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THESIS

DETERMINANTS OF DEMAND FOR AIR CARGO TRANSPORT BETWEEN TURKEY AND THE SELECTED FAR EAST COUNTRIES

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APPROVAL PAGE

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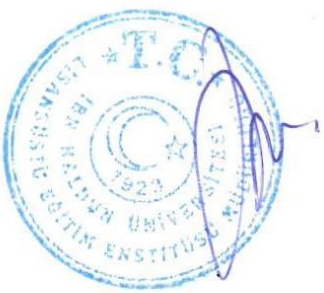

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ABSTRACT

DETERMINANTS OF DEMAND FOR AIR CARGO TRANSPORT BETWEEN TURKEY AND THE SELECTED FAR EAST COUNTRIES

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Air cargo transportation is the fastest way to carry goods between long distances. The sector is growing fastly in recent years and becoming increasingly competitive. Therefore demand analyses play an important role. This study aims to explore the fundamental determinants of demand for air cargo by focusing on the case of Turkey and the Far East. A panel data set covering the period 2008-2018 and six Far East destinations is used. DOLS and FMOLS techniques are employed in order to estimate our model. The findings indicate that air cargo transportation is influenced by GDP per capita and the number of aircraft emphasizing the important of market size and the cargo capacity.

Keywords: Air Cargo, Air Cargo in Turkey, Far East Destinations, Panel Data Analysis.

ÖZ

TÜRKİYE İLE SEÇİLMİŞ UZAK DOĞU ÜLKELERİ ARASINDA HAVA KARGO TAŞIMACILIĞI TALEBİNDE ETKİLİ OLAN BELİRLEYİCİLER

Zerin Bozan

Hava Taşımacılığı Yönetimi Yüksek Lisans

Tez Danışmanı: Prof. Dr. Fuat Erdal

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Hava kargo taşımacılığı ürünleri uzak mesafelere ulaştırmanın en hızlı yoludur. Sektör son yıllarda hızla büyümekte ve giderek rekabetçi olmaktadır. Bu nedenle talep analizlerinin önemi büyüktür. Bu çalışma, Türkiye ile Uzak Doğu arasındaki hava kargo talebini etkileyen faktörleri keşfetmeyi amaçlamaktadır. Modelimizi tahmin edebilmek amacıyla, 2008-2018 yılları ve altı Uzakdoğu hedefini kapsayan bir panel veri seti kullanılmıştır. Modelimiz, DOLS ve FMOL yöntemleri ile tahmin edilmiştir. Sonuçlar hava kargo taşımacılığının en çok kişi başına milli gelir ve kargo uçak miktarından etkilendiğini göstermekte ve piyasa büyüklüğü ve kargo kapasitesinin önemi vurgulanmaktadır.

Anahtar Kelimeler: Hava Kargo, Türkiye'de Hava Taşımacılığı, Uzak Doğu Varış Yeri, Panel Veri Analizi.

DEDICATION

It is dedicated to Prof. Dr. Fuat Erdal, for without his early inspiration, coaching and enthusiasm none of this would have happened and to my parents whose affection, love, encouragement and prays of day and night make me able to get such success and honor.

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LIST OF ABBREVIATIONS

DOLS	Dynamic Least Squares
FMOLS	Fully Modified Least Squares
GDP	Gross Domestic Product
HKG	Hong Kong Airport
ICN	Incheon Airport
IST	Istanbul Airport
NRT	Narita Airport
OECD	Organization For Economic Co-Operation and Development
PEK	Beijing Capital Airport
PVG	Shanghai Pudong Airport
RTK	Revenue Tonne-Kilometers
SIN	Singapore Changi Airport
SWOT	Strength, Weakness, Opportunity, Threats
TC	Republic of Turkey
THY	Turkish Airlines
US/USA	United State

CHAPTER 1

INTRODUCTION

Air cargo, which is the fastest way to reach long distances, has developed rapidly in the world in the last decade. According to Boeing's World Air Cargo Forecast, in 2011 the air cargo industry generated 202.4 billion revenue tonne-kilometers (RTK) and is expected to rise (Da Silva, 2014: 4). In addition, air cargo traffic increased by 10.1 percent, while the long-term average growth rate increased more than twice that of 4.2 percent in 2015. Air cargo transport measured at RTK in 2018 is expected to exceed 4 percent and air cargo revenue to exceed $ 100 billion (Boeing, 2018: 4). The study focuses on the fundamental determinants of air cargo demand. Air cargo transportation has a complicated services system and very competitive. Therefore demand analyses play an important role for the existing air cargo companies as well as the future of the sector. There is not enough research on analyzing econometrically the main factors affecting the air cargo demand particularly for air cargo sector in Turkey. Therefore, this study is expected to make an important contribution to the literature.

This study focuses on the air cargo transportation between Turkey and the Far East from 2008 to 2018. We initially analyze the basic characteristics of the air cargo sector in the world as well as in Turkey. Then we investigate empirically the main factors affecting the air cargo demand by taking the case of bilateral air cargo transportation between Turkish Cargo, a subsidiary of Turkish Airlines, and the selected Far East airport destinations. We firstly carry out a survey of the literature on air cargo operations, basic dynamics of the sector and the fundamental determinants of demand for air cargo. Then we set up an ad hoc econometric model and in order to estimate which factors are significant for the air cargo transport between Turkey and the Far East. We are going to estimate that model by panel dynamic least squares (DOLS) and panel fully modified least squares (FMOLS) methods.

This study has three chapters. Following an introductory chapter on aims and methods of the study, the second chapter summarizes the literature on air cargo. The third chapter covers the data description, the model and the econometric methods used and the empirical results. The last chapter mentions about the conclusions.

CHAPTER 2

AIR CARGO TRANSPORTATION

The air cargo sector plays a remarkable role in the growing world trade. Its advantages over the alternative transports and speed increase the interest in air cargo. One of the most vital influences affecting the expansion of air cargo is the increase in the circulation of the goods, which are risky particularly by land, and sea transportation in the world markets. The volume of air cargo has increased twice every 10 years since 1970.

There are various definitions of air cargo transportation. Air cargo is described as the transportation of any goods from one place to another with the aircraft. The term air cargo is broadly defined to include the air load (Balik, 2015: 8). According to the international postal arrangement, all kinds of deliveries carried by the aircraft subject to customs and registered in accordance with the bill of lading, other than the registered baggage, are called air cargo (SHGM, 2016: 32).

Today the airfreight industry has sustained to operate as the main implementer of the world trade and doubled every 10 years since 1970. Universally, air cargo transportation has developed about 50 percent faster than passenger transport between 1995 and 2004 and continues to rise further. Air cargo transportation is also an important source of income for carriers. Their revenues increased by 40 percent in 2009 while they increased by only 5 percent in 2000. Airline companies are struggling to manage air cargo operations cost-effectively by improving tactical operations plans that permit these airlines to adapt and answer to the changes in the worldwide competition. For these challenges, a rising quantity of theoretical research has been done to address the difficulties of air cargo functions since the 1990s. However many of them remain unsolved because of the difficulties in air cargo operations (Feng and Shen, 2015:264). In addition air cargo transportation is a very important component of economic development.

2.1. Overview of Air Cargo Operations

Air cargo transportation can be considered as the process of transporting an article or cargo by aircraft. More broadly, packaging, labeling of goods (excluding postage and baggage), taking into account country and carrier restrictions, in accordance with the International Civil Aviation Organization (ICAO) and International Air Transport Association (IATA) rules. In other words, baggage, which is a separate load from the goods, carried under the terms of postal or international mail agreements and the baggage carried by the carrier or passenger, that is not accompanied and provided to be carried by way of bill of lading, shall be considered as cargo. While air cargo transportation is seen as a very costly mode of transportation for many businesses, the change of e-commerce and logistics strategies with the effect of globalization has changed the enterprises' view of air cargo transportation and airline companies have started to increase their cargo capacity in this direction. It is possible to summarize the main reasons for this increase in air cargo transportation as follows (Yavaş and Özsoy, 2012: 3).

- A new industry trend, the microelectronics sector, and the increase in the production of heavy goods at light cost, such as medical products, led to increases in air cargo demands of up to 80% to 90%.

- The shortening of the product life cycle and the adaptation to the JIT (Just in Time) philosophy required products to reach the markets quickly.

- Although many companies consider the cost of air cargo service to be high, they have realized that they cover the total cost of services such as time, transport, stock, storage and packaging compared to other modes.

- Thanks to the impact of numerous large hull aircraft entering the sector, an efficient handling system and an air cargo network, air cargo costs have fallen dramatically in the last 20 years and the efficiency of operations has increased.

The capacity of international air cargo trade, measured by ton-kilometers, has increased fivefold between 1980 and 2000. Air cargo between countries, regions and

companies provide an important comparative advantage in global markets. Air cargo has become the main type of worldwide transportation for an extensive diversity of products (Leinbach and Bowen, 2004: 299). The air cargo sector, which is affected extremely rapidly by the innovations, has some special features. The most prominent features are listed below (Balik, 2015: 10-12):

- ***Speed and confidence:*** Air cargo is a form of transportation where goods are distributed globally. The shipper requests that the cargo is delivered in an undamaged, timely manner at an affordable price. In general, international goods are carried out in two ways, which are seaway and airway. Airfreight transport guarantees speed and safety while maritime transport provides a low cost advantage.

- ***Transport direction:*** Air cargo transportation is usually one way. In order to reduce the costs, they usually use the night flights. According to this, air cargo can be divided into three ways as;

    - ***Emergency cargos:*** Some important products may be transported urgently over long distances. Cost for emergency cargos is secondarily important. Demand is not elastic in the face of price. For example, organ transports.
    - ***Routinely perishable cargos:*** It is the name given to the cargos that are transported when it comes to products that have the feature of rapid deterioration and can be sold only in certain periods. The senders are willing to pay the high price. For example, fresh fruit and vegetable transports.
    - ***Routine impermeable cargos****:* In land transport, fees are generally calculated by volume, while weight is important in airfreight transport and calculation is made by weight. Gold, banknotes and high-value items are included in this type of cargo.

- ***Competition structure:*** The air cargo market is very competitive. The air cargo sector is both labor intensive and capital intensive. In order to achieve superiority in competition, financial resources should be sufficient in order

to obtain effective human resources management as well as technical advantages.

- ***Advanced technology:*** Air cargo sector is a sector in which time-sensitive products are transported. Information technologies are needed to perform various activities among the players in the air cargo market. Information technologies have a very important place in determining the delivery time, safety and air cargo delivery process.

Furthermore, airfreight transport includes a range of services to transport the cargo between the shipper, a forwarder, a road transporter, an airline and a buyer. The carrier wants the product to be sent anyplace in the worldwide at low cost and at the necessitated level of service. The transmitter plays an important role between the sender and the airline. While, the history of road transport is very old, the importance of air transport has been increased by the globalization. The airline accepts, supplies, moves, roads, freights, and finally achieves capacity (Feng and Shen, 2015: 264). In this context, Table 1 reviews the activities of the important players in the air cargo operations.

Table 1: Activities of Main Players in Air Cargo Operations

Players	Activities	
Transporter	• Accept invoices and make payment • Fulfill demands and repair changes • Preparation of documents, bills and insurance	• Track trackers • Best deals • Reservation
Forwarder	• Fulfill demands and repair changes • Make a reservation • Best prices bargaining • Preparation of documents, bills and insurances • Accept invoices and make payments • Processing skills • Interact with multimodal carriers	• Booking accepted • Distribution • Storage • Invoice sender • Alliance of cargos • Track trackers
Carrier (Airlines)	• Resource management of terminal personnel • Plan shipping routes • Launch and open flights for booking • Agreement rates • Ensure distribution channels • Estimated cargo capacity • Segment and cargo demand • Revenue and sales accounting • Receive/send updates on arrival and delivery • Communication • Receive/send flight notification • Accept/reject delivery orders	• Maximize profit • Develop load factors • Cargo area allocations • Accept bids received • Hazardous goods control • Package verification • Load balancing • Storage • Installation bid prices • Billing • Publish prices • Service reliability
Airports	• Simplify trouble-free shipping operations • Hazardous goods control • Package verification	• Captain inform • Storage • Customs • Security check
Consignee	• Track trackers • Accept invoices and make payment • Specify the claims and repair costs	

Source: *Feng and Shen, (2015: 265).*

Air cargo carriage is more complicated than passenger carriage as the former includes more players, more complex procedures, a combination of weight and capacity, several primacy services, combination and amalgamation policies, and more routes than the latter. The main differences between cargo and passenger functions emphasized in the literature are uncertainty, complication and flexibility (Feng and Shen, 2015: 265). In this matter, strategies in air cargo have an important feature to reduce the problems/drawbacks in this sector. According to Da Silva (2014:_5), air cargo companies should apply three kinds of strategies for transportation:

1. ***Product Strategy:*** The product strategy is based on how an air company can be used to gain comparative advantage over its resources and competitors.
    a. Product differentiation,
    b. Efficiency management,
    c. Road network
    d. Customer relations management,
    e. Environment,
    f. Partnerships

2. ***Market Strategy:*** This strategy parallels to market variables that need to evaluate the decisions of an air company in relation to strategic selections, including market conditions.
    a. Capability management,
    b. Competitive market performance,
    c. Hub selection,
    d. Road network
    e. Relationship with organizational members
    f. E-portals

3. ***Network Strategy:*** Factors taken into account in developing a network strategy are the following:
    a. Unit costs,
    b. Taskforce management,

c. Airport selection,
d. Hub selection,
e. Road network
f. Service frequencies
g. Partnerships variables.

Lastly, air cargo transportation has some advantages and disadvantages compared to other transportation options. Advantages of air cargo transportation; Thanks to its speed advantage, air cargo is unrivaled especially in long distance transports. It can carry quickly perishable products, valuable cargoes and live animals without deteriorating its economic and physical value. The safety and security level is higher compared to other modes of transportation. It can reach areas (high places, islands, challenging geographies, etc.) that other modes of transport cannot reach. Flights are carried out frequently, regularly and on a wide range to address global markets. The disadvantages of air cargo transportation are; due to the weight and volume limits of aircraft, a higher transportation cost occurs compared to other types of transportation. Not suitable for transporting all types of loads (project loads, etc.). It is mandatory to use a roadway to transport a cargo to the receiver's warehouse. There is intense competition with other modes of transport over short distances (Yavaş and Özsoy, 2012: 6).

2.2. Overview of Market Share of Air Cargo

When air cargo transportation is evaluated worldwide, it has been growing with an average of 5% - 6% per year in the last 20-30 years. It is observed that the air cargo sector is not bigger than the current situation in 2008, but when the 2011 data is analyzed, it is in an upward momentum again. In 2011, when the world trade volume was estimated to be over 16 trillion dollars, it was seen that airline companies had a value of 5 trillion dollars, i.e. 35%, with a capacity of 48 million tons. In addition, air cargo transportation is expected to reach an annual average increase of 4.7% for the European market in 2030 targets (Yavaş and Özsoy, 2012: 7). The growth of air cargo according to the main regions in 2017 is shown in the Table 2 (Boeing, 2018: 4).

Table 2: Air Cargo Growth By Main Markets (2017)

Destination	Growth (%)	Destination	Growth (%)
East Asia-North America	9.1	Domestic China	1.6
Europe–East Asia	8.1	Latin America–Europe	6.2
Intra–East Asia	8.6	Latin America–North America	4.3
Europe–North America	10.7	Africa–Europe	3.7
Intra–North America	10.0	South Asia–Europe	6.7
Middle East–Europe	0.4	Intra-Europe	9.7
World	**10.1**		

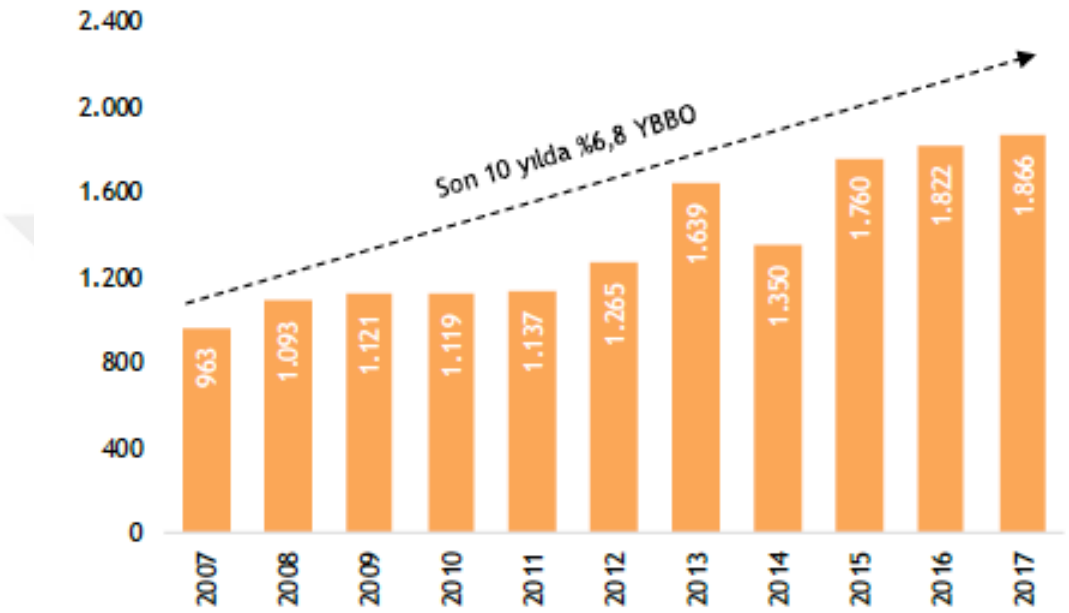
Source: *Boeing, (2018: 4).*

According to Table 2, the largest growth in air cargo is Europe-North America and Intra-North America. The least growth was in the Middle East-Europe market. Overall, as of 2017, the growth in air cargo transportation worldwide was 10.1 percent.

Freight transport in Turkey is the most preferred method of road transport. As of 2013, approximately 80 percent of freight transport is carried out by road and 0.44 percent by air (Gökirmak, 2014: 1). The airway freight traffic in Turkey (Shipping + Mail + Luggage) has grown by an average rate of 16 percent between 2002 and 2010. Total volume reached 2,021,076 tons in 2010. International freight traffic was 1,466,366 tons, while domestic freight traffic was 554,710 tons. The main air cargo transporters operating in Turkey are Turkish Cargo, a subsidiary of Turkish Airlines, MNG Airlines, ACT Airlines Inc. and ULS Airlines Cargo Transportation (formerly Kuzu Airlines Cargo). According to the data of 2009 and 2010, MNG Airlines carried most cargo-to-cargo aircraft, while Turkish Cargo carried most of the cargo by passenger aircraft. In terms of the number of flights made by cargo planes, MNG is at the forefront, while Turkish Cargo is the air cargo company with the highest number of cargo destinations (Balik, 2015: 75).

Information on cargo capacity between 2007 and 2017 is shown in Figure 1. According to Figure 1, air cargo transportation has increased by 6.8% over the period. While the capacity was 963 thousands kg in 2007, it increased to 1,866 thousands kg in 2017.

Figure 1: Cargo Capacity in Turkey (Thousand-KG, 2007-2017)*



Source: *VakifYatirim, (2018: 6).*

As of 2017, THY Company's current cargo terminal has a capacity of 1.3 million tons and is expected to increase to 4 million tons by 2023 at Istanbul Airport. Increased cargo capacity is expected to have a positive effect on operational profitability by accelerating the Company's growth in this area as a profitable segment.

2.3. Market Analysis for Turkish Airlines (THY)

Airport transportation is very important for the Turkish international trade and the economy as a whole; therefore, the government encourages improving air transport with several changes in regulations. Turkish Airlines is Turkey's biggest airline company and serves both domestic and overseas destinations. It is an airline that provides high quality service with its hub-and-spoke line structure. While Turkish Airlines have more than 100 routes abroad, in cooperation with the Star Alliance, it reaches more than 1,000 destinations. Turkish Airlines continued its efforts to become

a well-known brand in the world as a member of Star Alliance while expanding its flight network. Turkish Airlines, having difficulty in competing with prices when private firms entered the market, launched a low-cost airline service based in Ankara on April 23, 2008 with the sub-brand of Anadolujet (SHGM, 2016).

Turkish Airlines was established in 1933 as a state-owned company with 5 aircraft fleets and a capacity of 28 seats (Dursun et al., 2014: 106). Several changes have been made towards the liberalization of the sector in the 1990s. More and more reforms have been made enabling lower-cost shipments and increasing national air traffic. In addition, after Turkish Airlines has adopted a policy of airline transport as a transit carrier between Europe and Asia, THY's worldwide air traffic is increasing. In addition, the government, which increased flight infrastructure investments following the privatization reforms of the 1990s, supported the growth and expansion strategy of Turkish Airlines (Ishutkina 2009: 168).

Recently, Turkish Airlines' passenger volume has increased remarkably with the growing network enlargement. Hub airport (IST) is conveniently located in the central corridor between Europe, Asia and the Middle East. One of the main goals in the last decade was to transform Istanbul's airport into a universal hub. Europe is the largest international network of Turkish Airlines and represents 39.7 percent of the worldwide one-way flight in 2014. Turkish Airlines flew to 97 destinations in 2014 across Europe compared to 48 in 2014. The Middle East network, the second largest international Turkish Airlines Network, represents 15 percent of travelers. While the seat capacity of the Turkish Airlines to Middle East network grew 20 percent annually between 2003 and 2014, the Asian network represented the third largest network of Turkish Airlines and in 2013 this area denoted 12 percent of all travelers (Dursun et al. 2014: 110).

In short, due to the geographical location of Istanbul, Turkish Airlines can expand its network by flying small cities, which cannot be implemented by wide-body aircraft and add more frequencies to their main destinations, which have a comparative advantage. This is one of the key policies that drive Turkish Airlines to become a world leader because it operates more cities than any other airline in the world. Furthermore, Istanbul Ataturk Airport was improved as a center for European travelers traveling east

and south in Asia. In 2003, the company concentrated mainly on European paths, enlarging its route network in specific to the Middle East, Africa and Asia. The creation of a strong hub has considerably affected the transfer rate of Turkish Airlines. Considering that 42 percent of the company's passengers are still direct local travelers, 39 percent of the total transfer customer rate is considerably higher in the company's environmental situation (Dursun et al. 2014: 112).

Istanbul Airport, which is one of the largest airports in the world, was opened on 29 October 2018. With the completion of all stages of Istanbul New Airport, it is expected to be the world's highest passenger airport by passing Atlanta International Airport, which serves 94 million passengers annually. Approximately 35 km from Ataturk Airport away, on the northern part of the European side of the city, within the borders of Arnavutköy, is located on the Black Sea coast. Construction on the European side of Istanbul between Yeniköy and Akpınar was established on an area of 7,659 hectares, 6,172 of which are forest areas. When completed, a total of six runways, a total of 165 passenger boarding platforms at all terminals, four terminals connected to railways, three maintenance and repair buildings, six air traffic control towers, sixteen taxiways, an area of 6.5 million square meters and five hundred aircraft aprons, capacity of seventy thousand vehicles and has the largest airport parking area, parking area, clinic, fire department, hotels, convention center, recycling and waste storage areas in Europe. Main opportunities of New Istanbul Airport are (Tanyaş and Düzgün, 2015: 4);

- The fact that the airport has the necessary infrastructure for optimal performance allows the creation of new layout and development plans.
- Noise problems due to location have been minimized.
- Then the traffic capacity and the number of appropriate departures increased can be served with more flights.
- Thanks to the size of the new airport, it can also serve the flights to be made with large aircraft.
- With the new airport, both passenger and cargo flights are expected to increase.
- Finally, the new airport is supposed to offer new and faster transport systems with better transport services and easier access to airport facilities.

In order to be successful in today's competitive market in which economic, socio-cultural and technological developments occur continuously and for the emergence of new performance criteria, Turkish Airlines should develop strategies that will benefit from the opportunities by knowing the strengths and weaknesses of the airfreight. In this context, SWOT analysis enables THY to analyze its internal situation and the state of its competitors. Table 3 shows the SWOT analysis for THY.

Table 3: Turkish Airline SWOT Analysis

Strengthens	**Weakness**
• Convenient geo-location • Wide distribution network • Being a flag carrier • Having a young fleet • Important cost advantage for international flights compared to international competitors • Ethnic international traffic • Having a strong financial position • Turkey to be strong in the domestic market • A rising market share • Having subsidiaries to distribute risks and make it difficult to enter the market	• Extreme State Intervention • Lack of a clear growth strategy • Having Old Processes • Low service quality and customer-oriented work culture • Lack of R & D studies • Not profit oriented • Management does not meet performance criteria • Inadequate marketing and distribution • High seasonality in occupancy • Low motivation of employees • Many aircraft accidents in the past • Lack of preparedness for the crisis
Opportunities	**Threats**
• Large cities not yet flying abroad • Unmet customer needs • A growing domestic market • Popular tourist destinations in Turkey • Government continues to invest in transport infrastructure • High cargo carrying potential • High income growth potential from subsidiaries.	• International competition (increasing number of traditional and low-cost airlines) • Competition in domestic market is increasing • Infrastructure problems • Fast trains between major cities • High and unbalanced fuel costs

Source: *Gökırmak, (2014: 15).*

As Turkish Cargo is a sub-brand of Turkish Airlines, SWOT analysis for Turkish Airlines is more or less valid for Turkish Cargo too.

Turkish Cargo

Turkish Airlines carried its first international cargo in 1936. Turkish Cargo is a sub-brand of Turkish Airlines and uses its flight network and fleet. Passenger planes are transported to more than 160 destinations, including 39 domestic flights, as well as scheduled cargo flights to 26 destinations with cargo aircraft. With a cargo occupancy rate of 72 percent (including passenger and cargo planes) in 2010, THY increased the frequency of cargo airplanes by 40 percent and harmonized the cargo airplane tariff with the passenger tariff and increased the transit cargo share in cargo traffic to 52 percent. The increase in cargo in the last year has been realized as 31.9 percent. In 2010, 314,000 tons of cargo was transported and 91,000 tons of them were transported together with passengers and 223,000 tons were transported by direct cargo aircrafts (Balik, 2015: 77).

2.4. Literature Review

Although the use of air cargo transportation has been increasing, the theoretical and empirical studies on air cargo operations are relatively limited. We provide a summary of the selected papers on air cargo in this section.

Korkmaz (2017: 10) aims to provide information on the measures to be taken to minimize the threats to the safety of air cargo transportation, which has shown a momentum of continuous growth and is open to threats especially after the attacks carried out on September 11, 2001.

Feng and Shen (2015: 263) review the literature on air cargo operations and compare the academic papers and the practical difficulties of airlines, transport businesses and terminal service suppliers. Specifically, this paper analyses the basic features of air cargo operations by using a model. The paper discusses the new research challenges of air cargo operations as well.

Totamane et al. (2014: 52) model and forecast the air cargo operations focusing particularly on the frequencies (weekends, holidays, and time-varying functions). Additional predictors such as GDP, air cargo growth has been taken into consideration, but have not found significant. The empirical findings show that the variables used in the model play a substantial role in increasing the effectiveness of air cargo demand forecasts.

Sarılgan (2011: 69) investigates what needs to be done to improve the regional airline transportation in Turkey by using semi-structured interview technique with the managers. Regional air transport is expected to facilitate business, trade and tourism activities. According to the findings obtained from the interviews with the managers of the airline industry, financial support to be made in this sector may be listed as tax incentives, investment incentives, fuel and accommodation incentives.

Gerede (2011: 505) examines the historical development of the airline industry, reviews the main regulations in the market. The market entry regulations have changed recently and the paper summarizes and evaluates them in terms of their effects on the managerial functions of airline companies. Furthermore, there are air cargo transport arrangements, which have two characteristics to be evaluated. First of all, cargo transportation was defined as a separate type of transportation for the first time in 2007 and related regulations were collected under this definition. The other issue is that cargo transport, which is supported in terms of market entry regulations and other factors, is arranged a little more tightly for the first time. It is thought that the growth of Turkish Air Cargo transportation and the necessity of regulating it have played an important role in this change.

Tan and Kara (2007: 28) focus on cargo distribution systems. The interviews were conducted with various cargo distribution companies operating in Turkey. Cargo distribution and hub location problems of the sector were identified.

Kasarda and Green (2005: 459) examine the factors affecting the role and effect of air cargo on economic development. Three factors that can increase the positive effects of air cargo are addressed: liberalization of air services, improvement of

customs quality and reduction of corruption. Then, the effects of these three factors on net foreign investment per capita and gross domestic product per capita are modeled and evaluated for 63 countries worldwide.

Ohashi et al (2005: 149) apply a collective form of a multinomial logic model to identify critical factors affecting air cargo transportation selection decisions. They use a unique data set for the 760 air cargo transport routes to the Northeast Asia region in 2000. The analysis focuses on the balance between time cost and monetary cost, taking into account other variables related to transfer airport selection. The estimation technique considers the presence of unobserved attributes and corrects the endogeneity obtained by two-step least squares estimation using instrumental variables. Their empirical results indicate that the choice of air cargo transport center is more sensitive to time costs than monetary costs such as landing fees and line fees. For example, their simulation results show that a 1-hour reduction in total transport and handling time for a specific destination, air cargo traffic would be more effective than a $ 1000 reduction in airport fees. This demonstrates that it is important to reduce air cargo connection time at an airport by increasing the landing and other airport fees, and through adequate investment in capacity and automation.

Jiang et al (2003: 6770) evaluate the future of air cargo demand in China and its effects on the operation infrastructure are explained. It is forecasted that China will achieve sustainable economic development over the next 20 years by considering the current trends and government strategies. Forecasts of air cargo demand are made for the period up to 2020 using econometric methods. Air cargo traffic is anticipated to grow by 11.2 percent per year and to grow more than seven times in 2020. Several estimates of cargo production at major headquarters and foremost airports in China, Hong Kong and Taiwan are also done in the paper.

Zhang (2003: 123) discusses Hong Kong air density in the context of both China and the Asia-Pacific region. After a detailed description of the characteristics and trends of air cargo in Hong Kong, regional and global competitors of Hong Kong are analyzed, An analysis of the competitive factors in the market and in the sector, including airports in China and East Asia, was conducted through the interplay of international aviation policies between Hong Kong and the People's Republic of China.

In Kasilingam (1997: 221), a cost model is presented to make an optimal double reservation of air turmoil under uncertain capacity. Equations are derived to calculate double reservation levels for discrete and continuous probability distributions of capacity. The model is shown with numerical examples. Overbooking is the practice of deliberately selling more cargo than available capacity to minimize distortion and/or oversold. Overbooking becomes more complicated when the available capacity is not known for certain.

There is not any empirical study –to the authors' knowledge- on air cargo industry in Turkey. Therefore, this study is expected to make a significant contribution to the literature and provide policy implications for the future of the sector.

2.5. Demand for Air Cargo Transport

Forecasts show that the air cargo sector will continue to rise and competition in the air cargo industry will be challenging. Several methods such as econometric modeling, critical evaluation, trend analysis and potential analysis have been used for demand estimations and forecasting. Econometric models are used for medium and long-term forecasts. These models also analyze the effects of some macroeconomic factors such as gross domestic product, gasoline price, volume of trade on air cargo (Totamane et al., 2014: 52).

The challenges show that a demand analysis exposes the potential of the market and needs to be dealt with in a suitable estimation method. Any changes in market dynamics can be analyzed by using the air transport estimates. Regardless of the demand modeling used, the following factors should be reflected in the model (Mandel, 2014: 7-8).

- The competition of journey's end (destinations).
- Multimodality of modes such as air, rail and road.
- Modes of modalities such as airway, air-rail.
- Competition in flight mode such as airports, airlines.
- Economic value and environmental balance
- The interdependence of diverse decision points of customers such as location selection, airport selection, entry/exit selection, mode selection and travel request.
- Thoughtfulness of passengers in supply changes such as flexibility of the level of service variables, thresholds, capacities
- The synergic strength of networks such as air partnerships, hub and spoke, fast train

For a stable estimate, it is crucial that air transport has an economic value, because no network that is subsidized as a sustainable transport system can be sustained in the long term. In addition, air transport is determined by external factors.

- Socio-economics (population, GDP, export/import),
- Technology (infrastructure, vehicle/impulse types),
- Suburbanization (land use, economy density)
- Policy (domestic/universal restrictions, directives, contracts).

Given the fact that an investment in airway cargo transportation is costly and it will take years to cover the costs and to make a profit, it is important to estimate the expected return correctly. Estimates in the aviation sector are heavily influenced by some fundamental challenges. Air transport demand depends on a number of variables. These are international social and commercial relations, the economic situation of the countries and the incentives for transport in exports. These variables significantly affect demand and vary very frequently, making it difficult to estimate long-term and stable demand in air cargo transportation. For example, textile exports from Turkey to the United States constitute most of the air cargo transportation. The reduction of quotas by the US administration in textiles will invalidate the demand forecasts of the companies that carry cargo to this country. For these reasons, the airline constitutes one of the investments with high risk of cargo transportation. Therefore, it should be very meticulous in estimating demand for air cargo transportation and the factors affecting the forecasts may change all the time, thus varying economic, political and social factors in the world should be monitored closely (Turşucu, 1995: 60).

CHAPTER 3

EMPIRICAL ANALYSES ON AIR CARGO DEMAND

In this chapter, the main determinants of air cargo demand between Turkey and the Far East are estimated in an econometric model. Turkish air cargo sector is represented by Turkish Cargo, which is the main player of the sector and the Fast East market is represented by six international airports in Hong Kong, China, Singapore, Japan and South Korea.

3.1. Data Description

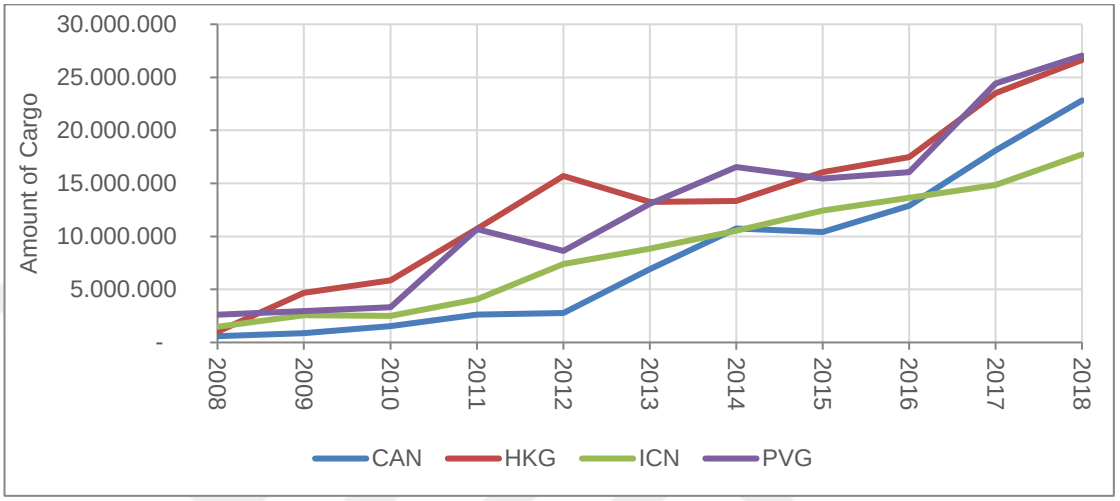
Annual panel data from 2008 to 2018 are used in this study and collected from Turkish Airlines (THY), Turkish Statistical Office (TUIK) and World Bank. Depending on the data availability, the amounts of air cargo transported bilaterally between Istanbul Ataturk Airport and six international airports (HKG: Hong Kong Airport, ICN: Incheon Airport, NRT: Narita Airport, PEK: Beijing Capital Airport, PVG: Shanghai Pudong Airport and SIN: Singapore Changi Airport) from the Far East are used as the dependent variable. Four macroeconomic variables that are cited in the literature as the factors affecting cargo demand are selected: Firstly, Gross Domestic Product per capita indicates the purchasing capacity of the country. The higher the GDP per capita of the destination country, the higher the amount of cargo transported. Secondly, population of the destination (cargo receiving) country is used in order to measure the potential of the cargo senders. Thirdly, as Turkish Cargo is the leading and the biggest air cargo company in Turkey and it is a sub-brand of Turkish Airlines, the number of aircraft owned by THY is used as the main carrier. Obviously the higher the number of aircrafts, the higher the amount of cargo transported. Finally, volume of trade is included our model of the air cargo demand as trade is considered to be one of the most important reasons of sending or receiving goods. The description of the data and their sources are listed in Table 4.

Table 4: Data Descriptions and Sources

Variable Name	Description	Source
Cargo	Amount of shipping plus mail cargo (kg) carried by Turkish Cargo to / from Istanbul Atatürk Airport from / to the airport of country *i*	THY
GDP	Real GDP per capita of the destination country ($)	TUIK /World Bank
Aircraft	The number of aircraft of Turkish Airlines	THY
Population	Population of the destination country	TUIK / World Bank
Trade	Exports of Turkey to country *i* for outgoing cargo to the airport of country *i* ; or imports of Turkey from country *i* for incoming cargo from the airport of country *i*	TUIK / World Bank

The trend of the data used are presented in the following graphs:

Figure 2: The Amount of Cargo Transported to IST from CAN, HKG, ICN and PVG Airports (kg)



According to Figure 2, the amounts of cargo transported to Istanbul from CAN, HKG, ICN and PVG Airports are continuously increasing. The highest amount of cargo is transported from Hong Kong and Shangai Airports.

Figure 3: The Amount of Cargo Transported to IST from NRT, PEK and SIN Airports (kg)

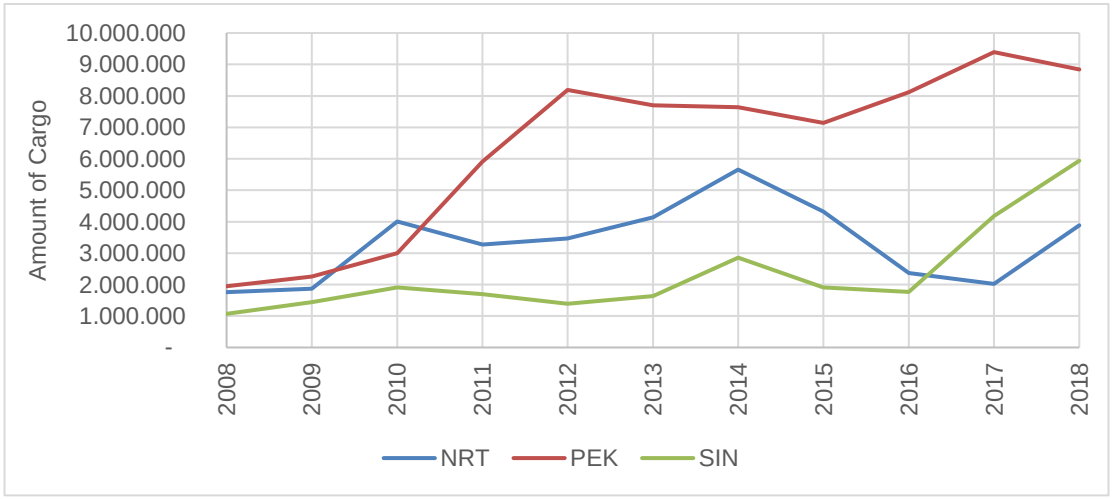
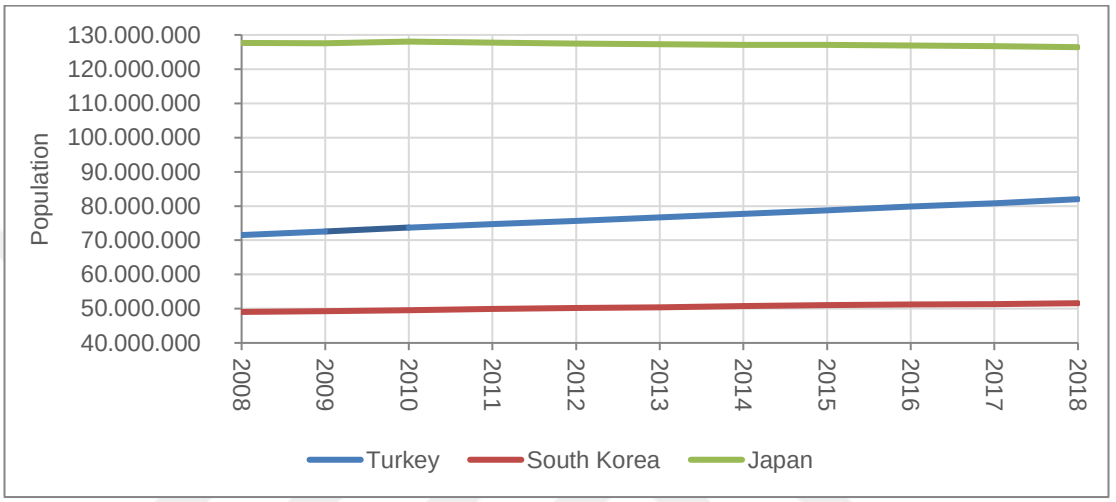


Figure 3 shows the amount of cargo sent to Istanbul from NRT, PEK and SIN airports. After 2016, the amount of cargo from Singapore has increased sharply.

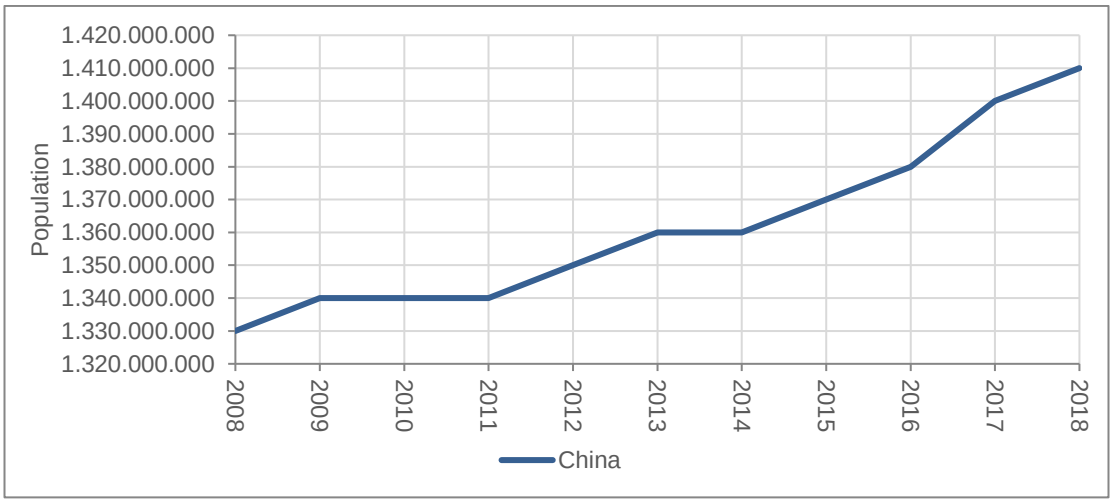
On the other hand, the amount of cargo from Narita Airport has decreased 2014. The air cargo from Pekin Airports has been rising throughout the period.

Figure 4: Population of Turkey, South Korea and Japan



In Figure 4, the population of Turkey, South Korea and Japan are shown. Turkey's population is increasing, while the population of Japan and South Korea remained almost constant.

Figure 5: Population of China



According to Figure 5, China's population has been increasing over the years. In 2018, the population of China has exceeded 1.410 million.

Figure 6: Populations of Singapore and Hong Kong

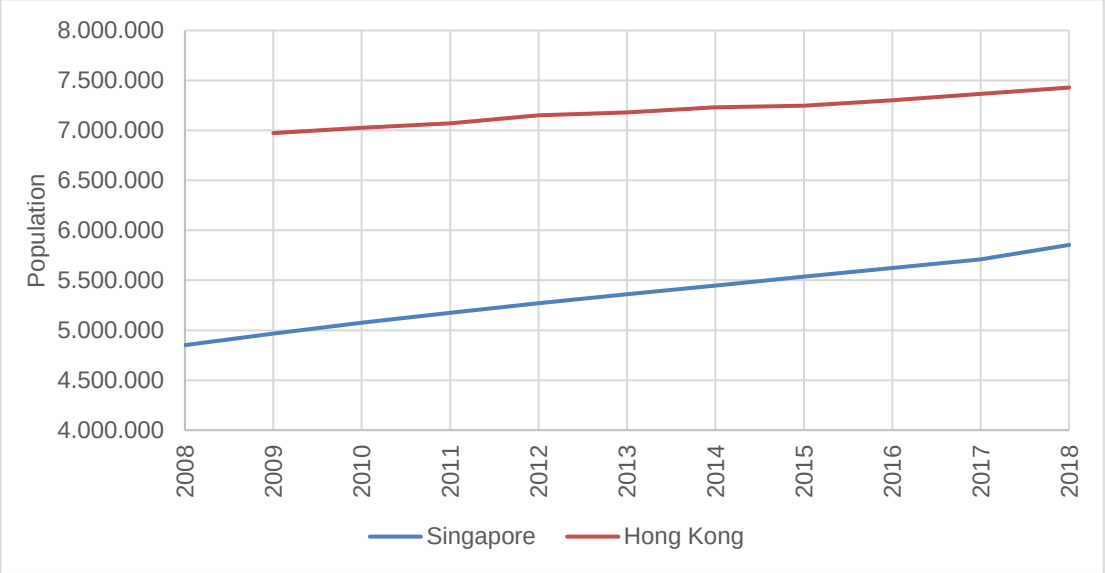
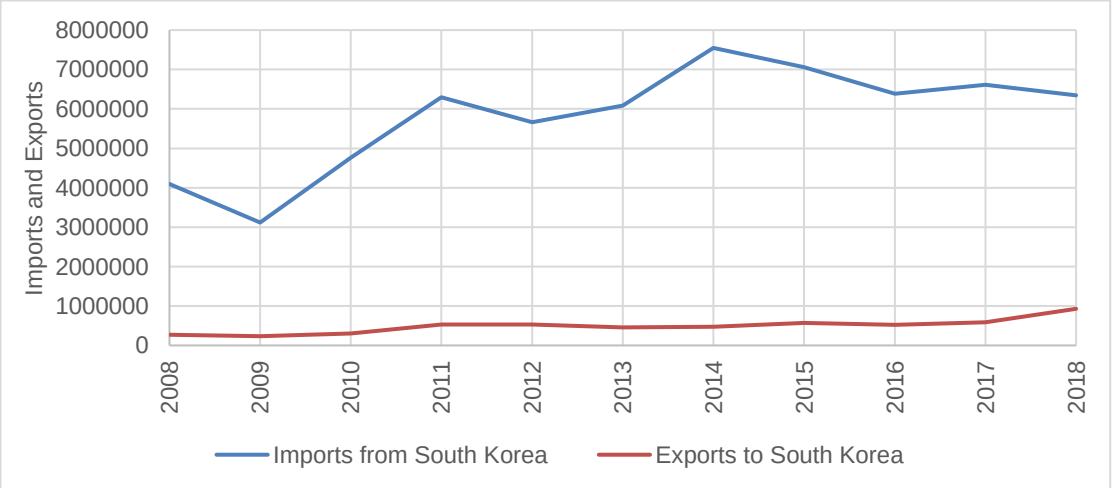


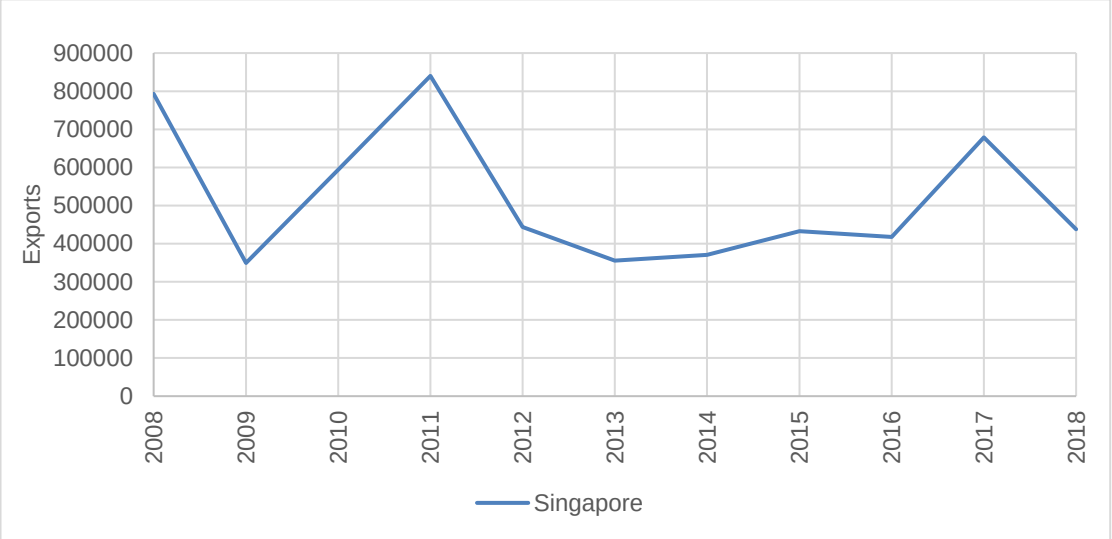
Figure 6 shows the population trend in Hong Kong and Singapore. Both countries' populations are increasing slowly.

Figure 7: Exports and Imports by South Korea ($)



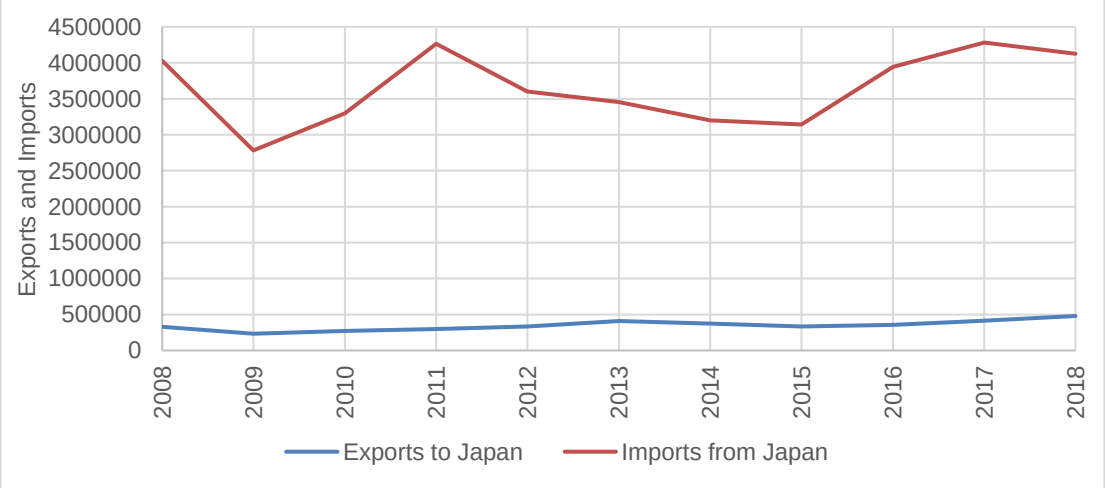
According to Figure 7, imports from South Korea are much higher than exports to that country from Turkey.

Figure 8: Exports by Singapore ($)



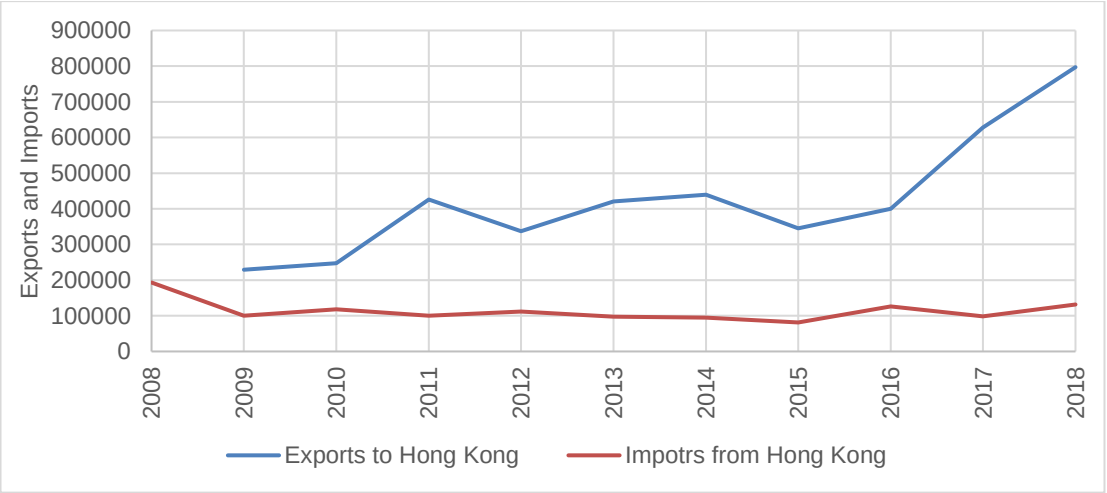
According to Figure 8, Export to Singapore reached the highest level in 2011. After then, there was a decrease in exports, They started to increase in recent years.

Figure 9: Exports and Imports by Japan ($)



The amounts of imports from Japan has reached to 4 million USD while the export to Japan are about 500.000 USD

Figure 10: Exports and Imports by Hong Kong ($)



According to Figure 10, Turkey's imports to Hong Kong are smaller than exports to that country.

Figure 11: Gross Domestic Product of China (Billion US$)

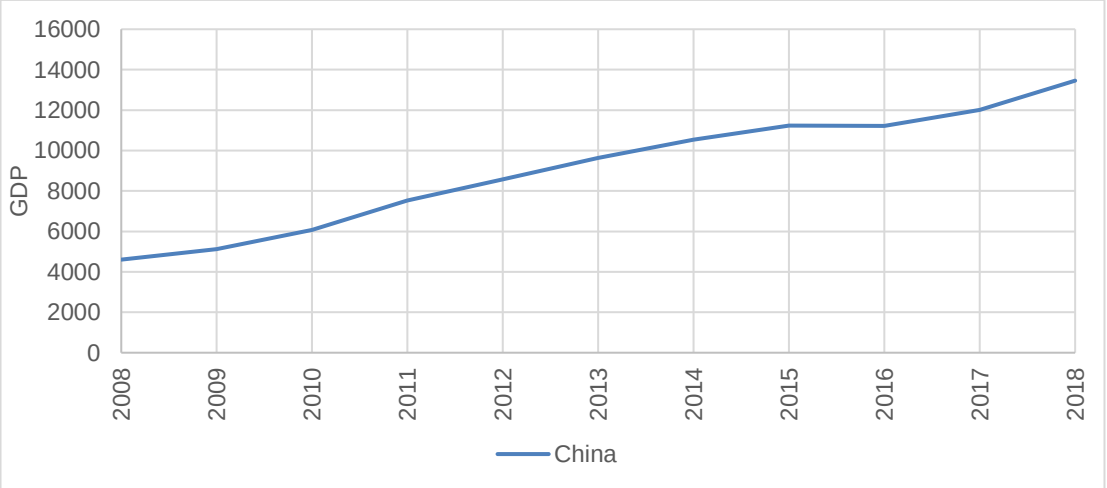


Figure 11 shows that the Gross Domestic Product of China has increased remarkably over ten years.

Figure 12: Gross Domestic Product of Turkey, South Korea and Japan (Billion US$)

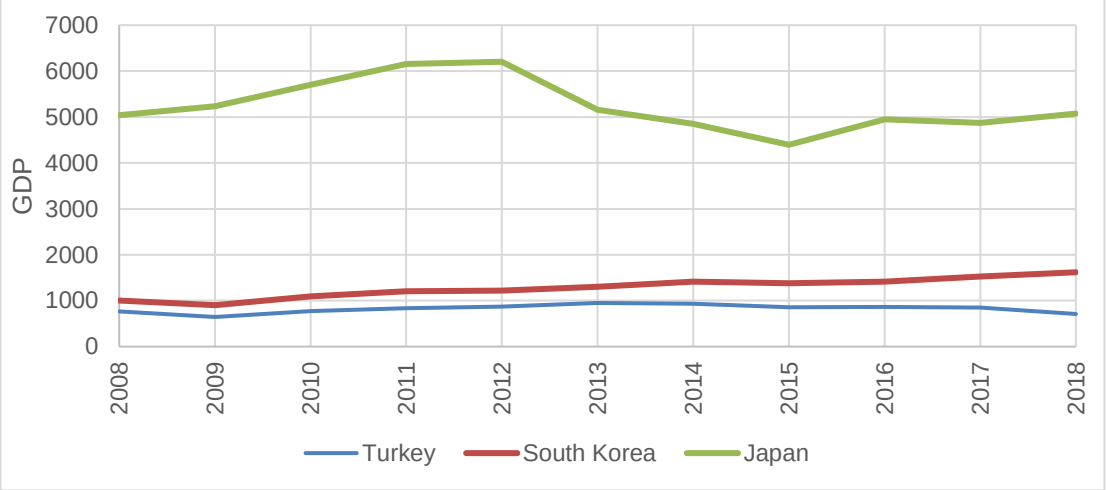


Figure 12 illustrates the GDP of Japan, South Korea and Turkey. It seems that the Japanese economy slows down in the recent years, while the South Korean economy is growing steadily.

3.2. The model

An ad hoc model is set up in order to estimate the main economic determinants of the demand for air cargo between Turkey (proxied by Istanbul Ataturk Airport) and six Far East countries (proxied by their respective airports). The following model is estimated by using the panel data from 2008 to 2018 for 7 airports.

$$y_{it} = b_0 + b_1 x_{1it} + b_2 x_{2it} + b_3 x_{3it} + b_4 x_{4it} + u_{it}$$

Where

ly is the logarithm of cargo carried from/to Atatürk Airport to/from the country *i*'s airport,

lx_1 is the logarithm of real GDP per capita of the destination country *i*,

lx_2 is the logarithm of population of the destination country *i,*

lx_3 is the logarithm of number of aircraft

lx_4 is the logarithm of exports of Turkey to country *i* for outgoing cargo to the airport of country *i* ; or imports of Turkey from country *i* for incoming cargo from the airport of country *i.*

We expect positive signs for all variables because the amount of cargo transported increased as the GDP per capita, population, number of aircraft and the volume of trade rise. All variables are used in logarithms.

Panel Data Test

The present study utilizes panel regression tests, resulting in a wide-ranging analysis of the relationship between air cargo amount and independent variables. The paper uses a panel data set spanning from 2008 to -2018 and employs a random-effect model in order to control for data heterogeneity, (Khandker, 2005). Since unobserved heterogeneity is constant over time, one can use a constant effects estimator. A constant-effect panel property is used to test for unobserved heterogeneity and all variables are expressed as deviations from their mean values (Waldfogel, 1997). That is, panel data are employed to examine the hypothesis that air cargo capacity is related to observable and unobservable properties that affect the amount of air cargo transport. This study can treat unobserved variables and employ panel data techniques to obtain consistent estimates of parameter coefficients. This approach provides consistent estimates of residues in the regression, so the article employed the approach to establish a test for the correlation between cargo quantity and unobserved heterogeneity (Himmelberg et al. 1999). The estimation regression model is;

$$\ell Y_{it} = \delta \ell X_{it} + + u_i + \omega_{it} \qquad (2)$$

where ℓY_{it} is a measure of amount of cargo capacity in airport $_i$ at year $_t$, ℓX_{it} denotes the vector of explanatory variables, δ is the vector of coefficients of explanatory variables, u_i is the index, and ω_{it} is the random error term that applies to airports at each year.

3.3. Empirical Findings

Hadri Z-Statistics are presented in Table 6.

Table 5: Hadri Test Results

	Cargo	Trade	Population	GDP	Aircraft
Hardi Z-Statistic	1.32	.78	1.77	1.45	1.90
p	.1868	.4334	.0768	.1470	.0586

According to Table 6, since p values are greater than .05, the null hypothesis is accepted and the series are considered as stationary. First generation unit root test is used. Initially, the data are tested for stationarity by using the Unit Root Test in order to avoid from spurious regression. The test results indicate that variables did not have unit root.

Table 6: Unit Root Tests Results*

Method	Statistic	Probability**	Cross-Sections	Observation
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-7.30224	0.0000	14	119
Im, Pesaran and Shin W-stat	-3.68425	0.0001	14	119
ADF - Fisher Chi-square	63.6097	0.0001	14	119
PP - Fisher Chi-square	49.7112	0.0070	14	126

** Automatic lag length selection based on SIC: 0 to 1*
*** Probabilities for Fisher tests are computed using an asymptotic Chi-square distribution. All other tests assume asymptotic normality.*

Two well-known estimation techniques for panel data are employed in the

study: the Fully Modified Least Squares Method (FMOLS) developed by Phillips and Hansen (1990) and the Dynamic Least Squares Method (DOLS) developed by Stock and Watson (1993). Also, we can check the robustness of the results to the estimation techniques used.

If the cointegration analysis shows a long-term relationship between the variables, then we estimate the long run coefficients. If there is no cointegration, the estimation of this model by ordinary least squares method might result in the loss of coherent, deviant and efficiency properties of ordinary least squares method and thus invalidation of hypothesis tests. Phillips and Hansen (1990) proposed the FMOLS and DOLS to overcome this problem faced by the ordinary least squares method. The FMOLS estimator uses a semi-parametric correction method that takes into account the autocorrelation problem between the error terms and the inherent relationship between independent variables and the error term to avoid problems caused by long-term correlation of co-integrated equations and stochastic shocks. Phillips and Hansen (1990) showed that the FMOLS estimator is consistent, asymptotically deviant, and gives good results even in small samples (Küçükaksoy vd. 2015: 695).

In order to eliminate the deviation and endogeneity problems in the Least Squares estimator, Stock-Watson (1993) advocated in this method to use the level values of the explanatory variables to consider the lag and lead of their differences. The DOLS estimator is used when there is a cointegration relationship between the series.

$$Y_t = \alpha_0 + \alpha_1 t + \alpha_2 X_t + \sum_{i=-q}^{q} \beta_1 \Delta X_{t-1} + \varepsilon_t \qquad (3)$$

In the equation q; indicates the optimum premise and delay value. The unrestricted model (equation 1) is estimated initially by using the DOLS method and the results are given in Table 8.

Table 7: Estimation Results by Panel Dynamic Least Squares (DOLS) Method

Variable	Coefficient	Std. Error	t-Statistic	Probability
LGDP	1.101402	0.476611	2.310903	0.0242
LAIRCRAFT	0.537095	0.247350	2.171399	0.0338
LPOP	4.034678	3.285404	1.228062	0.2241
LTRADE	0.424468	0.292722	1.450072	0.1522
R-squared	0.936242	**Mean dependent variable**		15.35468
Adjusted R-squared	0.865168	**S.D. dependent variable**		0.898686
S.E. of regression	0.329993	**Sum squared residual**		6.642624
Long-run variance	0.055089			

The empirical results indicate that GDP influence the demand for air cargo positively and significantly. The demand is highly elastic to the changes in GDP. This is consistent with the theory that the demand for air cargo will increase as the income of the destination country (cargo receiving) rises. The demand is expected to increase by 11 percent in response to a 10 percent rise in GDP.

The demand for air cargo is affected positively and significantly by the changes in the number of aircraft. The demand will rise by 5.4 percent in response to a 10 percent increase in the number of aircraft. The population of the cargo receiving country and the volume of trade between Turkey and the cargo receiving/sending country also affect the demand for air cargo positively, but the coefficients are found to be insignificant. The model is re-estimated by using FMOLS method and the results are presented in Table 9.

Table 8: Estimation Results by Panel Fully Modified Least Squares (FMOLS) Method

Variable	Coefficient	Std. Error	t-Statistic	Probability
LGDP	1.337850	0.374669	3.570751	0.0005
LAIRCRAFT	0.759327	0.268903	2.823796	0.0056
LPOP	1.080336	3.408497	0.316954	0.7519
LTRADE	0.282145	0.285261	0.989078	0.3247
R-squared	0.818506	**Mean dependent variable**		15.35468
Adjusted R-squared	0.792808	**S.D. dependent variable**		0.898686
S.E. of regression	0.409067	**Sum squared residual**		18.90893
Long-run variance	0.269808			

FMOLS estimations produce very similar results to DOLS estimations. Once again GDP and the number of carriers are found to be positive and significant determinants of the demand for air cargo. Because the volume of trade between the two countries is found to be insignificant, this variable excluded and the model is re-estimated. As can be seen from Table 6, the results did not change much. The main determinants of the demand are still GDP and the number of aircraft.

Table 9: Estimation Results by Panel Dynamic Least Squares (DOLS) Method (without trade)

Variable	Coefficient	Std. Error	t-Statistic	Probability
LGDP	1.746646	0.346551	5.040083	0.0000
LAIRCRAFT	0.715823	0.201482	3.552779	0.0007
LPOP	1.461464	2.709936	0.539298	0.5913
R-squared	0.919545	**Mean dependent variable**		15.35468

Adjusted R-squared	0.861618	**S.D. dependent variable**	0.898686
S.E. of regression	0.334309	**Sum squared residual**	8.382190
Long-run variance	0.072568		

The model is re-run without the volume of trade by using the FMOLS method and the results are denoted in Table 11. The results confirm that the population of the destination country is not significant.

Table 10: Estimation Results by Fully Modified Least Squares (FMOLS) Method (without trade)

Variable	Coefficient	Std. Error	t-Statistic	Probability
LGDP	1.472816	0.365347	4.031276	0.0001
LAIRCRAFT	0.870537	0.246710	3.528587	0.0006
LPOP	0.199067	3.359541	0.059254	0.9529
R-squared	0.820972	**Mean dependent variable**		15.35468
Adjusted R-squared	0.797416	**S.D. dependent variable**		0.898686
S.E. of regression	0.404493	**Sum squared residual**		18.65205
Long-run variance	0.282904			

Table 12 presents the estimation of the model without population variable by the DOLS method. GDP and the number of carriers are still significant determinants of the air cargo demand.

Table 11: Estimation Results by Panel Dynamic Least Squares (DOLS) Method (without population)

Variable	Coefficient	Std. Error	t-Statistic	Probability
LGDP	1.304576	0.459124	2.841442	0.0058
LAIRCRAFT	0.771760	0.166128	4.645570	0.0000
LTRADE	0.292220	0.278630	1.048774	0.2977
R-squared	0.907184	**Mean dependent variable**		15.35468
Adjusted R-squared	0.840357	**S.D. dependent variable**		0.898686
S.E. of regression	0.359073	**Sum squared residual**		9.670025
Long-run variance	0.094626			

The results are confirmed by the FMOLS estimation method as presented in Table 13.

Table 12: Estimation Results by Fully Modified Least Squares (FMOLS) Method (without population)

Variable	Coefficient	Std. Error	t-Statistic	Probability
LGDP	1.326516	0.373000	3.556348	0.0005
LAIRCRAFT	0.839863	0.134184	6.259038	0.0000
LTRADE	0.231824	0.275272	0.842164	0.4015
R-squared	0.818760	**Mean dependent variable**		15.35468
Adjusted R-squared	0.794912	**S.D. dependent variable**		0.898686
S.E. of regression	0.406984	**Sum squared residual**		18.88255
Long-run variance	0.271171			

Finally, we run a parsimonious model by excluding all insignificant variables. It can be seen from the Table 14 that the results are very robust to the estimation

techniques as well as the added variables. The demand for air cargo is consistently elastic to the changes in income while it is inelastic to the changes in the number of carriers.

Table 13: Parsimonious Model by DOLS Method

Variable	Coefficient	Std. Error	t-Statistic	Probability
LGDP	1.592018	0.375071	4.244579	0.0001
LAIRCRAFT	0.402911	0.164898	2.443391	0.0192
R-squared	0.998071	**Mean dependent variable**		15.21205
Adjusted R-squared	0.992978	**S.D. dependent variable**		0.991382
S.E. of regression	0.083077			0.269170
Long-run variance	0.001297	**Sum squared residual**		

The model estimated by FMOLS method as presented in Table 15 confirms the above results. The model by DOLS seems to be better fit as R-squared is relatively higher.

Table 14: Parsimonious Model by FMOLS Method

Variable	Coefficient	Std. Error	t-Statistic	Probability
LGDP	1.469978	0.359517	4.088757	0.0001
LAIRCRAFT	0.868253	0.122372	7.095203	0.0000
R-squared	0.821301	**Mean dependent variable**		15.35468
Adjusted R-squared	0.799547	**S.D. dependent variable**		0.898686
S.E. of regression	0.402360	**Sum squared residual**		18.61773
Durbin-Watson stat	0.676746	**Long-run variance**		0.283445

CHAPTER 4

CONCLUSION

Air transportation has been one of the most important transportation modes in terms of comfort, speed and safety and mass transportation. Turkish aviation industry grows much faster that the economic growth of the country. Turkish Airlines flies to hundreds of destinations connecting businesses and Turkish Cargo carries tons of goods accordingly. Thus the importance of empirical studies on demand for travel as well as demand for cargo has become vital in order to benefit from the expanding markets. The main factors affecting the demand can be determined by these studies and the results can guide the companies in making their future strategies. Thus this study aims to explore the main determinants of air cargo by taking the case of bilateral cargo transportation between Turkey and the selected Far East countries.

In the first chapter of the thesis, the motivation, the aims and the method of the study are mentioned and the basic structure of the study is presented. Second chapter reviews the relevant theoretical and empirical literature on air cargo transport and talks about the main characteristics of air cargo operations. In the third chapter, we set up a model in order to analyze the main factors affecting the demand for air cargo.

The dependent variable being the amount of air cargo transported from and to Turkey (proxied by Istanbul Ataturk Airport) to and from the selected Far East countries (proxied by six international airports: Hong Kong Airport, Incheon Airport, Narita Airport, Beijing Capital Airport, Shanghai Pudong Airport and Singapore Changi Airport), the unrestricted model consists of four variables: GDP, population, trade volume and the number of aircrafts. The data covers the period from 2008 to 2018. Two different panel estimation techniques are used: Panel Dynamic Least Squares and Panel Fully Modified Least Squares in order to check the robustness of the results to the estimation techniques.

The empirical findings indicate that the most important factors affecting the air

cargo demand are market size and the capacity of the air carriers. The demand is highly elastic to the changes in income of the cargo receiving country. One can say from here that as the economies of Turkey's trading partners grow, they will demand more goods and services from Turkey, thus there will be more demand for air cargo transportation. In other words, expansion of the air cargo sector is heavily dependent on growth of our trading partners. The capacity of the air cargo company, proxied by the number of aircrafts is found to be the second important determinant of air cargo demand. Turkish Cargo has expanded its fleet five times within the last decade, reaching to 20 cargo aircraft in 2018. Consequently, the amount of cargo transported increased over 23 million kg in 2018. Two other macroeconomic variables, namely population of the destination country and the volume of trade are found to be positive but insignificant, an expected result as both variables is expected to encourage demand for air cargo.

According to panel DOLS results, GDP influence the demand for air cargo positively and significantly. The demand is highly elastic to the changes in GDP. This is consistent with the theory that the demand for air cargo will increase as the income of the destination country (cargo receiving) rises. The demand is expected to increase by 11 percent in response to a 10 percent rise in GDP. FMOLS estimations produce very similar results to DOLS estimations. GDP and the number of carriers are found to be positive and significant determinants of the demand for air cargo. Because the volume of trade between the two countries is found to be insignificant, this variable excluded and the model is re-estimated. The main determinants of the demand are GDP and the number of aircraft.

Some other economic, social, technological and policy-related factors could be included in the model in order to see if they affect the demand, however there were data limitations. In addition, a price variable could not be used in the model because of unavailability of data. These issues stay for further research.

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