this question, we create 6 different hypotheses. To test these hypotheses, demand model for domestic air transport is generated. In the light of the outcomes of demand model and the reviewed literature, we test following hypotheses.

First of all, we accept H1, which is stating: "Income changes have a significant effect on domestic air passenger demand." The model indicates that income changes have positive and significant effect on domestic air passenger numbers. Secondly, we test whether or not population has an effect on passenger demand (H2). According to the results, we found strong and positive relation in the short run, which is indicating that population increase is stimulating air transport passenger demand. However, long run effect of population has insignificant coefficient. As a result H2 is partially accepted. Moreover, H3 is partially accepted, as well. Outcomes exhibit that while some deregulations have positive effect on passenger demand, some have negative or insignificant impact on passenger numbers. This depends on the constitution of deregulations. Fourth, we reject H4, which is stating: "Oil prices have a significant effect on air transport demand". The rationale behind this is explained in chapter 6. Moreover, we reject H5, which is indicating that Turkish domestic air transport market would face with maturity soon. Based on this, in the short and mid-term Turkish air transport sector is not expected to face maturity. However, no market is expected to grow in the same tempo for years. Demand of domestic air transport has a life cycle, as most of the goods and services have. Sooner or later domestic market is expected to reach maturity and parallel to this, elasticity levels would fall. In the outcomes of the demand model, we fail to find any significant effect of high-speed rail on passenger demand. Therefore, we reject H6. However, in the literature it is anticipated that in the future high-speed rail will be major competitor of airways.

In summary, Turkish domestic air transport demand is stimulated by 3 major factors. These factors are income, population and the 2003 deregulations. The first step started with the 2003 deregulations and it constitutes backdrop for the market growth. As a result, strict regulations on market were abolished and the domestic market was opened for the private airlines without any restrictions. New entries to the market increased the

competition and the service quality, so prices dropped significantly. At the same time, government incentives helped airlines to provide lower fares. All these happenings attracted more and more passengers to use airways. Decreasing airfares and increasing national income together doubled the effect of the 2003 deregulations. In addition, dynamic population growth and young population in Turkey accounted for demand growth.

The target of General Directorate of State Airport Authority Turkey and Ministry of Transportation is to serve 400 million domestic and international passengers and increase the number of airports from 43 to 70 by 2023. This is an ambitious goal but is not impossible to realize. If Turkey continues its economic performance and population growth at the current pace, the 400 million-passenger target can be nailed down by 2023 in the 100th year anniversary of the Republic of Turkey. However, air transport industry is a very fragile market and demand is dependent on a number of exogenous factors such as maturity, income, and population. Since airlines do not have control over these exogenous factors, predictions come into prominence. Therefore, all the above-mentioned factors indicate for airlines, government agencies and for airlines managers that it is crucial to foresee income and population changes. Successful predictions about determinants of air transport demand and how they evolve in the course of time are a key factor for achieving success in aviation. Serious planning and forecasting on domestic air transport will help to ensure 400 million passenger numbers by 2023.

While Turkish civil aviation is evolving into the one of the world's biggest domestic markets, there are insufficient researches in this field. This study provides important information and results for Turkish domestic air transportation. The author believes that this research will contribute to academic literature on Turkish air transport industry, where there is a significant shortage of empirical approaches for air transport demand models. Moreover, in Turkey there is a need for passenger survey to obtain airfares and O&D statistics, which would help enhance the future researches.

Finally, the study accommodates some limitations. First of all, fixed effect approach does not allow obtaining country specific coefficients. In other words, coefficient of variables expresses average effect of within estimators. Moreover, as important determinant of demand beside income and population, airfares are not available for

given countries except the United Kingdom. Thus, we cannot acquire price elasticities of demand.

For further researches, analyzing domestic air transport demand with sufficient number of observation by using time series model with quarterly or monthly observation is inevitable. Even though model used in this study is increasing capability of model, it has some disadvantages as well. Moreover, demand model for domestic O&D market is important to investigate domestic market in micro level.

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List of Abbreviations Used

ADL: Auto distributed lag model

ATS: Air Transport Service

BRIC: Brazil, Russia, India, China

CAA: Civil Aviation Authority UK

CPI: Consumer Price Index

DfT: Department for Transport UK

ECM: Error correction model

EU: European Union

GDP: Gross Domestic Product

GDSAA: General Directorate of State Airport Authority Turkey

GSP: Gross state product

IBGE: Brazilian Institute of Geography and Statistics

ICAO: International Civil Aviation Organization

INSEE: National Institute of Statistics and Economic Studies France

O&D: Origin and destination

OECD: Organization for Economic Co-operation and Development

PKM: Passenger kilometer

TGV: Train à Grande Vitesse, meaning high-speed train

US: United States

USA: United State of America

UK: United Kingdom

VIF: Variance Inflation Factor

VFR: Visiting friend and relatives

WEO: World Economic Outlook

Appendices

Appendix A. Result of Variance Inflation Factor test (VIF)

```
. vif
```

Variable	VIF	1/VIF
lnexpen	508.43	0.001967
lncons	448.40	0.002230
lnrail	77.17	0.012959
lnincome	33.84	0.029551
lnpop	24.06	0.041557
lnhst	3.61	0.276714
lnoil	1.39	0.721892
Mean VIF	156.70	

Appendix B. Result of Hausman Test

	Coefficients (b) fixed	(B) random	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
lnincome	2.602092	.4168905	2.185202	.2218652
lnpop	3.535697	1.055467	2.480231	.240556
lnhst	.0129773	-.0193186	.0322959	.0054848
lnoil	-.0046885	-.0469835	.042295	.
year	-.0276984	.0393453	-.0670437	.0047217

```
                b = consistent under Ho and Ha; obtained from xtreg
     B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test:  Ho:  difference in coefficients not systematic

           chi2(5) = (b-B)'[(V_b-V_B)^(-1)](b-B)
                   =      180.35
         Prob>chi2 =      0.0000
         (V_b-V_B is not positive definite)
```

Appendix C. Long Run Effect of Independent Variables

```
. nlcom _b[L.lnincome]/(-_b[L1.lnpax])

       _nl_1:  _b[L.lnincome]/(-_b[L1.lnpax])
```

D.lnpax	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
_nl_1	2.627294	.4126021	6.37	0.008	1.31421	3.940378

```
. nlcom _b[L.lnpop]/(-_b[L1.lnpax])

       _nl_1:  _b[L.lnpop]/(-_b[L1.lnpax])
```

D.lnpax	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
_nl_1	1.260661	1.418277	0.89	0.440	-3.252928	5.77425

```
. nlcom _b[L.lnhst]/(-_b[L1.lnpax])

       _nl_1:  _b[L.lnhst]/(-_b[L1.lnpax])
```

D.lnpax	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
_nl_1	.0020297	.0072461	0.28	0.798	-.0210306	.0250899

```
. nlcom _b[L.lnoil]/(-_b[L1.lnpax])

       _nl_1:  _b[L.lnoil]/(-_b[L1.lnpax])
```

D.lnpax	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
_nl_1	-.1504123	.1043161	-1.44	0.245	-.4823926	.181568

Appendix D. Result of Ultimate FE Model

```
Fixed-effects (within) regression               Number of obs      =       116
Group variable: country                         Number of groups   =         4

R-sq:  within  = 0.4736                         Obs per group: min =        26
       between = 0.9655                                        avg =      29.0
       overall = 0.0484                                        max =        30

                                                F(3,3)             =         .
corr(u_i, Xb)  = -0.9914                        Prob > F           =         .

                                                (Std. Err. adjusted for 4 clusters in country)
```

D.lnpax	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
lnincome D1.	1.294042	.1015669	12.74	0.001	.9708112	1.617274
lnpop D1.	.997668	.1670833	5.97	0.009	.4659343	1.529402
lnhst D1.	.0004332	.0009361	0.46	0.675	-.002546	.0034123
lnoil D1.	-.0227115	.0277279	-0.82	0.473	-.1109541	.0655311
lnpax L1.	-.2080908	.0429289	-4.85	0.017	-.3447098	-.0714717
lnincome L1.	.5467156	.0763064	7.16	0.006	.3038746	.7895566
lnpop L1.	.262332	.3422685	0.77	0.499	-.826919	1.351583
lnhst L1.	.0004224	.0015451	0.27	0.802	-.0044949	.0053396
lnoil L1.	-.0312994	.0205648	-1.52	0.225	-.0967458	.034147
dturkey1983	-.0688735	.0186871	-3.69	0.035	-.1283441	-.0094029
dturkey2001	-.2507701	.0421417	-5.95	0.009	-.3848838	-.1166563
dturkey2003	.1639692	.040157	4.08	0.027	.0361718	.2917665
dbrazil2001	.1414892	.0510854	2.77	0.070	-.0210873	.3040658
deu1997	-.0550001	.0397684	-1.38	0.261	-.1815609	.0715607
year	-.0019834	.00329	-0.60	0.589	-.0124535	.0084867
_cons	-1.999688	7.129681	-0.28	0.797	-24.68952	20.69014
sigma_u	.6848486					
sigma_e	.08627967					
rho	.98437612	(fraction of variance due to u_i)				

Appendix E. Income Elasticity of Turkish Domestic Air Transport Demand