IBN HALDUN UNIVERSITY
SCHOOL OF GRADUATE STUDIES
MASTER OF SCIENCE IN AIR TRANSPORT MANAGEMENT

MASTER THESIS

EXPLORING THE IMPACT OF SOCIO-POLITICAL CRISES ON THE OPERATIONAL PERFORMANCE OF THE TURKISH AIRLINES

VİLDAN HAVVA KESİCİ

THESIS SUPERVISOR: PROF. MUSTAFA KEMAL YILMAZ

ISTANBUL, 2020

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by

VİLDAN HAVVA KESİCİ

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

THESIS SUPERVISOR: PROF. MUSTAFA KEMAL YILMAZ

ISTANBUL, 2020

APPROVAL PAGE

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

Thesis Jury Members

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Prof. Mustafa Kemal Yilmaz	Approved	
Prof. Lokman Gürsüz	Approved	
Dr. Ahmet Kaplan	Approved	

This is to confirm that this thesis complies with all the standards set by the School of Graduate Studies of Ibn Haldun University.

Date of Submission

05.03.2020

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PLAGIARISM CLEARANCE PAGE

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

Name Surname: Vildan Hawa Kesici

Signature:

ÖZ

SOSYO-POLİTİK KRİZLERİN TÜRK HAVA YOLLARI'NIN FAALİYET PERFORMANSINA ETKİLERİ

Kesici, Vildan Havva
Hava Taşımacılığı Yönetimi Yüksek Lisans Programı
Tez Danışmanı: Prof. Dr. Mustafa Kemal Yılmaz
Ocak 2020, 90 sayfa

Çalışmada, 2010-2018 döneminde Türkiye'de yaşanan sosyo-politik birtakım krizlerin, Türk Hava Yolları'nın faaliyet peformansı üzerindeki etkisi, arz edilen koltuk kilometre (ASK), ücretli yolcu kilometre (RPK), yolcu doluluk oranı (PLF) ve taşınan yolcu sayıları gibi parametreler değerlendirilerek araştırılmıştır. Bu olaylar kronolojik sıra itibari ile; Gezi Parkı, Rus askeri jetinin vurulması, 15 Temmuz askeri darbe girişimi ve elektronik cihazların yasaklanmasıdır. Söz konusu olayların etkileri bölgesel bazda dört farklı algoritma kullanılarak analiz edilmiştir: (1) nedensel etki analizi, (2) aykırı değer algoritması (ODA), (3) kırılma noktası algoritması (BDA) ve (4) değişim noktası algoritması (CPA).

Çalışma bulguları, sosyo-politik krizlerin Türk Hava Yolları'nın faaliyet performansı üzerinde bölgesel olarak sınırlı ölçüde etkileri olduğunu göstermiştir. CPA, Gezi Park döneminde yurtiçi, Afrika ve Kuzey Amerika bölgelerinde RPK'da; Avrupa, Uzak Doğu ve Kuzey Amerika bölgelerinde ASK değerlerinde değişim tespit etmiştir. ODA, Rus askeri jetinin vurulduğu dönemde, Afrika ve Kuzey Amerika bölgelerinde ASK ve RPK değerlerinde aykırı değerler tespit etmiştir. ODA aynı zamanda, 15 Temmuz askeri darbe girişiminde Avrupa, Orta Doğu ve Kuzey Amerika bölgelerinde değişkenlerde aykırı değerler ortaya çıkarmıştır. Son olarak ODA, elektronik cihaz yasağında yurtiçi, Kuzey ve Güney Amerika bölgelerinde daha yoğun bir etki tespit ederken; CPA, aynı dönemde Afrika, Uzak Doğu ve Güney Amerika bölgelerinde RPK değerlerinde etki oluştuğunu ortaya kolymuştur. Yaşanan krizlerin yolcu doluluk oranı (PLF) üzerindeki etkisi düşük seviyede kalmıştır. Bu bulgular, yaşanan krizlerin Türk Hava Yolları'nın faaliyet performansını bazen anlık bazen de sınırlı ölçüde etkilemesine karşın, şirketin almış

olduğu önlemler ve çevik yönetim yeteneği sayesinde krizlerin hızlıca üstesinden gelebildiğini göstermiştir.

Anahtar Kelimeler: Aykırı Gözlem Analizi, Etki Analizi, Faaliyet Performansı, Sosyo-Politik Krizler, Türk Hava Yolları

ABSTRACT

EXPLORING THE IMPACT OF SOCIO-POLITICAL CRISES ON THE OPERATIONAL PERFORMANCE OF THE TURKISH AIRLINES

Kesici, Vildan Havva
MSc in Air Transport Management
Thesis Supervisor: Prof. Mustafa Kemal Yılmaz
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This study investigates the impacts of socio-political events on the operational performance of the Turkish Airlines, by referring to the firm-specific factors i.e. available seat kilometers (ASK), revenue per kilometer (RPK), passenger load factor (PLF) and passenger carried (PC) over the period of 2010M1-2018M12. To conduct the study, we selected four critical events among many others that had a serious impact on the Turkish socio-political environment. These events, by chronological orders, are; Gezi Park, the shooting of the Russian military jet, the attempted military coup and electronic devices ban. To detect the outlier impact, we run four different outlier algorithms, namely outlier detection algorithm (ODA), breakout detection algorithm (BDA), change-point algorithm (CPA) and causal impact analysis on a regional basis.

The findings suggest that the socio-political crises have changing impacts on the operational performance of the Turkish Airlines regionally. CPA successfully detected the Gezi Park in domestic, Africa and North America regions for RPK and in domestic, Europe, Far East, and North America regions for ASK. ODA detected an outlier impact in Africa and North America for RPK and ASK for the shooting of the Russian military jet. ODA had an outlier impact in Europe, the Middle East, and North America regions for the attempted military coup. Finally, for the electronic devices ban while ODA successfully detects an outlier effect in domestic, North and South America regions, CPA reveals an impact in Africa, Far East, and South America for RPK. The impact of the crises in PLF has been less visible. These findings show that although the crises had an immediate effect on the operational performance, Turkish Airlines recovered from each crisis very promptly. This proves the resilience and agile management ability of the company.

Keywords: Causal impact, Operating Performance, Outlier Detection Analysis, Socio-Political Crises, Turkish Airlines

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In the process of writing this thesis, many people contributed in various ways to make my work a reality. I would like to thank my mentor Prof. Dr. Mustafa Kemal Yılmaz for sharing his professional experience with me with great devotion, patience, and contributions during the guidance process.

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I would like to thank my dear mother, who is the greatest supporter in my life and did not give up her prayers, to my father who gives power with his presence, to my brother Ömer and to my little brother Samet who give me enthusiasm in life.

I would like to deeply thank my sister Sevda who believed in me in every process and my friend Neriman who showed me patience in this process and my secret heroes who are too many to name.

I wish the study will be useful on behalf of the community and my colleagues.

Vildan Havva Kesici

ISTANBUL, 2020

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LIST OF ABBREVIATIONS

ACI	Airports Council International
ALF	Average Load Factor
ARIMA	Autoregressive Integrated Moving Average
ASK/ASM	Available Seat Kilometer/Mile
ATAG	Air Transport Action Group
ATM	Air Traffic Management
ATW	Air Transport World
BDA	Breakout Detection Algorithm
BELF	Break Even Load Factor
CAGR	Compound Annual Growth Rate
CAPA	Centre for Aviation
CASM/CASK	Cost Per Available Seat Mile
CIA	Causal Impact Algorithm
CPDA	Change Point Detection Algorithm
D/E	Debt to Equity Ratio
DHMI	General Directorate of State Airports Authority
EASA	European Aviation Safety Agency
EBIT	Earnings Before Interest and Tax
ECAC	European Civil Aviation Conference
EDM	E-Divisive with Medians
EPS	Earnings per Share
ETD	Explosives Trace Detector
FAA	Federal Aviation Administration
FTK	Freight Tonne Kilometer
FX	Forex
GCC	Gulf Cooperation Council
GDP	Gross Domestic Product
GFC	Global Financial Crisis
GPS	Global Positioning System
IATA	International Air Transport Association
ICAO	International Civil Aviation Organization

ICAT	International Center for Air Transportation
IOSA	IATA Operational Safety Audit
IMF	International Monetary Fund
MSHGK	National Civil Aviation Security Program
ODA	Outlier Detection Algorithm
PDP	Public Disclosure Platform
PLF	Passenger Load Factor
PAX	Passenger
QA	Qatar Airways
RASM/RASK	Revenue per Available Seat Kilometer/Mile
ROA	Return on Asset
ROE	Return on Equity
RPK/RPM	Revenue Passenger Kilometer / Mile
SARIMA	Seasonal Autoregressive Integrated Moving Average
TAI	Turkish Aerospace
TCI	Turkish Cabin Interiors
TEC	Turkish Technic Incorporation
THY	Turkish Airlines
TL	Turkish Lira
TSA	Transportation Security Administration
TSI	Turkish Seats Industries
UK	United Kingdom
UNWTO	United Nations World Tourism Organization
US	United States
USD	United States Dollar
WACD	World Air Cargo Data

CHAPTER I

INTRODUCTION

1.1. Overview of Aviation Industry

The aviation industry is one of the main drivers of the economy creating considerable value for all countries. It significantly contributes to social and economic growth across the world. Some studies show that the tourism industry and business travel have created a strong stimulus in airport capacities at a worldwide level, supporting millions of jobs in both developed and developing countries (Oprea, 2010). In this respect, air transport is not only a vital and the most efficient way of transportation, but also affects the lives of many people by maintaining economic prosperity and providing job opportunities to 65.5 million individuals. By 2017, the global economic impact of the aviation industry is estimated to be USD 2.7 trillion, equivalent to 3.6% of the World's gross domestic product (GDP) which makes airlines very sensitive to the economic turmoil, and political events. (Figure 1.1) (Air Transport Action Group (ATAG), 2017). By the end of 2018, the global airline industry consists of over 1,303 commercial airlines operating more than 31,717 commercial aircraft and providing services to over 3,800 airports (ATAG, 2018).

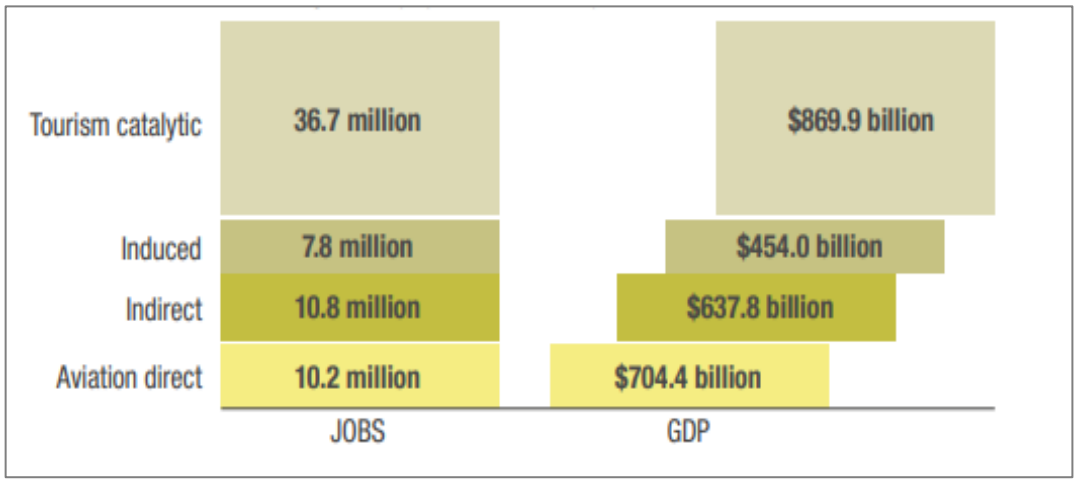

Figure 1. 1 Aviation's global employment and GDP impact of aviation industry

Source: ATAG, Airbus GMF 2019

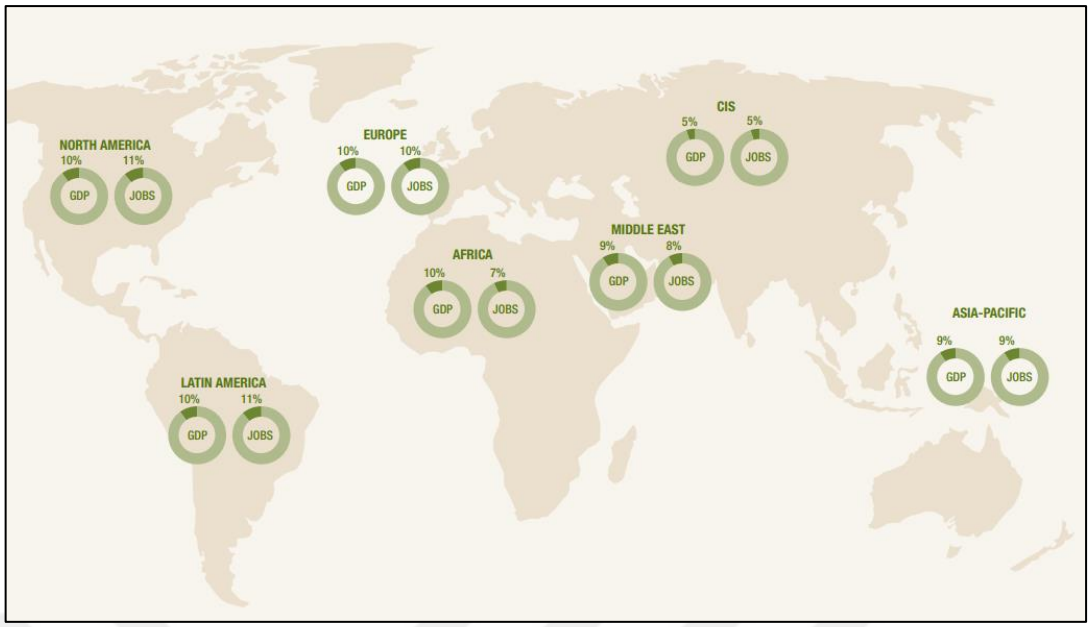

Figure 1. 2 The contribution of tourism to global GDP and employment by region

Source: World Travel & Tourism Council Report, Airbus GMF 2019

If aviation were a country, it would rank 20th in size by GDP (Figure 1.2). It is estimated that the benefit of the aviation and space industry to community is much more than the costs of research and development in these areas. Every USD 100 million of research spending eventually generates additional GDP benefits of USD 70 million, year after year (ATAG, 2017).

The annual growth rates in passenger air traffic measured in revenue passenger kilometers (RPKs) and capacity growth (measured by available seat kilometers or ASKs) are shown in Figure 1.3 for the period 2012-2019. Besides this strong demand, the average annual growth rates of global aviation capacity which is measured by the available seat kilometers (ASKs) has depicted an overwhelming growth of 6.7 % average YoY in the last years (2013-2018) (Figure 1.3). The growth of passenger air traffic and capacity by the regions of the world illustrated in Table1.1. All these figures underline the growing importance of the airline industry.

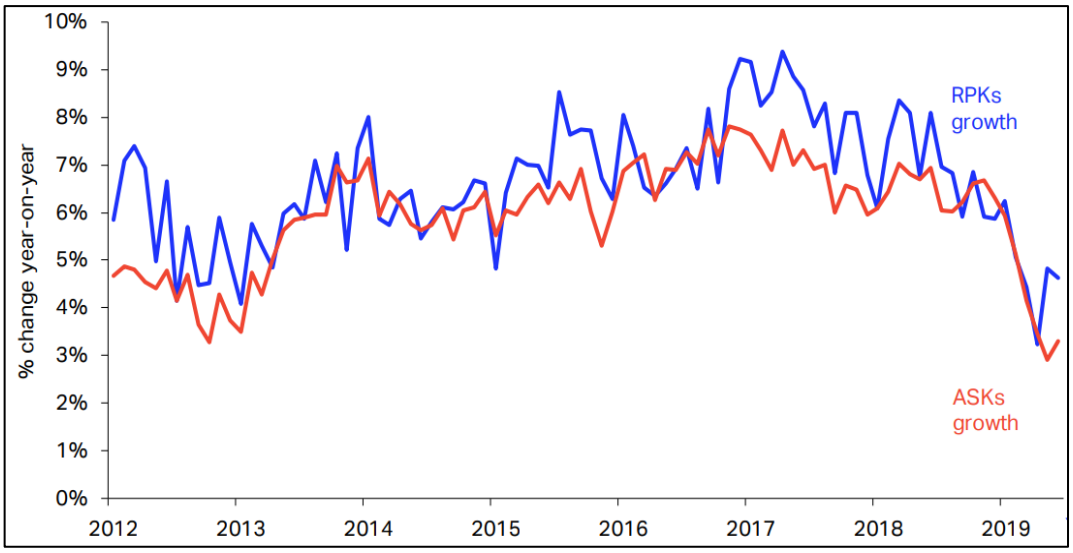

Figure 1. 3 Growth in global RPKs and ASKs (2012-2019)

Source: IATA, Outlook for the Airline Industry Report, September 2019

Table 1. 1 Traffic results by the world regions

System-wide global commercial airlines	Passenger traffic (RPK), % Year-on-Year							Passenger capacity (ASK) % Year-on-Year						
	2013	2014	2015	2016	2017	2018	2019F	2013	2014	2015	2016	2017	2018	2019F
Global	5.7	6.0	7.4	7.4	8.1	7.4	5.0	5.2	5.8	6.7	7.5	6.7	6.9	4.7
Regions														
North America	2.6	3.0	4.3	4.0	3.9	5.3	4.3	2.3	2.8	4.1	4.7	3.8	4.9	4.1
Europe	4.7	6.5	5.8	5.3	9.1	7.5	4.9	3.4	5.8	4.5	5.3	6.7	6.6	5.6
Asia-Pacific	8.0	7.8	9.6	11.1	10.9	9.5	6.3	7.9	8.1	7.5	10.1	9.1	8.8	5.7
Middle East	11.5	11.9	9.9	11.4	6.8	5.0	2.0	12.3	10.9	12.6	13.2	6.7	5.9	0.6
Latin America	6.3	6.3	6.7	4.5	7.4	7.0	6.2	4.7	4.3	6.5	3.3	5.5	7.3	5.1
Africa	5.0	0.6	3.4	7.3	7.0	6.1	4.3	5.0	3.5	2.4	6.9	3.5	4.4	3.7

Source: IATA, Industry Statistics, June 2019

Note: Includes domestic,international, and all commercial airlines.

In parallel to the rapid growth in the global aviation industry, Turkey has also significantly improved its status in international civil aviation, with an expansion of the route network, air traffic and the number of passengers. While during centuries trade routes have moved from the east to the west, especially after the 2008-2009 global financial crisis (GFC), it turns out to be the opposite, the routes moving from

the west to the east (North Atlantic-European region, Asia-Pacific-Middle East region). Thus, the region, where Turkey stands, will have further increases in air traffic and passenger transportation in the forthcoming years. (Table 1.1)

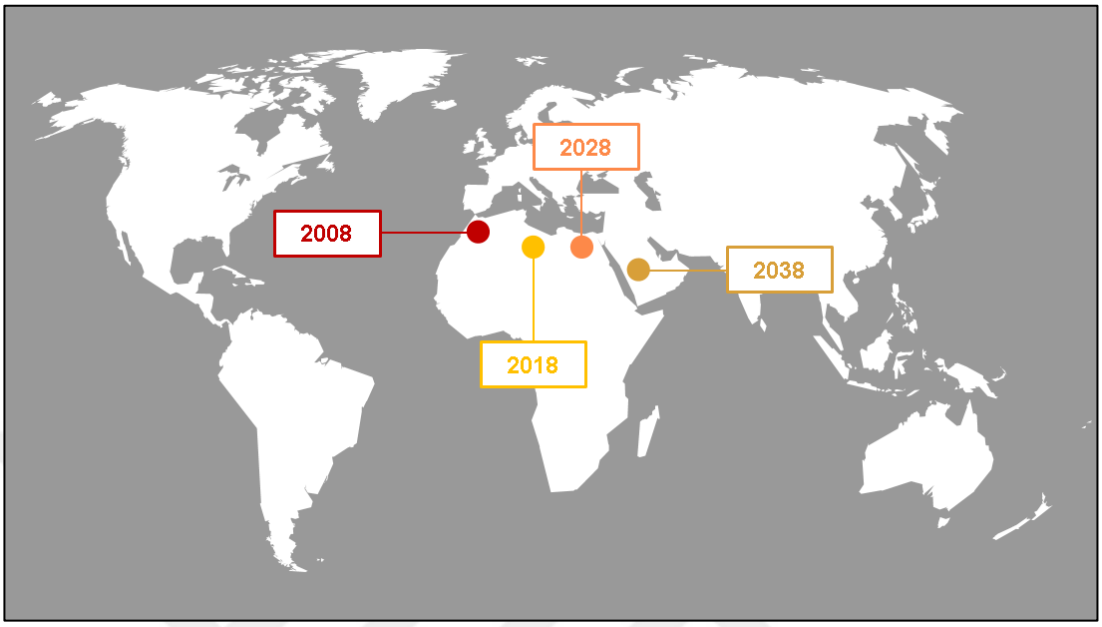

Figure 1. 4 Centre of gravity moving south and east

Source: Airbus GMF 2019

Figure1.5 shows the number of domestic and international passengers carried from 2010 to 2018 and the predicted improvement on number of passenger carried in Turkey until 2021. As of the end of 2018, the total number of passengers carried out by airline companies in Turkey reached 210 million.

While the airline companies in many developed and developing countries face with an extensive crisis in the last decade, Turkish Airlines has continued to grow despite all negative economic and political circumstances, offering safety and quality in air services. In 2016, Turkey also became a member of the International Civil Aviation Organization (ICAO) that sets the rules of international aviation. This membership will support the aviation industry further to reach its targets by 2023 and will help to improve the position of Turkish Airlines in the global arena (Figure 1.4).

Figure 1. 5 Airline market growth in Turkey

Source: Turkish Airlines Financial & Operational Reports

Turkish Airlines, the national airline of Turkey, has also shown an overwhelming performance for the last 15 years. The passenger carried have increased from 10 to 75 million between 2010- 2018, showing an average annual growth of 37% (Figure1.6). Being located in the center of three continents and owning the world's third biggest airport, i.e. Istanbul Airport, Turkey will become the world's largest global transit center for aviation in the next couple of decades.

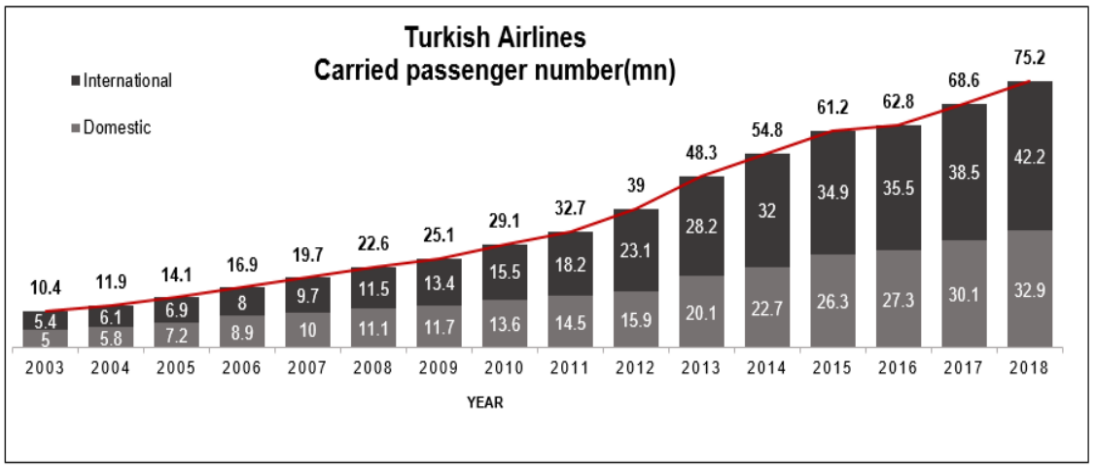

Figure 1. 6 Turkish Airlines passenger carried number (mn)

Source: Turkish Airlines Financial & Operational Reports

Global passenger demand (revenue passenger kilometers - RPKs) has also grown throughout the years, the average annual growth is 6.6 % globally and 15.9 % in Turkish Airlines since 2010 (Figure1.7).

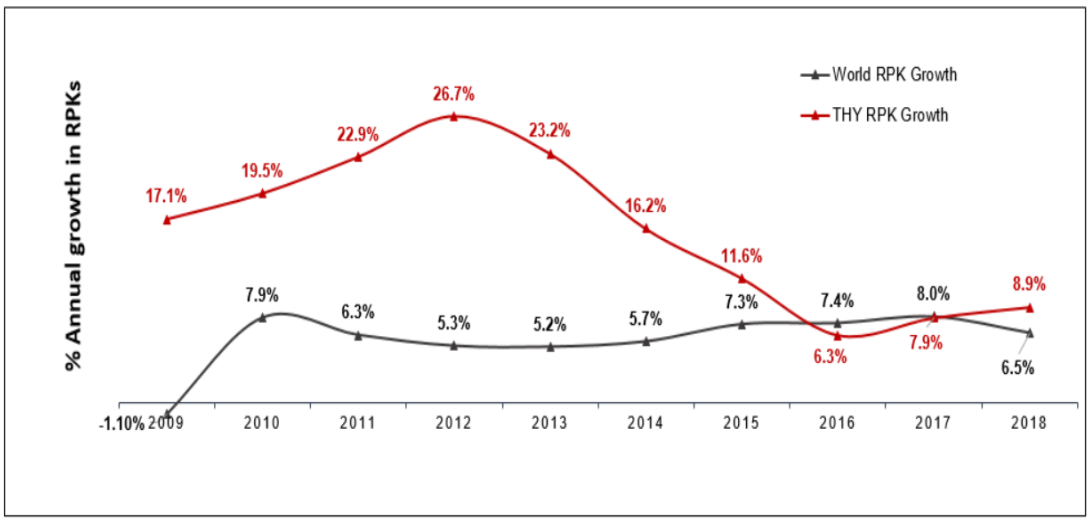

Figure 1. 7 Annual RPK growth:Turkish Airlines versus worldwide RPK growth rate

Source: Turkish Airlines Financial & Operational Reports

1.2. Objectives of the Study

Although the aviation industry contributes to a large extent the social and economic growth across the world, its growth rate has been highly affected by crises, showing a high degree of cyclicity in terms of financial and operational performance. In the airline industry, the balance between supply and demand is critical to the cycle of performance assessment. From a point of view, capacity flexibility has a significant function at the point where demand decrease. If the airline company cannot reduce the capacity while the demand below the expected value, probably the load factor rates of the aircraft will decrease. For this reason, the airline has to drop the prices of the ticket in order to increase the revenue of the passenger unit and to protect its position in the market. Thus, managing airlines means managing cycles (Hatty and Hollmeier, 2003). The challenge is to achieve a successful cycle over the long term; good results in the short term are not enough.

This study aims to investigate the impact of socio-political crises on the airline industry by focusing mainly on Turkish Airlines, the national flag carrier, over the period 2010-2018. The main motivation behind this study is that there is a gap in the literature in analyzing the impact of socio-political crises on the airline industry, especially in emerging markets. We believe that the topic is critical in managing the Turkish Airlines's operational performance at crisis periods since it gives clues to the managers about the efficiency of the company's operations and what strategic actions they should take. Finally, given that the demand for air travel has the effect of spreading to other industries, the decline in passenger demand affects not only the aviation industry but also many industries that connected the world economy more broadly. (Button, Lall, Stough, and Trice, 1999).

1.3. Aim and Scope of Research

Turkish Airlines is one of the high-quality international airline company in the global aviation industry. It has a strong brand value globally, creating an attraction for flying to Turkey and other destinations through Turkey. Thus, it is important to measure the significant impact of negative changes in the socio-political environment to find out how the performance of Turkish Airlines is affected by them.

In this study, we referred to the crises under the headings of political attack, restrictions imposed by other countries and relations with Russia. We discussed these incidences in Chapter 4. We also run a quantitative analysis of the airline-specific measures reported by Turkish Airlines to assess its operational performance from 2010 to 2018. We held the analysis on a regional basis covering Europe, Middle East, Far East, North America, Central and South America, Africa and Russia.

For operational analysis, we use airline-specific parameters such as revenue per kilometer (RPK), available seat kilometer (ASK), passenger load factor (PLF) and passenger carried (PC) as the key indicators. We expect this analysis to provide foresight about the management strategies of the Turkish Airlines by evaluating the size and direction of the effects of the events and revealing the measures that should be taken in the future to better manage crises in similar situations.

To run the analysis, we use time series iterative models to detect outliers and anomalies. There are certain points in the data set that do not fit the expected or natural behavior and these findings important for meaningful predictions to the efficiency of the methodology in the analysis of time series.

We compared these outlier points with the selected event dates for measuring the efficiency of algorithms.

The study is structured as follows. Chapter 1 provides an overview of the global airline industry, aim, and scope of the study and research question. Chapter 2 presents some facts for the global and Turkish aviation industry. Chapter 3 briefly reviews the literature. Chapter 4 provides the data, methodology, variables and describes important crises. Chapter 5 discusses empirical findings and finally, Chapter 6 concludes.

CHAPTER II

AVIATION INDUSTRY IN THE WORLD AND IN TURKEY

2.1. Progress of the Global Aviation Industry and Future Prospect for Turkey

Air transport provides tremendous benefits in economic, cultural and social dimensions to countries and it is one of the leader of global industries all over the world. The developments in the aviation industry increases the integration of countries. The growth in aviation varies depending on various qualifications structured by the economic and geographic characteristic of the region, including alternative modes of transportation, population and political factors among many others. As a result, the revenues of the airline companies are cyclically due to the close relationship between aviation, economic and political situations (Hätty and Hollmeier, 2003; Button, 2009; Franke and John, 2011).

When we refer to the statistics, air transport has doubled in size every fifteen years and has grown faster growth than most other industries. Airlines transport over four billion passengers annually, with RPKs reaching USD 8 trillion in 2017 (ATAG, 2017). The number of passengers has increased on average by 3.35% annually since 2010 and reached to 4.3 billion in 2018 (Figure 2.1).

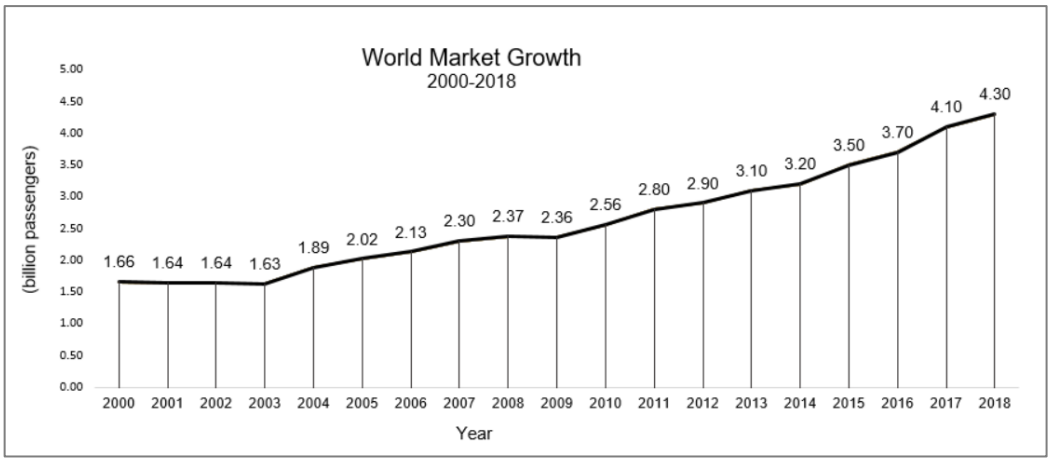

Figure 2. 1 Air passenger volumes in the world market

Source: Turkish Airlines Financial & Operational Reports

Despite this growth, the instability in global economical and political environment led by critical incidents such as economic crisis, trade wars, terrorist attacks, wars and political debates create tension and have detrimental effects on aviation industry. Figure 2.2 shows the history of world GDP growth and RPK growth relationship for the last half-century. As one may notice, despite various crises, aviation industry has continued to expand and demonstrate long-term resilience becoming an indispensable for transport.

Ongoing uncertainty about global and regional socio-political issues contributed to the first time for the RPK/GDP multiplier returning to its long-term median position since 2011. According to the recent forecasts, the number of passengers is expected to increase, but the slowdown in the RPK growth rate in recent years and the unpredictability about the global economic conditions in 2020 may include some downside risks in the near future.

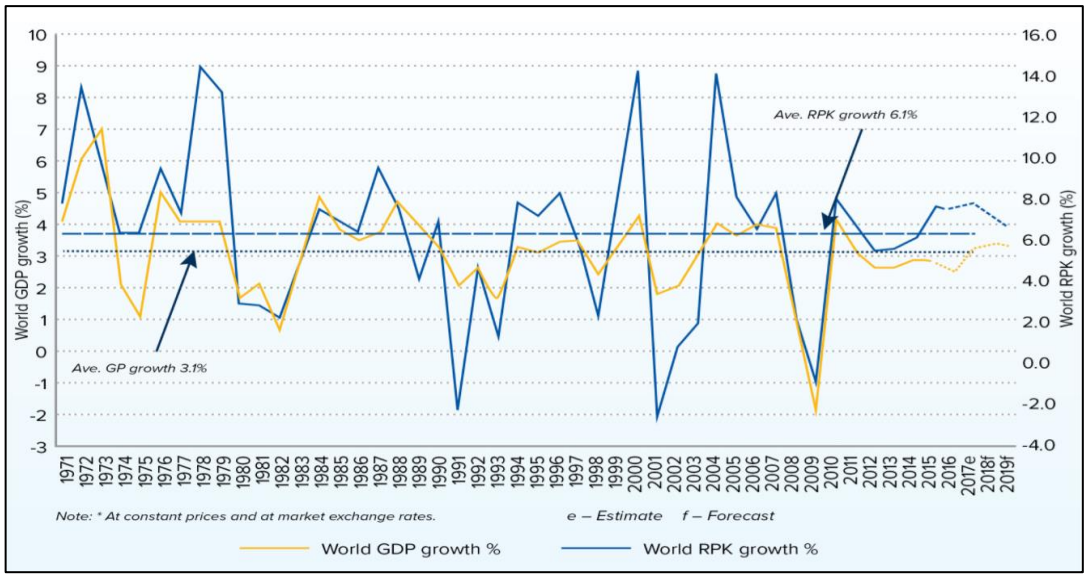

Figure 2. 2 Worldwide GDP growth* and RPK growth, 1971 to 2019f

Source: CAPA - Centre for Aviation, Airline Monitor, IATA, IMF.

There was also a significant change in air travel demand during the GFC in 2008-2009, followed by a steady increase until 2011, in other respects air cargo side shows more aggresive movements in demand between 2009-2011. Figure 2.3 shows the demand for air travel and air cargo for the last two decades. When we look at the trend line for the last decade, we observe that although the growth rate of both RPK and FTK (flight tonne kilometer) is slower, it is still above the growth of average RPK, which running well above trend. This trend may be slown down further as economic growth weakens and fuel prices rise in the forthcoming years.

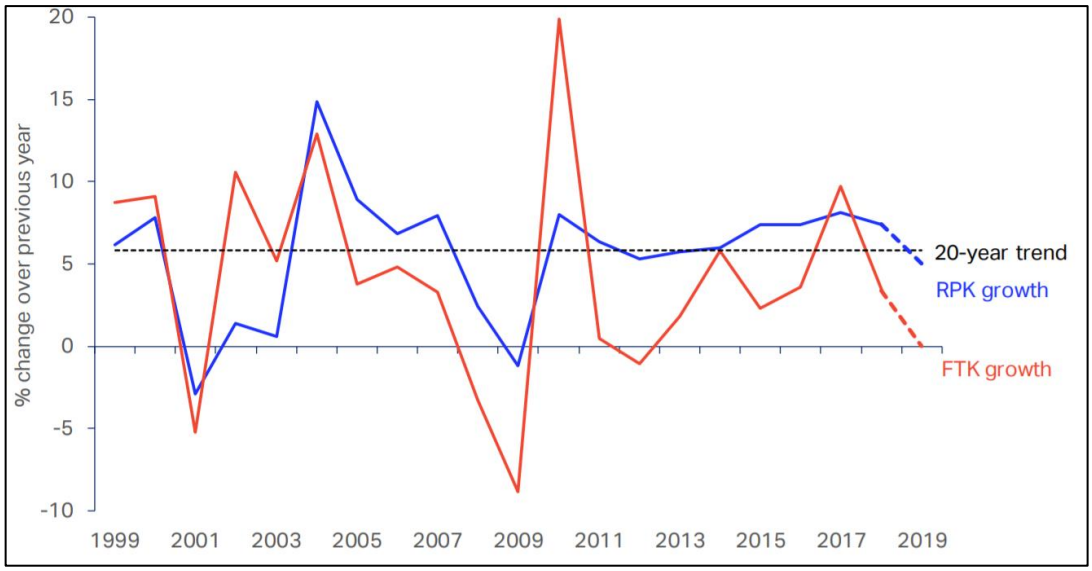

Figure 2. 3 Demand for air travel (RPK) and air cargo (FTK) growth versus trend

Source: IATA, Airline Industry Outlook, 2019

Another important fact is that about 20 years, the aviation industry has failed to produce returns that meet the average costs , until 2015. The fact that average ROIC are below WACC in airlines indicates that investors invest their capital in assets other than aviation with for higher returns. In other words, it shows that capital investors did not have the appropriate risk positions expected for invest in the airline sector until recent years. Although the returns of sector to 9% and the capital cost is 7.1%, ROIC qualification production that could meet the expected minimum level could not achieved. (Figure 2.4)

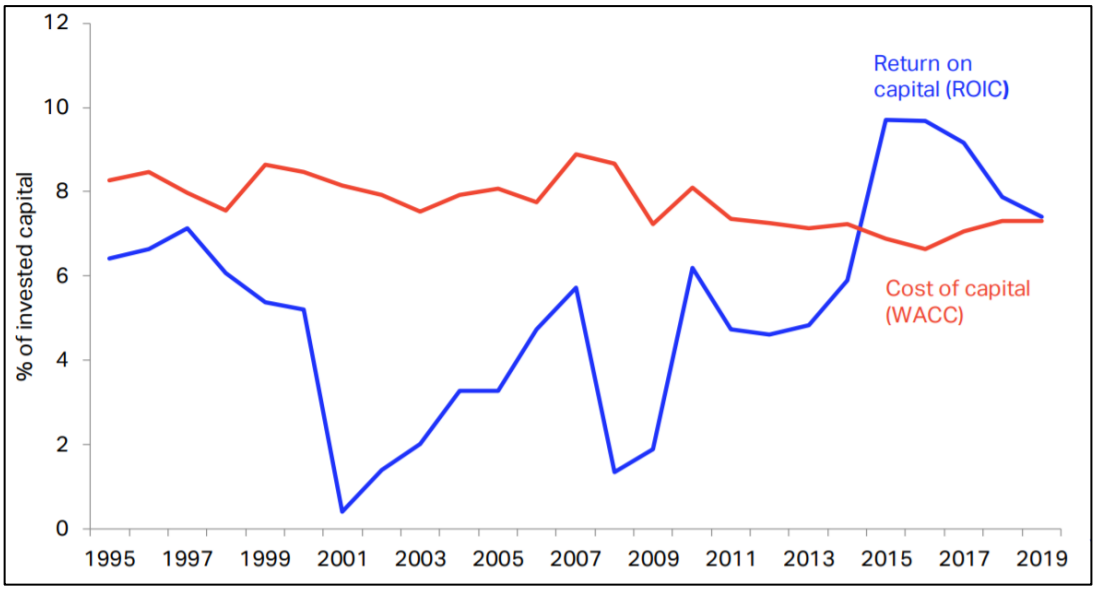

Figure 2. 4 Return on capital invested in airlines and their cost of capital

Source: IATA Economics (Economic Performance of the Airline Industry), Mid-Year 2019

Over the last 15 years, Turkey has also increased the number of annual passengers from 15 million to 210 million. Since Istanbul Airport is a major international transfer center, the number of international transfer passengers will increase further. The new airport is expected to become a global aviation hub, with flights to over 350 destinations around the world. When all four phases with six runways by 2028 are completed, the full annual capacity will be 200 million passengers. This potential will not only contribute to the global reputation of Istanbul as a city center, but also to the image of Turkey, with air transport becoming a door to people coming from different regions of the world. In particular, a large number of international flights to Istanbul will provide to the business and tourism potential in Turkey.

2.2. The Interaction of Airline Industry and Tourism

Many studies have revealed that a close relationship between tourism and business travel leads to strong development in airport capacities in developed and developing countries. More precisely, tourism accelerates the economy by providing employment

and makes a valuable contribution to the world economy. The analysis of the World Travel and Tourism Council revealed that growth in the aviation industry has recently been short-term but strong. According to the related report, a similar growth model will be formed with an average annual rate of 3.9% up to 2027. In light of these estimates, tourism is expected to constitute 11% of GDP and provide 380 million jobs globally until 2027.

Naturally, the growth in tourism is dependent on travel business, particularly air transport. Aviation is indispensable for tourism, particularly in developing countries at which the aviation industry creates a vital economic lifeline for communities. Visitors that arrive by air transport make expenditures creating an impact called "catalytic effect" in the economy. Thus, international air access help to improve the tourism industry. Globally, 57% of international tourists travel by air (ATAG, 2017). While the number of international passengers traveling by airlines was only 25 million in 1950, today this number has increased to 1.4 billion (Figure 2.5). Table 2.1 gives the number of tourists by region.

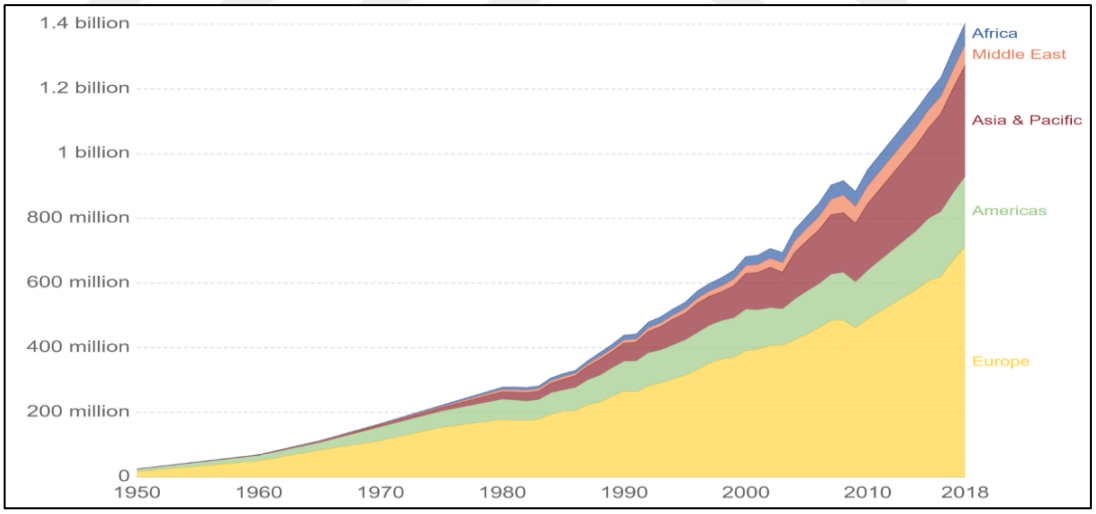

Figure 2. 5 International tourists by the world regions

Source: United Nations World Tourism Organization- World Tourism Barometer (2019)

Table 2. 1 International tourist arrivals by region

	International Tourist Arrivals (million)									Share (%)	Change (%)		Av. annual growth (%)
	1990	1995	2000	2005	2010	2015	2016	2017	2018*	2018*	17/16	18*/17	'10-'18*
World	438	531	680	809	952	1,196	1,241	1,329	1,401	100	7,0	5,4	5,0
From													
Europe	254.6	308.1	396.4	450.7	490.8	581.8	592.8	636.6	672.3	48.0	7.4	5.6	4.0
Asia and the Pacific	58.7	86.2	113.8	152.9	205.3	293.6	314.4	337.6	358.7	25.6	7.4	6.2	7.2
Americas	99.4	108.2	130.6	136.5	155.4	200.2	211.6	227.3	235.0	16.8	7.4	3.4	5.3
Middle East	8.2	8.5	12.8	21.5	33.5	39.7	36.3	36.8	40.6	2.9	1.5	10.2	2.4
Africa	9.8	11.5	14.9	19.4	28.3	36.0	39.6	42.5	45.5	3.2	7.3	7.1	6.1
Origin not specified[1]	7.6	8.7	12.0	28.4	38.3	44.2	46.4	47.7	49.0	3.5			
Same region	353.1	427.2	539.0	630.8	722.6	906.1	941.0	1.003	1.058	75.5	6.6	5.4	4.9
Other regions	77.7	95.3	129.5	150.2	190.6	245.1	253.8	277.6	294.2	21.0	9.4	6.0	5.6

Source: United Nations World Tourism Organization (UNWTO) (Data collected by UNWTO, July 2019)

[1] Arrivals that could not be allocated to a specific region of origin.

Table 2.1 presents data where the origin country of passengers were not reported or it is grouped under the "other countries of the world". While this is the case, any economic and political crisis may have a deteriorating effect on tourism through aviation industry. For instance, during the Asian crisis in 1997, the arrivals of fights considerably declined leading to a drop in tourism revenues by 6.9% in 1997 and 3.8% in 1998 as compared with 9.7% growth in 1996 (Sadi and Henderson, 2000). We also observed similar effects in GFC experienced in 2008-2009. Ispas (2010) stated that the growth in international tourist arrivals significantly decelerated due to GFC in 2008. After a 5% increase in the first half of 2008, the growth in international tourist arrivals became negative in the second half of 2008 (-1%). The final result was 2% growth for the full year – down from 7% in 2007, which was the fourth year of consecutive strong growth in the world tourism. Worldwide, international tourist arrivals declined by 8% between January and April 2009.

2.3. Aviation Industry and Economic Growth

Economic growth has also an important impact on civil aviation since it broadly influences the demand for air transportation services, which in turn, affects aircraft orders and deliveries. During periods of economic growth, companies build and

service new outlets, which lead to an increase in business travel. Additionally, family incomes generally rise resulting in greater spending on leisure travel. Yet, the reverse is true when there is an economic turmoil. In this case, businesses close facilities, unemployment rises, and air traffic declines.

Inflation is also a mediating factor since it effects economic growth. When prices are stable, interest rates tend to be low and this encourages investment and business expansion. When prices rise quickly and interest rates go up, it will inhibit economic activity, which can put a damper on air traffic. As high interest rates increase the borrowing cost, aircraft can put financing management in difficult positions.In addition, inflation can lead to increased labor and fuel costs. When this happens, airline companies face with the unpleasant options such as absorbing these higher costs or raising their fares. Fuel price has also a significant impact on the growth of air transport as it directly affects the cost base of airlines.

Last but not least, the expansion of air travel has a sensitive relationship with increasing and decreasing that confidence in the business world. It can be said, in 2019, the significant decrease in business confidence was the result of the effect of 2008 GFC, in this connection when the data are examined in recent year, it is seen gain of momentum of air traffic and the business confidence move in the positively and same direction. (Figure 2.6).

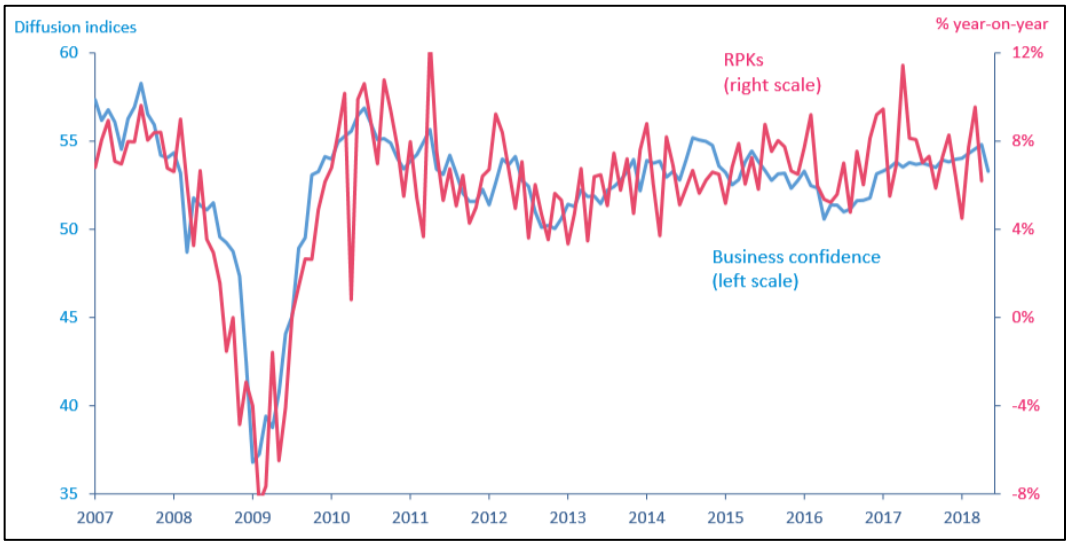

Figure 2. 6 RPK growth and global business confidence

Source: IATA Economics (using data from IATA Statistics)

2.4. The Effects of Crises on Aviation Industry

Since there is a synergy between global environment and the demand for air transport, aviation is negatively affected by any downturn. In the last two decades, as shown in Figure 2.7, economic and political crises have significantly affected the airline industry, the most remarkable events being the first Gulf War in 1991, the bird flu scare and Asian crisis in 1997, the September 11th terrorist attack in 2001, and GFC in 2008-2009 (Alderighi and Cento, 2004).

1991 was a year in which a crisis in aviation was catalyzed by Gulf war and aircraft hijacking threats. As of September 11, 2001, there was an economic recession in America in January 1991. The duration of the war lasted 2 months, and demand in the airline industry dropped by 30%. However, the geopolitical crisis was resolved in a short time. There was no aircraft hijacking incident and the drop in demand recovered. It took about 1 year to reach pre-crisis levels in the industry. (Hatty and Hollmeier, 2003).

The coincidence of the industry downturn and the terrorist acts of New York City and Washington, DC on September 11, 2001 had led the airline industry into its most severe crisis in history and challenged the crisis management capabilities of the world's airline leaders. On 11 September 2001, terrorists attacked the US through the hijacked civilian aircraft as weapons against the World Trade Center and the Pentagon. These events were the turning points that dramatically shooked the international system. After the September 11 attacks, the collapse of air traffic and passenger revenues caused serious economic uncertainty.

The recent cyclical downturn was the deepest crisis experienced by the commercial airline companies since the 1930s. High unemployment rate after the GFC of 2008 led the airline industry to experience its worst annual financial performance. Boeing and Airbus, which are aircraft manufacturers, faced a wave of cancellations and adjournments. Early 2009 marked the lowest point for international air travel markets. From the early-2008 peak to the early-2009 through, premium travel and economy travel fell by 25% and 9% respectively (IATA, 2010).

The effects of the GFC on the airlines in emerging markets had been less visible since the recession was later felt in these countries. As per IATA's data, the Asia-Pacific

region appears to have been hardest hit with a loss of 14.5% between June 2008 and June 2009, whereas there had been a drop of 4.7% and 5.9% in Latin America and Africa respectively.

In 2008, the rise in fuel costs to $ 187 billion played a major role that the operational costs increased to %33.This abrupt increase in fuel cost ratio had a significant impact on the airline industry net profit data during the GFC period. Figure 2.7 shows the effect of 2008 GFC on GDP. Since the main source of airlines income comes from tickets and freight, in 2008, the net profit of the airline companies has decreased importantly. This decline was not only connected to the decrease of number of passengers, but also to the fierce competition from low cost carriers serving now both economy and business segment. To fight with the crisis, the national airline companies decided to improve their board services and promote new destinations at accessible prices. The GFC had also caused a significant decline in the aviation industry investments.

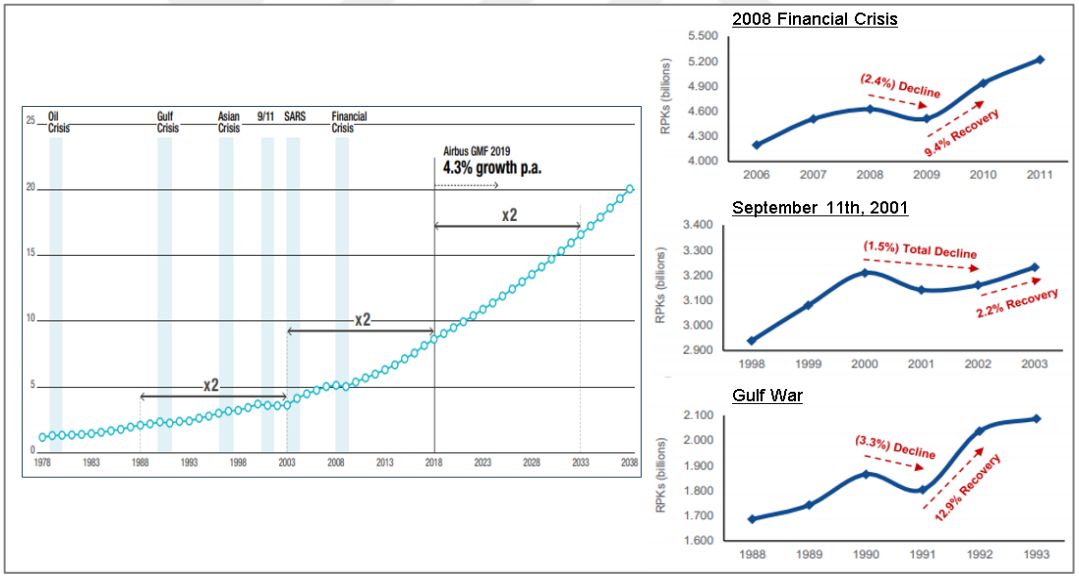

Figure 2. 7 Historical and Forecasted World Annual Traffic

Source: Airbus GMF 2019 & Turkish Airlines Presentations

* RPK: Revenue Passenger Kilometer

Figure 2. 8 The growth of global GDP versus average airline operating margin

Source: IATA Economics (data from ICAO, IATA Statistics, IMF)

All these incidents show that there is a strong relationship between politics, economy and aviation. Since the aviation is strongly cyclical the crises have the potential to influence the financial and operational performance of airline companies and the industries that support them. During these periods, some companies successfully managed the crisis, while others failed to do so.

The global and regional crises also affected Turkish aviation companies. During the GFC, Turkish Airlines responded to the crisis by investing in new aircrafts.

Table 2.2 shows the fleet of the Turkish Airlines since 2011. With the increasing demand in aviation, Turkish Airlines has planned to double the number of aircraft from 202 in 2012 to 487 in 2023 to manage the capacity problems in the future. Experts highly praised this investment decision since the Turkish Airlines made these purchases when aircrafts prices were at their lowest level.

Table 2. 2 Turkish Airlines fleet composition

		2011-2024 Aircraft Purchases														
		Delivered									Total Deliveries					
30.09.2019	Type	2011	2012	2013	2014	2015	2016	2017	2018	TOTAL	2019	2020	2021	2022	2023	TOTAL
Wide Body	A350-900											5	4	8	8	25
	B787-9										6	9	6	4		25
	A330-300	3	3	2	6	7	5			26						
	B777-3ER	7			4	7	6	1		25						
	Total	**10**	**3**	**2**	**10**	**14**	**11**	**1**		**51**	**6**	**14**	**10**	**12**	**8**	**50**
Narrow Body	B737-900ER	2	7	1		5				15						
	B737-9 MAX										1	9				10
	B737-800	2	2	6	10		20			40						
	B737-8 MAX								7	7	4	27	15	12		58
	A321	8	7	9		13	10			47						
	A321 NEO								2	2	13	15	29	18	15	90
	A319	6								6						
	Total	**18**	**16**	**16**	**10**	**18**	**30**		**9**	**117**	**18**	**51**	**44**	**30**	**15**	**158**
Cargo	A330-200F	1	1	2		1	2	1		8						
	B777F							2	3	5	1	2				3
	Total	**1**	**1**	**2**		**1**	**2**	**3**	**3**	**13**	**1**	**2**				**3**
	GRAND TOTAL	**29**	**20**	**20**	**20**	**33**	**43**	**4**	**12**	**181**	**25**	**67**	**54**	**42**	**23**	**211**
	YEAR END FLEET	**180**	**202**	**233**	**261**	**299**	**334**	**329**	**332**		**354**	**402**	**449**	**480**	**487**	

Source: Turlish Airlines Board Activity Report (Q'3 2019)

2.5. Airline Demand and Supply Interaction

Any capacity decision in the aviation industry triggers the interaction between supply and demand factors that ultimately lead to equilibrium change. Possessing the accurate knowledge allows the stakeholders to identify the best algorithm in their capacity for making changes in demand, and how these decisions affect airline demand and profitability (Wei and Hansen, 2005).

The relationship between air transport supply and demand also determines the allocation of airline resources to a specific route. The factors that affect air transport may be divided into two categories. First, the factors that have direct impacts on demand are; external demand shocks, economic decline, political and economic sanctions, competition from other modes of transport and civil unrest. Second, the demand may also be indirectly influenced by economic factors such as economic and institutional reforms, investments, exchange rate fluctuations, political and macroeconomic stability, and consumer demand (Ishutkina and Hansman, 2009). Table 2.3 shows the variables affecting the demand and supply in aviation industry.

Table 2. 3 Demand and supply variables in aviation industry

Airline Demand	
RPM/RPK (Revenue Passenger Mile/Kilometer)	RPM/RPK is a simple statistical way of measuring passenger demand. Passenger-km is a measure that expresses the passenger transport demand that occurs as it compares the number of passenger transported with the distance it is carried.
YIELD (Revenue per RPM)	Yield is the average fare per passenger per mile. Passenger revenue is calculated by multiplying the efficiency. Yield varies according to demand and supply factors. As the demand for air travel is seasonal, the yield is high in peak seasons.
RASM (Unit Revenue)	Revenue Per Available Seat Mile (RASM) is a unit of measurement used to compare the efficiency of various airlines. It is more comprehensive than total revenue - RASM, which takes into account all operating income, taking into account operating income rather than passenger income, is accepted as a favorite standard measurement unit by most airline companies and analysts following them

Airline Supply	
ASM/ASK (Available Seat Mile/ Kilometer - One aircraft seat flown 1 mile)	The most common measure of airline output is an ASK or (ASM)
CASM (Cost per Available Seat Mile/Unit Cost)	CASM is a unit of measurement used to compare the efficiency of airlines. It is calculated by dividing operating costs of an airline by ASM. Generally, the lower the CASM, the more profitable and efficient the airline.
ALF (Average Load Factor)	ALF presents the proportion of airline output that is actually consumed. To calculate this figure, one should divide RPMs by ASMs

Table 2. 3 Cont.

The basic airline profit can be shown as in the following equation:

$$Operating\ Profit = Revenues - Operating\ Expenses$$

$$Operating\ Profit = RPM \times Yield - ASM \times Unit\ Cost$$

Airline profit maximizing strategy is to increase revenues, decrease costs, but the above terms are interrelated. The use of shared individual terms for supply and demand can be misleading to measure the success of the airline in this profit equation. If the average load factor is too low, high yield is not desired. In general, yield is a weak indicator of airline profitability. Even the average load factor says very little about profitability by itself, because the high average load factor can be the result of extremely low fares (yield).

2.6. Future Prospect in Aviation Industry

The demand in aviation industry is a derived demand. Despite various geopolitical shocks, global air traffic has doubled every 15 years. Authorities expect that passenger demand will increase by 6.0% in 2019, marking the tenth year of trend growth in RPKs. As stated by the International Air Transport Association (IATA), current trends in air transport suggest that the number of passengers may double to 8.2 billion in 2037. Over the next two decades, the forecasts anticipate a 3.5% compounded annual growth rate (CAGR), leading to a doubling in passenger numbers from today's levels. Growth in this market is mainly driven by a combination of continued robust economic growth, improvements in household incomes, favorable population and demographic profiles (ATAG, 2017). Political and economic uncertainties constitute the gray points in the air transport industry forecasts.

2.7. A General Outlook to the Turkish Airlines

Turkish Airlines started its journey in 1933 with five aircrafts. Turkish Airlines, whose average fleet age is 8.2, has one of the youngest fleets in Europe. It carries cargo and passengers with 332 aircraft which serves with 218 narrow-body, 92 wide-body and 22 as a freighter. In 2019, Turkish Airlines operates with 351 aircraft. The substantial growth it has achieved put Turkish Airlines among the top airlines of the world. Turkish Airlines flies to 316 destinations in 126 countries (Figure 2.9).

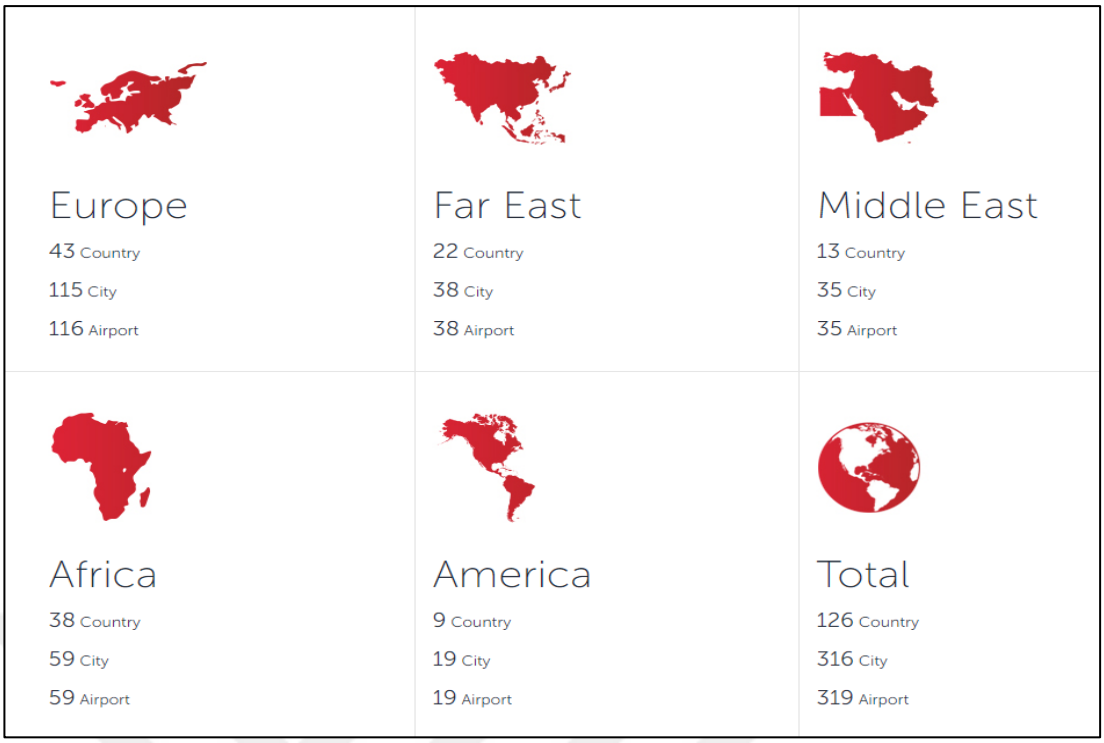

Figure 2. 9 Turkish Airlines' Network

Source: Turkish Airlines website

Reinforcing this prominent position and energy with its significant growth figures and innovative approach, the Turkish Airlines has always put its signature under important successes in the industry. In particular, the decision to order the aircraft in 2013 is an indication that it plans to protect its fleet age and also improve its service quality in the following years.

Turkish Cargo provides cargo transportation services to 306 points with its large fleet. The air cargo carrier, which evolved into a brand under the title of Turkish Cargo in 2000, carried a total of 1.4 million tons cargo in 2018.

Turkish Airlines has taken an important step in Turkish Civil Aviation with its maintenance and repair center opened at Istanbul Sabiha Gökçen International Airport in June 2014. The center that costed to USD 550 million added additional momentum to the industry growth in the region.

CHAPTER III

LITERATURE REVIEW

As many studies have pointed out there is a synergy between economic and political crises and traffic and revenues of airline industry. Since the demand for air transport is pro-cyclical any economic or political downturn strongly affects aviation (Hätty and Hollmeier, 2003; Franke and John, 2011). In the last two decades, we have witnessed several financial and socio-political crises that greatly affect the airline industry. The most spectacular examples are the first Gulf War in 1991, the Asian crisis in 1997, economic crisis and the September 11th terrorist attack in 2001, and finally the GFC in 2008. Many airlines across the world have struggled to cope with these unprecedented crises that they had very little control over. The uncertainty generated by these crises has usually accelerated the process of change in the aviation industry and has highlighted the need for adaptability.

Beside these crises, the airline industry is also widely impacted by regulations, restrictions and sanctions imposed on itself related to international trade, tax policy, and competition beside other issues like war, terrorism, and the outbreak of diseases - such as Ebola. These crises had considerable effects in the cyclical change of the aviation industry and influenced policies of airline companies (Goyal and Negi, 2014). Nolan, Ritchie, and Rowcroft (2004) stated that economic conditions have a strong impact on air travel demand, while unbalanced fuel prices and over-capacity also affect the profitability very much. Although there are several studies that analyze the effects of the different global crisis on the aviation industry, studies analyzing the effect of the regional and local crisis on aviation, especially in emerging markets, are limited.

To begin with, the currency crisis experienced in Asia in 1998 reduced the demand for the region's tourism and transportation industries, and East Asia and Pacific countries recorded the smallest growth in international tourist arrivals across regions. The destabilizing events in some countries had not only scared foreign tourists, but also weakened investments (Sadi and Henderson, 2000). Airports Council International (ACI) (2011) reported that in June 1998, the overall number of passenger movements for all of the Asia's main airports fell by 5.1% compared to the same month in the

previous year (Chin, Hooper and Oum, 1999). However, Asian airlines recovered from the crisis quickly by taking the necessary actions such as reducing their capacity, restructuring their networks and operations for efficiency and cost competitiveness and by joining the alliances.

Another crisis that had adversely affected the airline industry is September 11. Many studies have been held examining the effects of September 11 terrorist attack on the aviation industry (Guzhva and Pagiavlas, 2004). Most of these studies show that the September 11 crisis had a severe and widespread effect on airline and tourism industries (Blake and Sinclair, 2003; Gillen and Lall, 2003; Hatty and Hollmeier, 2003). The crisis led to subsequent collapse of air traffic and passenger revenues as well as to shutdowns of some airlines causing severe economic uncertainty. Global passenger traffic (tonne kilometers performed) declined by 2.7% in 2001. Global airline revenues decreased from USD 329 billion in 2000 to USD 307 billion in 2001 and further to USD 306 billion in 2002 (Table 3.1). US passenger traffic, measured by RPKs (number of travelers multiplied by the distance traveled) declined 5.9% in 2001 (compared to 2000) and a further 1.4% in 2002. Despite the substantial government assistance, the US airlines posted total losses of USD 17.7 billion in 2001 and 2002 (Arndt and Zellner, 2004).

Lai and Lu (2005) investigated the effect of September 11 by using Seasonal Autoregressive Integrated Moving Average (SARIMA) methodology over the period 1997-2002 and found a temporary long-term impact**.** Ito and Lee (2005) assessed the impact of the September 11 terrorist attacks and its after-effects on the US airline demand by using monthly time-series data from 1986 to 2003 and found that September 11 resulted in both a negative transitory shock of over 30% and a negative demand shock amounting to roughly 7.4% of pre-September 11 demand. They claimed that this demand shock can not be explained by economic, seasonal, or other factors. It took three years to recover USD 22 billion revenue drop (6%) between 2000-2001.

The GFC in 2008 had also seriously affected aviation industry around the world and had led the industry into recessionary environment a second time within a decade. Indeed, the beginning of 2019 was determined the lowest score in the market of international aviation. From the beginning of 2008 to the end of the year, premium travel and economy travel down by 25% and 9% respectively (IATA, 2010).

The GFC affected employment in aviation straightly, resulting caused of significant job losses . However, social turmoil also occurred. The regression of economic effected negatively the investments in the industry of aviation. The crisis had led to a decline in travel industry since people were travelling lesser by preferring cheaper alternatives, i.e. low-cost carriers. The crisis also adversely affected the profitability of the aviation industry in this period due to inefficient use of aircraft capacity, passenger load factor and increasing unit costs. Revenues of the airline companies fell USD 82 billion to USD 482 billion in 2009. In percentage terms, this 14% drop was more than twice of the decline in 2001-2002 (Table 3.1). Airlines and airports started to offers high standard services to attract new segments of travelers.

Table 3. 1 Variability of airline companies financial perspective (2000-2011)

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011†
Revenues ($ billion)	329	307	306	322	379	413	465	510	564	482	554	598
Passenger growth %*	8.6	-2.7	1.0	2.3	14.9	7.0	5.0	6.4	1.5	-2.1	7.3	4.4
Passenger numbers (millions)	1,828	1,793	1,792	1,849	2,064	2,211	2,328	2,497	2,507	2,479	2,681	2,793
Crude oil price (Brent) $/b	28.8	24.7	25.1	28.8	38.3	54.5	65.1	73.0	99.0	62.0	79.4	110.0
Jet Fuel price $/b	36.7	30.5	29.1	34.7	49.7	71.0	81.9	90.0	126.7	71.1	91.4	126.5
Net profit ($ billion)	3.7	-13.0	-11.3	-7.5	-5.6	-4.1	5.0	14.7	-16.0	-9.9	18.0	4.0
Margin %	1.1	-4.2	-3.7	-2.3	-1.5	-1.0	1.1	2.9	-2.8	-2.1	3.2	0.7

* Tonne Kilometers Performed
† Projected forecast

Source: IATA, 2010

As Dobruszkes and Hamme (2011) stated, most of these studies contribute to the impact analysis of the economic and political crises on airline industry, often focusing to their impacts in limited segments of the airline market. But very few researches have been held providing a socio-political analysis of the regional or local crisis.

A good example may be the crisis experienced by Qatar Airways (QA). In June 2017, Bahrain, Egypt, Saudi Arabia and the United Arab Emirates (the G4) broke off the

diplomatic ties with Qatar, after that, imposing restrictions on fly to/from country Qatar citizens in relation to the State of Qatar.

The crisis had several implications and impacts on the passenger and air cargo traffic of and through into/out the GCC. To give an average figure, before this political dispute, QA, which performed around 56 flights per day to the G4, to manage the cancellation of excess flight rights across G4, QA had to adjust the flight network according to the situation, increasing flight times and fuel costs.

Overnight, QA had to drop 18 regional routes to the G4. Along with the blockade came airspace restrictions. This included Dubai which a very busy route with more than 20 flights daily to each direction. The blockade also brought airspace restrictions with it. Neighboring Saudi Arabia and Bahrain banned Qatar planes from crossing airspaces, further isolating Qatar and forced KG to take long periods in Iranian airspace. Some routes have extended flight times over an hour.

This turbulence has inevitably had an impact on the financial results. QA had substantial losses for the 2017/2018 financial year, after earning USD 540 million in 2016/2017. Following the flight cancellation of 18 Middle Eastern destinations, with some aircraft grounded, after the restrictions, QA added 14 new routes to flight network and continued its growth plan in other region. Despite this effort, operating costs have increased dramatically, placing an additional burden. QA reported a USD 69 million loss in the 12 months to the end of March 2018, marking a sharp reversal of fortune compared to the year before when it had posted a profit of USD 770 million. The loss comes even though the QA had a 14 percent increase in revenue at USD 13.2 billion. QA hit a wave of turbulence in the first quarter of 2019, posting a net loss of USD 639 million for the first three months of the year.

The aforementioned example clearly shows that regional or local crises may have considerable effects on the operational and financial performance of airline companies. Thus, the geography of the crisis is quite important in identifying and reflecting deviations to highlight the implications of the crises. Indeed, in this study we work out with the assumption in regions where the crisis is occured aviation is closely related to the impact it has on the country’s policies. On this respect, we attempt to investigate how the Turkish Airlines have been affected from socio-political crises.

CHAPTER IV

DATA AND METHODOLOGY

4.1. Sample

In order to explain the dynamics of Turkish Airlines, we used socio-political events (Gezi Park, the shooting of the Russian military jet, the attempted military coup and electronic device ban) as independent variables and the change in company-specific factors as dependent variables. We got company-specific monthly time-series data for the Turkish Airlines from their database. We focused our analysis on both domestic and international travel from January 2010 to December 2018 and conducted it on a regional basis.

To conduct the financial performance analysis, we used quarterly financial statements of the Turkish Airlines obtained from the Public Disclosure Platform (PDP). Further, to measure the market performance of the company, we took the Turkish Airlines monthly stock prices and monthly brent oil prices from Bloomberg.

4.1.1. Independent Variables

The purpose of our research is to determine whether there is any structural impact the socio-political crises have had on Turkish Airlines. As one may apparently guess socio-political turmoils usually have detrimental effects on the air traffic. Given its geopolitical location, we have witnessed a number of noteworthy events in Turkey from 2010 to 2018, including but not limited to the attempted July 15 coup, terror attacks and the getting more weak of diplomatic relations with Russia, In this study, we analyzed the impact of the selected events on the operational performance of the Turkish Airlines. The following part describes the events that have taken place during the last decade. Among many events, we then mainly focused on Gezi Park (May 26-June 16, 2013), the shooting of the Russian military jet (November 24, 2015), the

attempted military coup (July 15, 2016) and electronic device ban by U.S. and UK (March 25, 2017).

i) May 26 - June 16, 2013 / "Gezi Park"

A wave of demonstrations and civil unrest in Turkey began on May 28, 2013, initially to contest the urban development plan for Taksim Gezi Park in Istanbul.

ii) August 10, 2014 / Presidential Election

Turkey held presidential elections on August, 10 2014 to choose the 12th President. Incumbent Prime Minister, Recep Tayyip Erdoğan was elected outright with an absolute majority of the vote in the first round.

iii) November 24, 2015 / Shooting of the Russian Military Jet

A Turkish Air Force F-16 fighter jet shot down a Russian Sukhoi Su-24M attack aircraft near the Syria-Turkey border on November 24, 2015. In a statement made by the U.S. Department of State, confirmed that the aircraft violated Turkish territory during the flight period, and that the Turks were given more than one warning to pilots and did not receive a response, and they published the audio recordings of the warnings they issued.

iv) June 28, 2016 / Attack on Istanbul's Atatürk Airport

A gun and bomb attack on Istanbul's Ataturk airport had killed 42 people, at least 13 of them foreigners, and injured more than 230.

v) July 15, 2016 / The Attempted Military Coup

Since its establishment, the Turkish Republic has witnessed military intervention in politics, and seen four coups - two of them forced a change of government. They all had grave consequences, and shattered many lives. However, none of them is similar to the one witnessed on the night of 15 July 2016, where a coup d'état attempted in Turkey against state institutions, including the government and President Recep Tayyip Erdoğan. The attempt was carried out by a faction within the Turkish Armed Forces. Within a few hours, during which there were gunshots at the presidential palace - the Turkish National Intelligence unit claimed the coup was over. 290 people were killed and more than 1,400 people were injured.

vi) December 19, 2016 / Russian Ambassador was assassinated

Andrei Karlov, the Russian Ambassador to Turkey, was assassinated by Mevlüt Mert Altıntaş, a Turkish police officer, on December 19, 2016.

vii) March 25–July 5, 2017 / Electronic Device Ban by the US and UK

The US and UK announced that laptops, e-readers and any other electronic devices that are not a phone will be banned from cabin luggage on some flights on March 25, 2017. The US applied that rule to 10 airports and the UK to six - including Turkey and middle-eastern countries. Since the decision taken by the US on March 25, 2017, indirect flights from Morocco, Egypt, Jordan, Saudi Arabia, Kuwait, Qatar, the United Arab Emirates, and Turkey to the US and UK they transported the large electronic devices except cell phones in the cabin banned. The ban was purely political and had nothing to do with flight safety. Turkish Airlines, flying to 5 different destinations in the UK and 9 in the US, was one of the most affected airlines by the implementation of the decision. It ensured that all passengers and baggage were individually searched by a private security company structured under the rules of national and international organizations (ICAO, TSA, ECAC, MSHGK) on all US flights before the start of the relevant application.

The devices could only be carried in cargo. Following the arrival of flights from the countries covered by the ban, all baggage transported in the cargo was checked again by Transportation Security Administration (TSA) officials. From March 25 to July 5, 2017, when the US and UK implemented the sanctions, there were 1087 trips to the US for 102 days and 81,736 devices were delivered from the passengers one by one at the gates and carefully transported with special baggage. Among them, 75% of these devices were laptops and tablets and 25% were the camera, GPS, etc. During the sanction period, Turkish Airlines aircrafts were controlled more than other airlines flying to the US. The observations are shared below:

- Turkish Airlines was one of the 25% of the monthly flights that were subject to extra security searches at the New York station.
- The extra security search on flights to Los Angeles and Washington was carried out once a week for Emirates, Qatar and Etihad and twice a week for the Turkish Airlines.

- The extra security search for flights to Houston included one out of every 7 flights for Emirates and Qatar and 3 of every 7 flights for Turkish Airlines.
- At Miami station, while 2 out of the 7 flights of Qatar Airways were subject to additional security, 3 of the 5 flights of the Turkish Airlines were subject to the same process.
- At San Francisco station, while 1 out of 7 Emirates flights was subject to additional security, 2 of the 7 flights of Turkish Airlines were subject to the same process.
- At Boston Station, an extra security call on a monthly basis was implemented in Emirates and Qatar Airways on two flights, and this number was 5 flights for the Turkish Airlines.
- At Chicago station, 2 out of 7 Turkish Airlines flights were subject to the additional security check.

Precautions for Managing the Prohibition

In a short time period after the implementation of the decision, the Turkish Airlines made an announcement about the prohibition and provided information to all flight points, and ensured that officials took necessary actions in all the US and UK stations to meet customer satisfaction. Special luggage for the devices was produced because of large electronic devices and special laptops were designed for business class passengers. Additionally, Turkish Airlines provided free WI-FI service to the passengers during the flight. The devices within the scope of prohibition were handled with special care at boarding and they were delivered to the passengers by signature.

The Negative and Positive Effects of the Restrictions

Turkish Airlines has witnessed a couple of negative effects after the announcement of the ban. The passengers who already bought their tickets changed them. Due to the detection and control of the electronic devices and the implementation of the security procedures, waiting times during the check-in and boarding had a negative effect on the departure of the flights on time. Considering the length of travel time (10 hours and above for US, 4 hours for UK), especially those traveling for business purposes were deprived of their work. In the case of flights to the US, where additional security control was applied, the normal baggage delivery times were extended from 1 to 1,5 hours due to the fact that all baggage was scanned again with the ETD and K-9 in a

remote location away from the terminal. Due to the long duration of the baggage received on arrival, passengers were victimized by missing connection, which brought additional costs to Turkish Airlines. This effect is called *"hassle factor"* (Ito and Lee, 2005). In a few cases, devices carried in cargo were damaged. In some US stations, passengers forgot to take their devices.

As to the positive effects, the Turkish Airlines staff got experience in how to manage the process in similar cases. With the implementation of the ban, Turkish Airlines developed an immediate solution in a 2-days period to meet passenger satisfaction. In a very short time period, they designed special boxes for safe and undamaged transport of the devices. They also provided IPAD to the Business Class passengers for using it during the flight.

4.1.2. Dependent Variables

Literature about measurement metrics of airline performance has developed. While Schefczyk (1993) proposes to use published non-financial information to evaluate the performance of airlines, Dresner (2002) classifies metrics as assessing productivity, cost efficiency, profitability, and customer service. In many studies, RPM (revenue-per-passenger miles has been used as a common measure of performance, in which harmonized financial and operational information.(Guzhva and Pagiavlas, 2004).

In this study, we use secondary data sources to hold the analysis over the period 2010-2018. Secondary data will likely provide the main source to answer research questions and achieving goals (Saunders et al.). To elaborate on the impact of socio-political crises, we defined selected events and measured their effects on some key variables to the airline industry such as available seat kilometers (ASK), revenue passenger kilometers (RPK), passenger load factor (PLF), number of carried passenger. These variables largely express the scope of airlines operations. Furthermore, because domestic/international and interregional air services shows different behave in time of crises, we also analyzed the value of regional parameters. Table 4.1 presents the descriptions of the dependent variables.

Table 4. 1 Definition of the dependent variables

Variable	Definition
Available Seat Kilometers (ASK)	ASK represents the number of kilometers that the airline has flown with its available seats, regardless of whether the seat is filled by a passenger or not. ASK = Number of seats per aircraft × Flight distance
Revenue Passenger Kilometers (RPK)	RPK represents the number of kilometers that revenue passengers fly on the airline. It is a measure of revenues and demand. While ASK does not differentiate between whether the seat is occupied or not, RPK includes only seats occupied by revenue passengers. RPK = Number of revenue passengers per aircraft × Flight distance in kilometers
Load Factor (LF)	LF is simply the proportion of an airline's seats filled by revenue passengers. In other words, LF is a measure of capacity utilization. LF = RPK / ASK
Number of Passengers	Total number of passengers carried

4.2. Methodology

To analyze the impact of socio-political events on the dynamics of aviation, we used algorithms by employing company-specific parameters as dependent variables and selected events as independent variables. Since there is a significant seasonality and cyclicality in the aviation industry and that this may have impacted the demand, we eliminated the seasonality and cyclicality effect in implementing algorithms. For this purpose, we used the seasonal decomposition algorithm with moving averages. We employed the multiplicative model of time series given below:

$$y(t) = \text{Level} * \text{Trend} * \text{Seasonality} * \text{Noise}$$

After eliminating the seasonality and trend effects, we looked at whether there exists any outliers/anomalies. We defined anomalies as unexpected behaviors. Tiunov (2017) formulated the anomaly detection problem for time series as finding outlier data points relative to some standard or usual signal. Though there are many types of anomalies, in this study, we refer to the responses to socio-political crises by focusing only on the selected ones. After analyzing the outliers/anomalies, we matched those extreme points with the dates of selected events. To detect the outliers/anomalies we used the following four algorithms:

1. Outlier Detection Algorithm
2. Breakout Detection Algorithm
3. Change Point Detection Algorithm
4. Causal Impact Analysis

4.2.1. Outlier Detection Algorithm (ODA)

We first adopted the ODA model proposed by Chen and Liu (1993). We detected outliers/anomalies with ARIMA which is a time series forecasting model initiated by Box and Jenkins (1970). It is not only a simple method but also powerful enough to predict signals and find anomalies. The process is an iterative one. At the end of each iteration, the residues are adjusted for outliers detected at this stage. The process is repeated until no more extractor can be found or the maximum number of iterations is reached. The algorithm uses five types of outliers iteratively in the time series data:

- Additive Outlier (AO)
- Innovation Outlier (IO)
- Level Shift (LS)
- Temporary Change (TC)
- Seasonal Level Shift (SLS)

Assume that there are k outliers and then we calculate the combined effect as follows:

$$X_t = \sum_{i=1}^{k} L_i(B)\delta_0 I_t^{(T)} + \varepsilon_t$$

Where ε_t follows the ARIMA process, δ_0 is the initial impact, I_t =1 when t=T zero otherwise.

$$\text{IO:}\quad \hat{e}_t = \omega I_t(t_j) + a_t\,, \qquad \text{AO:}\quad \hat{e}_t = \omega\pi(B)I_t(t_j) + a_t\,,$$

$$\text{LS:}\quad \hat{e}_t = \omega\frac{\pi(B)}{1-B}I_t(t_j)a_t\,, \quad \text{TC:}\quad \hat{e}_t = \omega\frac{\pi(B)}{1-\delta B}I_t(t_j)a_t\,.$$

- Additive Outlier (AO): $L(B) = 1$
- Innovation Outlier (IO): The error is effected, $a_t' = a_t + w_I P_t^{(T)}$
- Level Shift (LS): $L(B) = \frac{\delta_0}{1-B}$
- Temporary change (TC): $L(B) = \frac{\delta_0}{1-w_1 B}$, $0 < w_1 < 1$
- Seasonal Level Shift (SLS): $L(B) = \frac{1}{\nabla_s}$ or in general Seasonal Outliers, $L(B) = \frac{1}{1+B+B^2+B^{s-1}}$

Except for an I_0 case, the effects of outliers on the series are independent of the model. The AO and LS are two boundary cases of a TC, where δ= 0 and δ = 1. For a TC, the outlier produces an initial effect ω at time t_1, and this effect fades away slowly with time. The parameter δ is designed to model the pace of the dynamic dampening effect. In practice, the value of δ can be specified by the analyst. We set δ = .7 to identify a TC. In the case of an AO, the typical value causes an immediate effect and a shot in the series observed. An LS produces a dramatic and permanent change in the series.

4.2.2. Breakout Detection Algorithm (BDA)

BDA detects changes in time series. It is described as an E-Divisive with Medians (EDM), which dissociate a time series into a series of segments of one of three types: Steady-state; The time series follows a fixed mean (with random noise around the mean), Mean shift; The time series jumps directly from one steady-state to another and ramp up/down. Using the EDM algorithm changes in the mean are detected using statistically robust methods (Nicholas *et al.*, 2016). The statistical distance between probability distributions has measured the discrepancy between the parameters, mean or median and to check for equality in distributions (Szekely and Rizzo, 2013). The time series transitions take place linearly from one steady-state to another over a fixed period of time.

The ability of these algorithms to decompose the data into seasonal and autocorrelative components may provide a more rigorous evaluation of trends, compared to simply comparing a single data point to an average of the prior data as is the case with traditional methods. EDM uses robust statistical metrics, viz., median, and estimates the statistical significance of a breakout through a permutation test and it is also non-parametric. The algorithm uses a permutation test to recursively determine section and the point of change recursively. The advantages of the algorithm shared below. (Zhang, 2018):

- On contrary to the mean, it uses a movable median that is resistant to the presence of abnormalities.
- Can detect both 'mean shift' (sudden change) and 'ramping' (gradual change) for multiple change points
- Takes a non-parametric approach, meaning the model will adapt to the data's underlying distribution and can find when the distribution changes
- Fast due to the usage of interval trees that efficiently approximates the median.

When estimating the location of a change point, we used the following formula:

$$\widehat{\mathrm{Q}}(X_n, Y_m;\ \alpha) = \frac{mn}{m+n}\hat{\mathcal{E}}(X_n, Y_m;\ \alpha)$$

It denotes the scaled sample measure of divergence based on Euclidean distances between sample elements for multivariate distributions based on U-statistics. This statistic leads to a consistent approach for estimating change point locations.

Let $Z_1, \ldots, Z_T \in R^d$ be an independent sequence of observations and let $1 \leq \tau < \kappa \leq T$ be constants.

Then, we define the following sets, $X_\tau = \{Z_1, Z_2, \ldots, Z_\tau\}$ and $Y_\tau(\kappa) = \{Z_{\tau+1}, Z_{\tau+2}, \ldots, Z_\kappa\}$.

A change-point location $\hat{\tau}$ is then estimated as

$$(\hat{\tau}, \hat{\kappa}) = \underset{(\tau, \kappa)}{argmax}\, \hat{Q}(X_\tau, Y_\tau(\kappa); \alpha)$$

To estimate multiple changepoints, we should iterate that statement (Matteson&James, 2013).

4.2.3. Change Point Detection Algorithm (CPDA)

Let us assume we have an ordered sequence of data, $y_{1:n} = (y_1,...,y_n)$. A changepoint is said to occur within this set when there exists a time, $\tau \in \{1, \ldots, n-1\}$, such that the statistical properties of $\{y_1,...,y_\tau\}$ and $\{y_{\tau+1},...,y_n\}$ are different in some way. Extending this idea of a single changepoint to multiple changes, we will have a number of changepoints, m, together with their positions, $\tau_{1:m} = (\tau_1, \ldots, \tau_m)$. The position of each change point is known to be an integer between 1 and n-1. We define $\tau 0 = 0$ and $\tau m+1 = n$, and assume that the changepoints are ordered so that $\tau i < \tau j$ if, and only if, $i < j$. In conclusion, the m changepoints will divide the data into m + 1 segments, with the ith segment comprise data $y(\tau i-1+1):\tau i$. Each section summarized by a series of parameters. The parameters associated with the ith segment will be expressed$\{\theta i,\varphi i\}$, where φi is a (possibly null) set of nuisance parameters and θi is the set of parameters that we believe may be changes in content.

The most known approach to adjust multiple changepoints in the literature is to minimize

$$\sum_{i=1}^{m+1} \left[\mathcal{C}(y_{(\tau_{i-1}+1):\tau_i})\right] + \beta f(m).$$

where C is a cost function for a segment e.g., negative log-likelihood and βf(m) is a penalty to guard against overfitting (a multiple changepoint version of the threshold c). This is the approach, which we adopt in this paper and the accompanying package. A brute force approach to solve this minimization considers 2^{n-1} solutions reducing to 2^{n-1} if m is known. There is often an obvious changepoint at (or by) a time-point s. This explains that the last change point for any T>s cannot be at the time of t <s. In this way, by finding the search step we can abstain searching in cases where t <s.

Adding a change point reduces the overall cost.Assumption:

This means that for t < s < T:

C(yt+1:T) ≥ C(yt+1:s) + C(ys+1:T)

While this applies to costs based on negative log-probability, it can generally be achieved for negative log-marginal-probability-based costs.

Let 0 < t < s < T

Theorem:

If F(t) + C(y(t+1):s) < F(s)

then at any future time T > s, t can never be the optimal last changepoint prior to T.

The circumstances in the theorem mean that for any T > s the best section which includes a changepoint at as will be better than one which has [t, T] as a single segment. Calculation time is expected to be greatly reduced if many t pruning is done and excluded from minimization. The expected computational complexity can be proved to be O (n) under certain conditions. As the most important condition, the number of change points has been increased linearly with n.

If many t cut off is done and excluded from minimization, the calculation time will be greatly reduced. Under certain regularity conditions, the most important condition to

prove that the expected computational complexity will be O (n) is that the number of change points increases linearly with n.

This is natural in many applications. At larger time intervals, time-series data or genomic data is collected in larger regions of the genome.

This is considered usual in many applications. Such as time-series data at larger time intervals or collection of genomic data in larger regions of the genome.

4.2.4. Causal Impact Algorithm (CIA)

The causal impact algorithm applies an approach to predict the causal impact of an intervention in the time series. As with all non-experimental approaches to causal inference, valid conclusions require solid assumptions. In case of causal impact, we assume that there is a set of control points established which not affected by the intervention. If they were, we could underestimate or falsely overestimate the true effect. We can incorrectly conclude that there was an effect, although there was not in reality. The model also assumes that the relationship between the variables of current and previous periods remain stable.

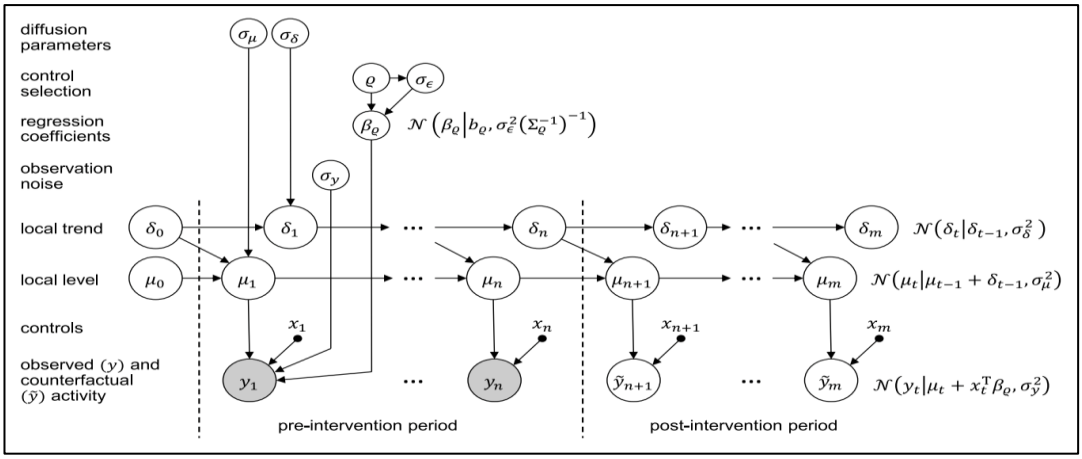

Figure 4. 1 Model for Causal Impact Algorithm

Source: Brodersen, Gallusser, Koehler, Remy, and Scott (2015)

The causal impact function needs at least three arguments: data, pre-period, and post-period. The easiest way to perform a causal analysis is to provide only the series where the intervention was performed as input data and specify the frequency of seasonality

in the parameter of the model. This is equivalent to specifying a local level model with a seasonality component.

Figure 4.1 shows the state-space model of the causal impact algorithm. At this model, the observed activity of market; $y1 : n = (y1 , ... , yn)$ is modeled as a result of Gaussian observation with standard error deviation σy. The state αt includes a local position μt, a local linear trend δt, and a set of simultaneous covariates xt, scaled by regression coefficients βQ. State components are assumed to evolve according to independent Gaussian random walks with constant standard deviations σμ and σδ.The model includes empirical priorities about these parameters and their initial states. In an alternative formulation, the regression coefficients β are themselves subject to random-walk diffusion. The main area of interest is the intensity of posterior prediction on over the unobserved counterfactual responses $\tilde{y}_{n+1},..., \tilde{y}_m$. Subtracting these from the actually observed data $y_{n+1},...,y_m$ yields a probability density over the temporal evolution of causal impact (Brodersen, Gallusser, Koehler, Remy, and Scott, 2015)

CHAPTER V

EMPIRICAL FINDINGS

Among many socio-political events, we run the analysis to measure the significance of the most prominent ones on firm-specific operational parameters for Turkish Airlines. These events, by chronological orders, are; Gezi Park (May 26-June 16, 2013), shooting of the Russian military jet (November 24, 2015), the attempted military coup (July 15, 2016) and electronic device ban by US and UK (March 25, 2017). We held the analysis for each event separately by employing the four algorithms defined in the methodology. In the analysis, we modeled RPK, PLF and ASK independently to see how the events affected each operational performance parameter.

First, we look at the changes in the measured parameters over the period 2010-2018 in Turkish Airlines. Figure 5.1 shows the annual growth rates in passenger air traffic, measured by RPK. The average annual growth is 13% for domestic and 16-17% for international flights. However, there is considerable variation from year to year in both domestic and international lines. Further, there is a steady decrease in the international flight growth rate from 2013 to 2016.

To measure the efficiency, we used ASK as an indicator of capacity produced, the amount of output generated per input unit. As shown in Figure 5.2, ASK changes in the same direction as RPK does on domestic flights. However, ASK has more sharp ups and downs in international flights compared to RPK.

We used PLF to measure aircraft capacity utilization, indicating the number of passengers with available seats as a percentage. As Figure 5.3 shows, the PLF is 81.9% in 2018. However, we observe an interesting trend in PLF throughout the last decade. It increases from 2011 to 2013 and then shows a concave decrease from 2013 to 2016 due to decreases in international flights. It was just at its lowest level of 74.5% in 2016. It is not surprising that most of the events we analyzed took place at that time span.

Figure 5.4 shows the annual rate of change in PC over the period 2010-2018. While the total passenger growth declined in 2016, the negative impact of the events on the growth of domestic passengers was sharper in 2015.

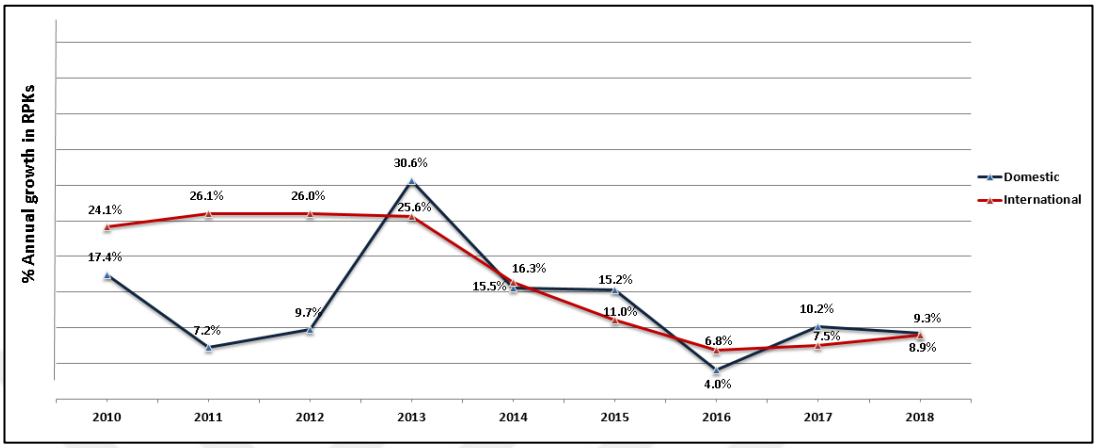

Figure 5. 1 Turkish Airlines annual RPK growth rates (2010-2018)

Source: Turkish Airlines Company Traffic Reports

***This data includes only scheduled flights, excluding hajj and charter flights**

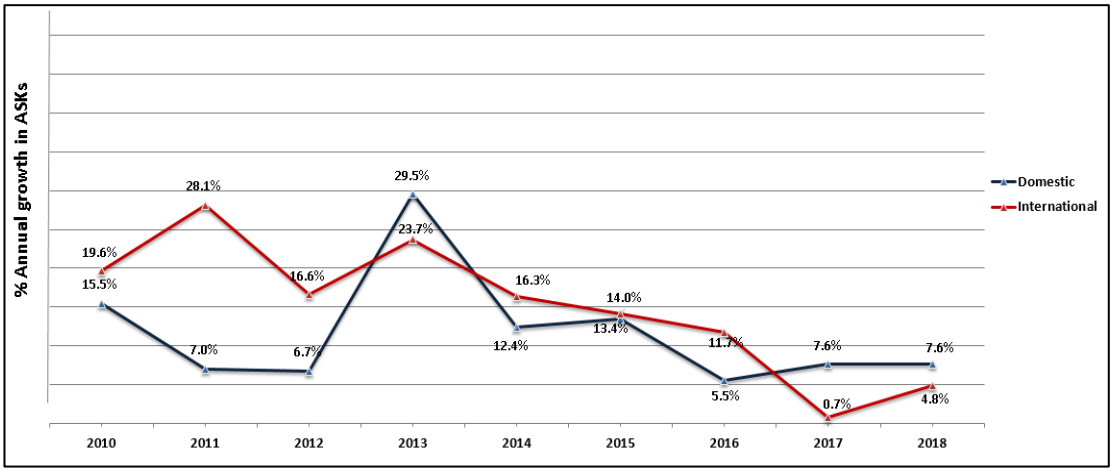

Figure 5. 2 Turkish Airlines annual ASK growth rates (2010-2018)

Source: Turkish Airlines Company Traffic Reports

***This data includes only scheduled flights, excluding hajj and charter flights.**

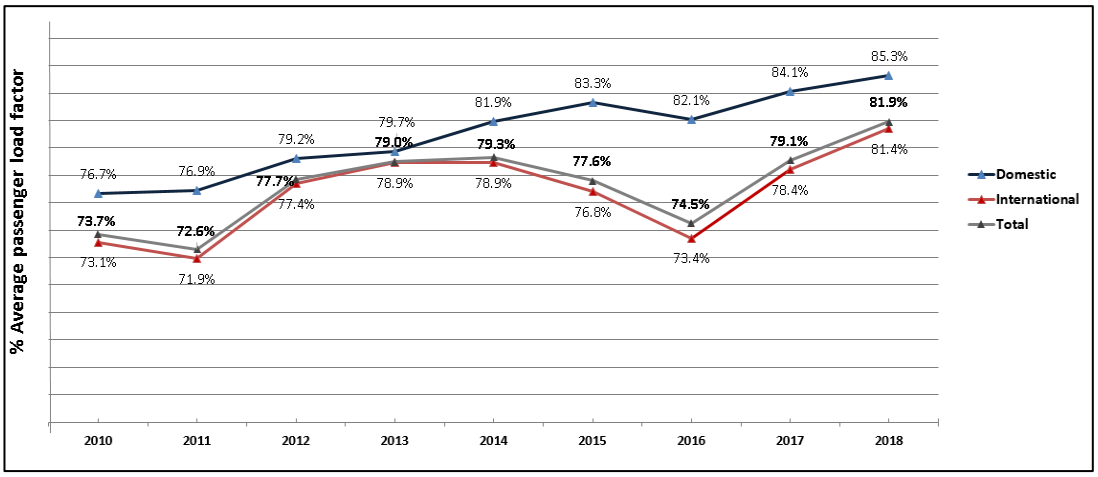

Figure 5. 3 Turkish Airlines Passenger Load Factor (2010-2018)

Source: Turkish Airlines company Traffic Reports

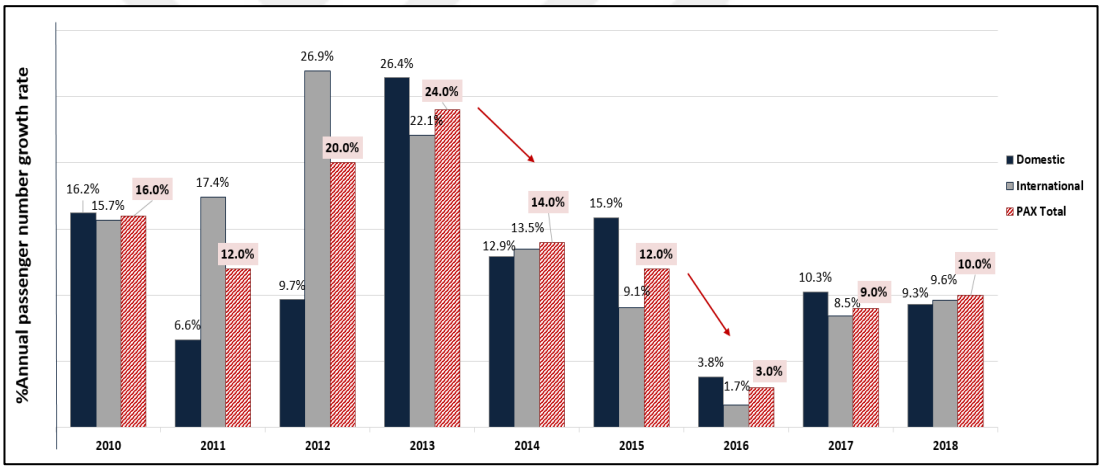

Figure 5. 4 Turkish Airlines PAX growth rate (2010-2018)

Source: Turkish Airlines Company Traffic Reports

5.1. Outlier Detection Analysis

We first looked at the three different outlier detection algorithms, namely outlier detection algorithm (ODA), breakout detection algorithm (BDA) and changepoint algorithm (CPA), to see whether the selected socio-political events show any outlier or changepoint impact in the data set. Figure 5.5., 5.6. and 5.7 present the results in

each region for the RPK, ASK, and PLF respectively. Each method is shown by a different dashed line color to distinguish its impact (Table 5.1).

Table 5. 1 Definitions of the outlier detection algorithms and incidents

Method 1	Outlier Detection Algorithm (ODA)	Dashed black line
Method 2	Breakout Detection Algorithm (BDA)	Dashed blue line
Method 3	Change Point Detection Algorithm (CPA)	Dashed red line

Case 1	Gezi Park (May 26-June 16,2013)	Bold black line
Case 2	Shooting of the Russian military jet (November 24, 2015)	Bold black line
Case 3	The attempted military coup (July 15, 2016)	Bold black line
Case 4	Electronic device ban by US and UK (March 25-July 5, 2017)	Bold black line

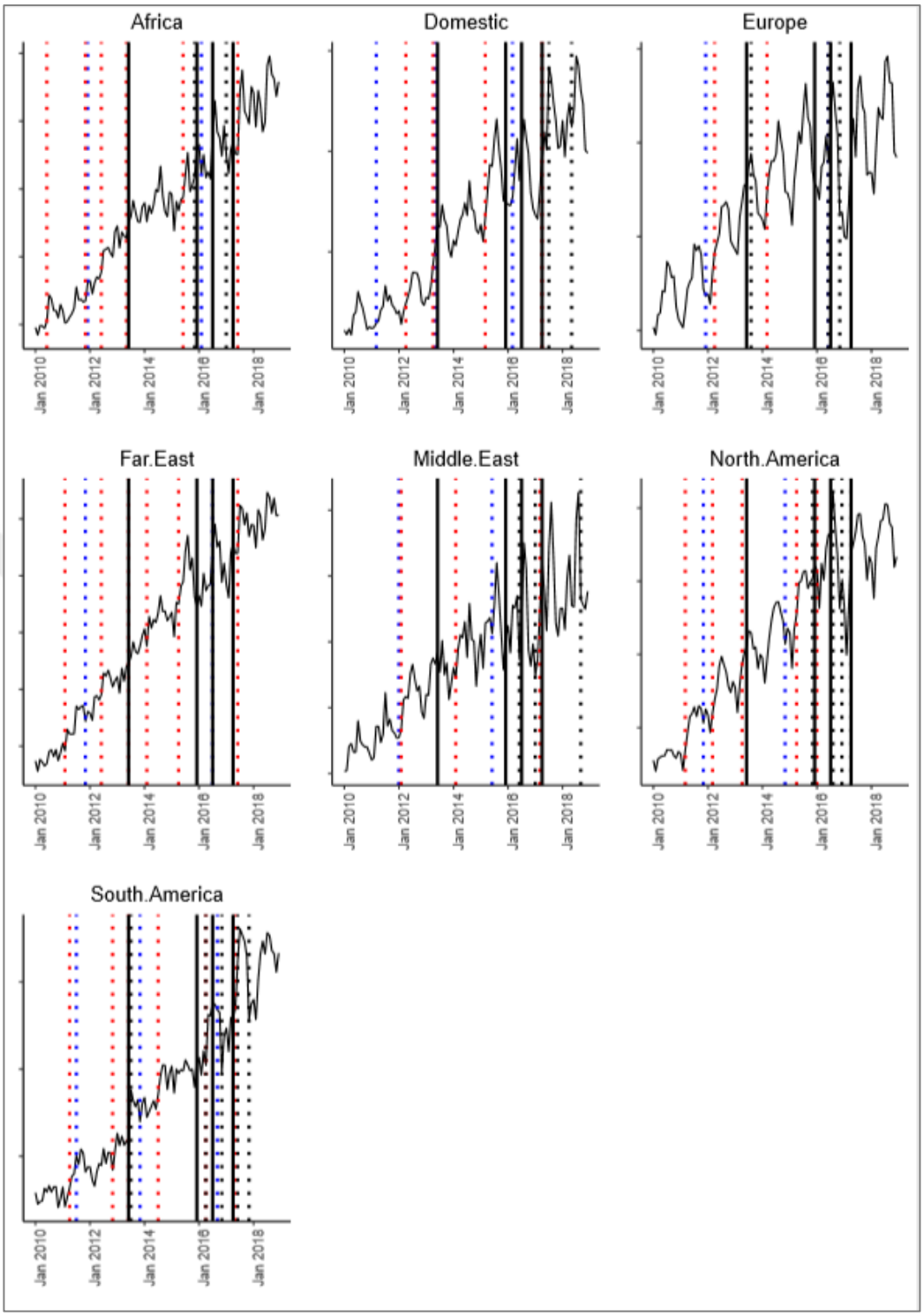

Figure 5. 5 Results of outlier detection models for RPK by region

Note: South America region also includes Central America.

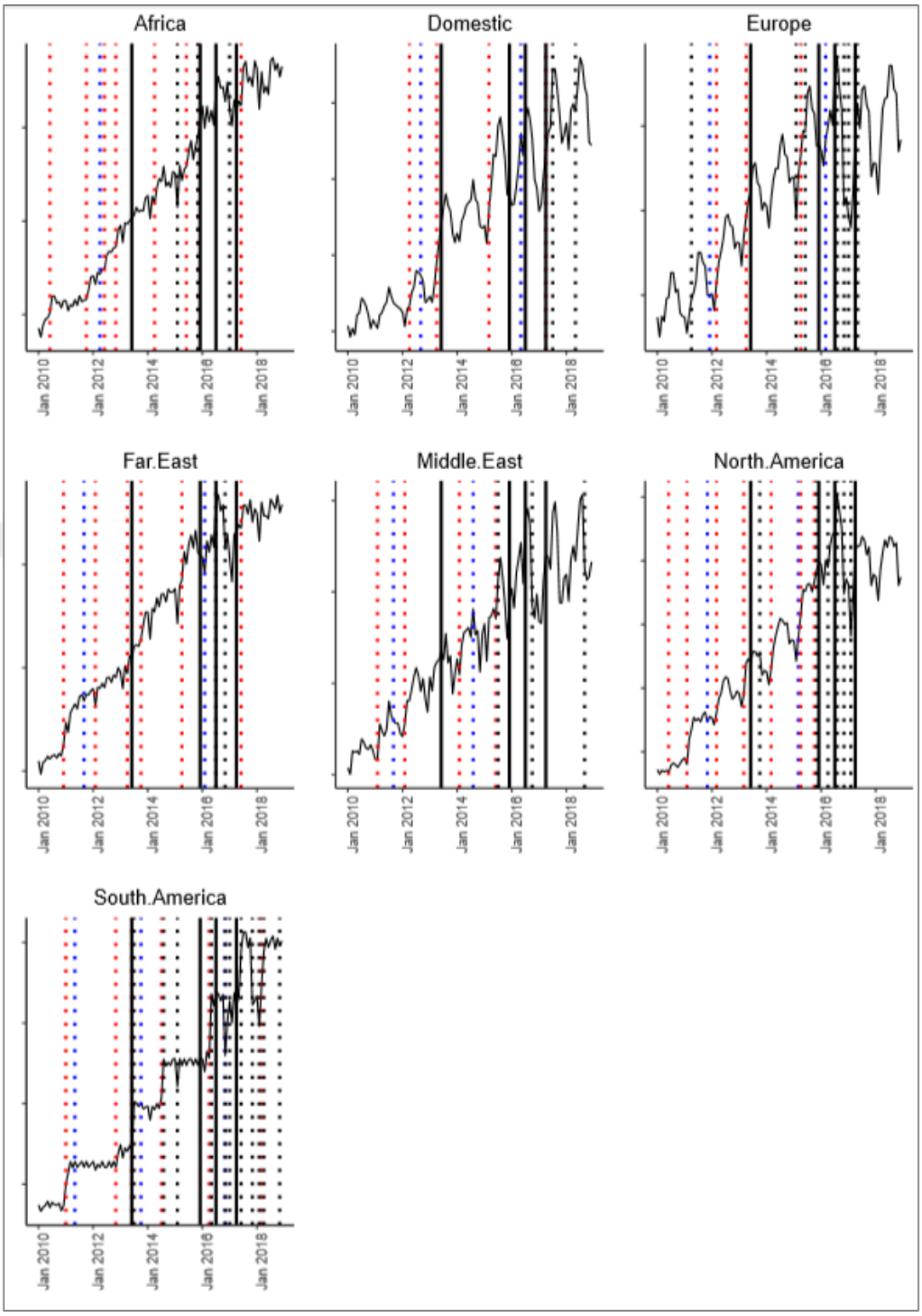

Figure 5. 6 Results of outlier detection models in ASK by region

Note: South America region also includes Central America.

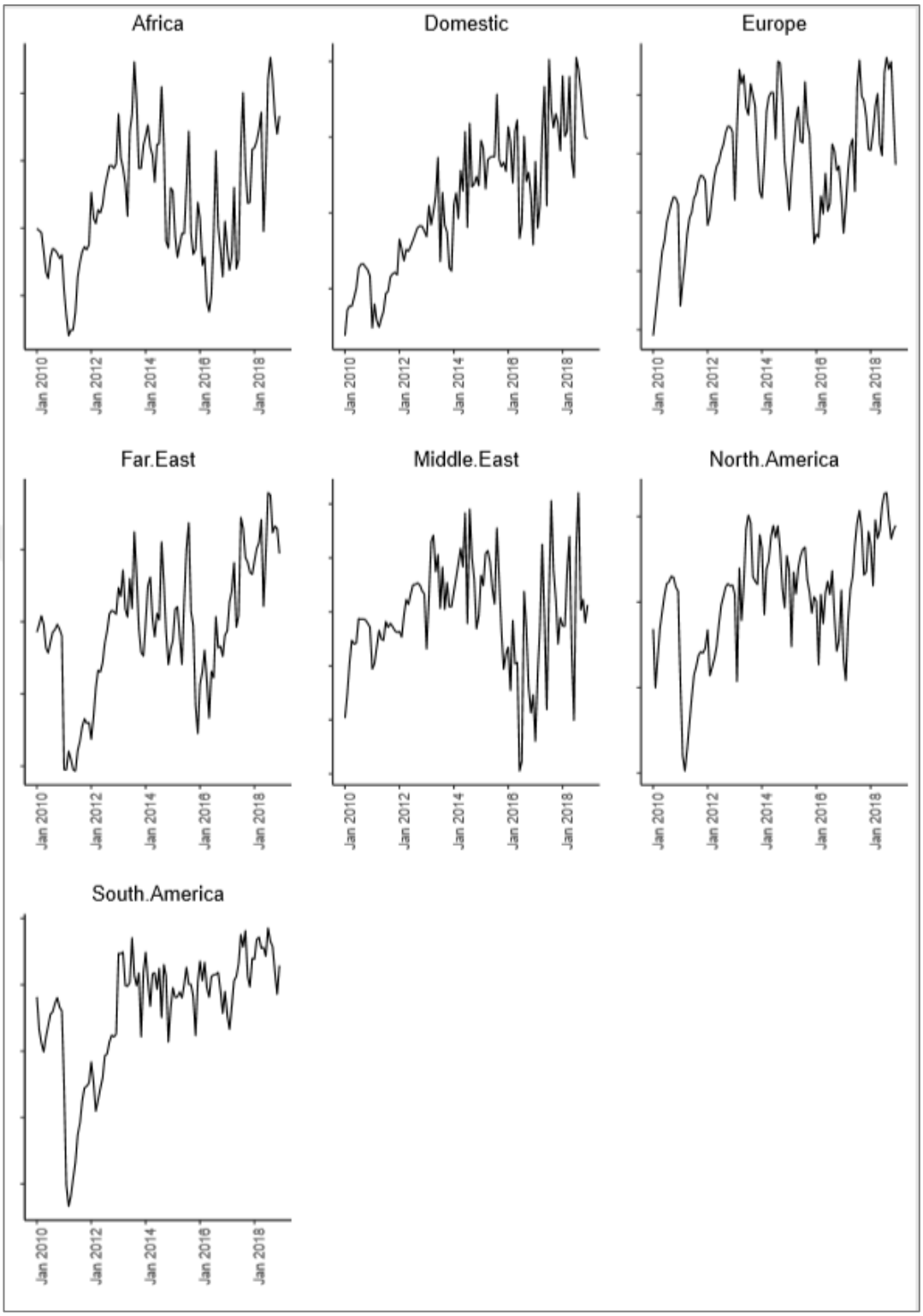

Figure 5. 7 Turkish Airlines PLF growth by region

Note: South America region also includes Central America.

Table 5. 2 RPK Matrix of outlier detection (link with Figure 5.5)

	Africa	Domestic	Europe	Far East	Middle East	North America	Central &South America
Case 1	3	3	-	-	-	3	-
Case 2	1,2	2	-	-	-	1	-
Case 3	-	-	1	-	1	1	2
Case 4	3	1	-	3	-	1	1,3

*(-) :There is no outlier effect

Table 5. 3 ASK Matrix of outlier detection (link with Figure 5.6)

	Africa	Domestic	Europe	Far East	Middle East	North America	Central &South America
Case 1	-	3	3	3	-	3	-
Case 2	1	-	-	2	-	1	-
Case 3	-	-	1	-	1	1	-
Case 4	3	1	-	3	-	1	1

*(-) :There is no outlier effect

5.1.1. Gezi Park

The results for Gezi Park event in Figure 5.5 show that the CPA successfully detected the event in domestic, Africa and North America regions for the Revenue per Kilometer (RPK). In the other regions, we did not find any outlier signal. As to the ASK analysis given in Figure 5.6, CPA also successfully reveals an outlier impact in domestic, Europe, Far East and North America regions. Both RPK and ASK analyses indicate that domestic flights are highly affected from Gezi Park incident. This findings may be explained by the concerns of the Turkish citizens for the future prospect of the political environment in the country.

5.1.2. Shooting of the Russian Military Jet

The result for the shooting of the Russian military jet in Figure 5.5 shows that ODA detected a strong outlier impact in Africa and North America regions for RPK. We also found partial impact for BDA in Africa and domestic regions. For ASK, ODA showed an outlier detection in Africa and North America regions. We also observed a partial impact detection of BDA in the Far East region. Thus, ODA showed an impactful success in both parameters. This finding may be explained by the decrease in transit flights of the Russian passengers to Africa and North America destinations.

5.1.3. The attempted military coup

When we investigated the attempted military coup incident for RPK, we found ODA to have an outlier impact in Europe, Middle East and North America regions. We found BDA impact only in South America region. When we look at the ASK results in Figure 5.6, we similarly detected the impact of ODA in the same regions. These findings reveal that there is a stong association between this highly political event and RPK/ASK change especially in international flights.

5.1.4. Electronic device ban by US and UK

We got interesting results for electronic device ban incidence. While ODA successfully detects an outlier effect in domestic, North and South America regions, CPA reveals an impact in Africa, Far East and South America regions for RPK. We found almost the same results for ODA in ASK data set. It has outlier impacts in domestic, Europe, North America and South America regions. We found CPA impact only in Africa and Far East regions. Thus, the outlier algorithms do show consistent results in regional basis on electronic device ban event. This is an expected outcome since the electronic ban had its most detrimental effects on the international flights to the cities in the America regions, besides UK.

When we run the outlier detection algorithms for PLF, we did not detect any outlier impact for any of the algorithms. However, when we look at Figure 5.7, we may infer from the trend analysis that while there are up and downs over the last decade, there is a dramatic downturn during the mid-2016 where we had a terrorist attack to the Atatürk Airport and we withnessed an attempted military coup. Both events had serious negative effects on the PLF especially in international fights. Although the magnitude of the impact varies from region to region, the hightest effect took place in the Middle East and Africa regions. The second incident that had a negative impact is Gezi Park. The effect of this event was highly felt in domestic and North American region flights.

5.2. Causal Impact Analysis

In causal impact analysis, the approach to evaluating differences in time series before and after the intervention is adopted. The related analysis helps companies in making strategic decisions. The causal impact analysis examines the differenciation between the observed value of response and the predicted value during after intervention. (Brodersen, K.H., 2015). We aimed to predict the effects of events on operational performance of the Turkish Airlines by employing Bayesian impact analysis. To powerfully construct the counterfactual, it is highly important that a number of predictor determinants come together under a single “synthetic control” (Abadie and Gardeazabal, 2003; Abadie, Diamond and Hainmueller, 2010). Three sources of information are used to create an adequate synthetic control. First, it is the time series behavior before the intervention (pre-intervention). The second is the behavior of other time series that predict pre-intervention target series. Third, it predicts counterfactual in post-event behavior (post-intervention). The Bayesian approach considers the existing preliminary information about model parameters as a third source of information to reveal the counterfactual. Bayesian factor (p) is the most important point of Bayesian hypothesis testing. Despite the classical p-value, the Bayesian factor has direct interpretation to test whether the hypothesis is correct. P (Probability) is a value used to determine the statistical significance of the effect observed in the study.This analysis helps us to draw the causal impact of socio-political incidents on passengers carried (PC) by the Turkish Airlines on regional basis, covering Africa, Europe, Domestic, Far East, Middle East, North America, South America and Russia.

For each region, we plotted graphics for (1) time series of PC, (2) pointwise (yearly) incremental impact and (3) cumulative impact of the event. The expected and actual values were revealed in the 95% credible interval the pre/post-intervention.

5.2.1. Africa Region

- **Causal impact of shooting of the Russian military jet**

Although we expect an average response of 159.79 K (blue) in the absence of an intervention in the 95% range of the counter-actual estimate [139.87K, 182.31K] during after interposition interval, the mean of answer variable that PC 262.76K (black) (Figure 5.8). The estimated value of the intervention effect on the response variable is 102.96 K in a range of 95% credible intervals (blue shaded area) [80.45K, 122.88K]. To obtain the importance of impact, the singular data points were collected throughout the post-intervention term. The total passenger carried after intervention was 9.20M. On the other hand, if there were no intervention, the expected value would be 5.59M. The results showed that PC had a growth of 64% (95% range of by [+50%, +77%]). The 95% interval of this prediction is [4.90M, 6.38M]. The analysis results show that the positive effect after the interposition is not caused by occasional waverings, that is to say this change is statistically significant. It is decided whether it is statistically significant or not by considering the probability of being obtained randomly. According to the effect analysis, if p value is less than 0,05 %, the effect is important. ($p = 0.003$). Moreover, the importance of the impact that detected increase on the number of passengers is obtained by comparing only the definite effect (102.96 K) with the real intervention target.

- **Causal impact of Gezi Park**

When we analyzed 6 months period after the Gezi Park, the number of PC in Jan 2014 appears to be rising different from the expected trend. After 2012, while there was a stable trend in the number of PC without dramatic changes in the region, there had been a steady increase with gradual decrease/increase in the consecutive years. Throughout the time of after interposition interval, the mean of answer variable of 237.80K. On the other hand, if there were no intervention, the expected average value

would be 121.09K.This counterfactual prediction is [105.67K, 134.66K] (95% interval). The differentiation between the estimated and observed value gives the predicted value of causal effect on the response variable. The value of impact is 116.71K by 95% interval of [103.14K, 132.12K].

The total value of the reacting variable as a result of the analysis, 15.46M. On the other side, if the case did not occur, the passenger carried would be expected to be 7.87M (95% range [6.87M, 8.75M]) That is, the answer variable that PC shows a rise of 96% with a 95% range of [+85%, +109%]. Thus, the positive effect is statistically significant. (p = 0.002).

- **Causal impact of the electronic devices ban**

When we look at the probability of this effect occurring by chance (p = 0.056), the impact of the electronic devices ban implemented by the US-UK on PC in the Africa region can not be real. It can said that it does not have statistical significance. However, when we evaluate the development Throughout the time of after interposition interval, the mean of answer variable that PC 289.84K. On the other hand, if there were no intervention, the expected average value would be 241.37K(with 95% interval [217.96K, 258.62K]). The distinction between estimated and observed value gives the predicted value of causal effect on the response variable. The value of impact is 48.46K by 95% interval of [31.22K, 71.87K].

To obtain the importance of impact, the singular data points were collected throughout after intervention term. The total value of the variable after intervention was 4.93M. On the other hand, if there were no intervention, the expected total value would be 4.10M. This impact is with 95% interval of [3.71M, 4.40M]. According to these results, the answer value presented a rise by 20% with 95% interval of this percentage is [+13%, +30%]. The positive effect considered to statistically significant.

- **Causal impact of the attempted military coup**

During July 15, 2016 crisis, the PC decreased more dramatically than predicted. It then recovered rapidly and went on fluctuating. The counterfactual-forecasting analysis and confidence intervals with expected values support this result. Throughout the time of

after interposition interval, the mean of answer variable of 271.39K. On the other hand, if there were no intervention, the expected average value would be 169.24K with 95% interval of the prediction of counterfactual is [146.03K, 192.30K]. The differentiation between estimated and observed value gives the envisaged value of a causal effect on the response variable. The value of impact is 102.15K by 95% interval of [79.09K, 125.36K]. On the other hand, if there were no intervention, the expected total value would be 4.57M with the 95% interval [3.94M, 5.19M]. Throughout the time of after interposition interval, the total answer variable that PC 7.33M. According to these results, the answer value presented a rise by 60% with 95% interval [+47%, +74%]. However, the analysis results show that the positive effect after the interposition is not caused by occasional waverings, that is to say this change is statistically significant. ($p = 0.003$) Moreover, the importance of the impact that detected increase on the number of passengers is obtained by comparing only the definite effect (102.15 K) with the real intervention target.

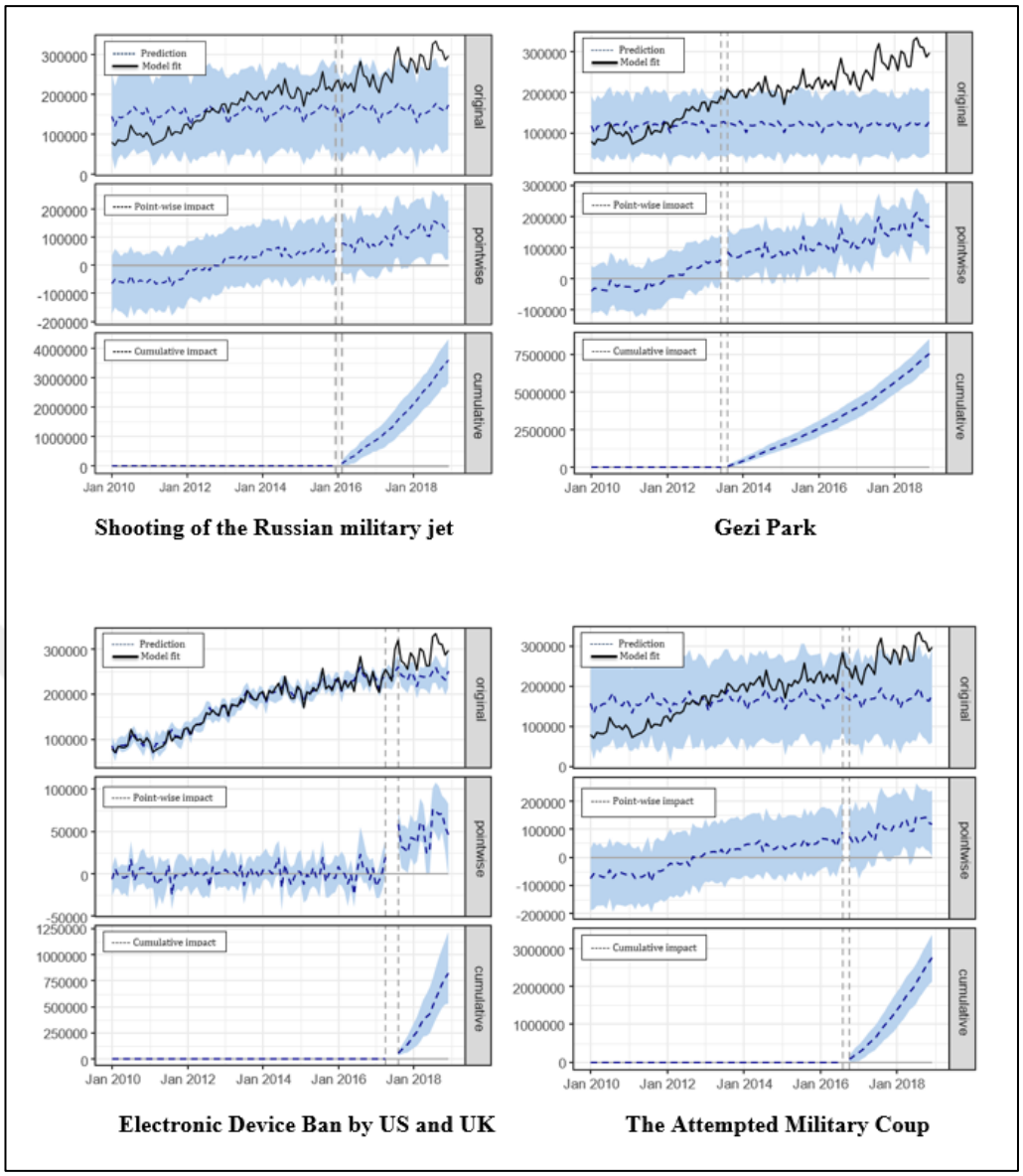

Figure 5. 8 Causal Impact Analysis of the PC in the Africa Region

5.2.2. Domestic Region

- **Causal impact of shooting of the Russian military jet**

During the attempted military coup, the PC in domestic region had fallen more smoothly than expected. For a short time following the event, the PC had changed with greater acceleration as expected (blue and black line). The widening difference between blue and black lines supports the predictions. Throughout the time of after

interposition interval, the mean of answer variable is 2.50M, If there were no intervention, the expected average value would be 1.59M with 95% interval of prediction that counterfactual is [1.40M, 1.76M]. To find the estimated value of the causal effect on the response variable, the observed value is subtracted from the expected value. The value of impact is 0.90M with a 95% interval of [0.73M, 1.10M]. The total value of the responding variable is 87.38M. If there were no intervention, the expected total value would be 55.71M with the 95% interval of this prediction is [48.98M, 61.75M]. In relative terms, the response variable showed an increase of +57%. The 95% interval of this percentage is [+46%, +69%]. Hence, the positive effect on the intervention can be evaluated statistically significant.

However, the importance of the impact that detected increase on the number of passengers is obtained by comparing only the definite effect (0.90 K) with the real intervention target. (p = 0.003).

- **Causal impact of Gezi Park**

Throughout the time of after interposition interval, the mean of answer variable that PC 2.26M. On the other hand, if there were no intervention, the expected average value would be1.26M with 95% interval of prediction that counterfactual is [1.19M, 1.32M]. The difference between estimated and observed value gives the estimated value of causal effect on the response variable. The value of impact is 1.00M with a 95% interval of [0.93M, 1.07M]. Without intervention, the total expected value would be 81.97M with 95% interval of [77.32M, 86.11M]. In relative terms, the response variable showed an increase of +79% with the 95% interval of this percentage is [+74%, +85%]. The positive effect during the intervention is statistically significant. The probability of obtaining this effect by chance is very small (p = 0.002), so the causal effect is statistically significant.

- **Causal impact of the electronic devices ban**

After interposition interval, the mean of answer variable 2.71M. On the other hand, if there were no intervention, the expected average value of response value would be 2.23M with 95% interval of [2.05M, 2.41M]. To determine the estimated value of the causal effect on the response variable, the observed value is subtracted from the

expected value. The value of impact is 0.48M with 95% interval of [0.30M, 0.66M]. When we collected singular data points throughout the time of after intervention term, the total response variable is 46.04M. On the other hand, if there were no intervention, the expected total value would be 37.93M. The 95% interval of this prediction is [34.86M, 41.00M]. The results showed that carried passengers had a growth of 21%. (with 95% interval of [+13%, +29%]). The P value confirms the information that the fluctuations during the response time did not occur randomly and that the changes were considered statistically significant (p = 0.003).

- **Causal impact of the attempted military coup**

After the event on July 15, 2016, the number of PC decreased in the same direction with the predicted change and started to increase after half a period. Throughout the time of after intervention interval, the mean of answer variable 2.55M. If there were no intervention, the expected average value would be 1.67M with 95% [1.45M, 1.88M]. The differentiation between estimated and observed value gives the estimated value of causal effect on the response variable. The value of impact is 0.87M with 95% interval of [0.67M, 1.09M].

When we collected singular data points throughout the after intervention term, the total value of the response variable is 68.74M. Without intervention, the total expected value would be 45.12M with 95% interval of [39.27M, 50.68M].

The results showed that the response variable rise of 52 % as relatively with 95% interval of [+40%, +65%]. The P value shows the fluctuations during the response time did not occur randomly and that the changes were considered statistically significant (p = 0.003

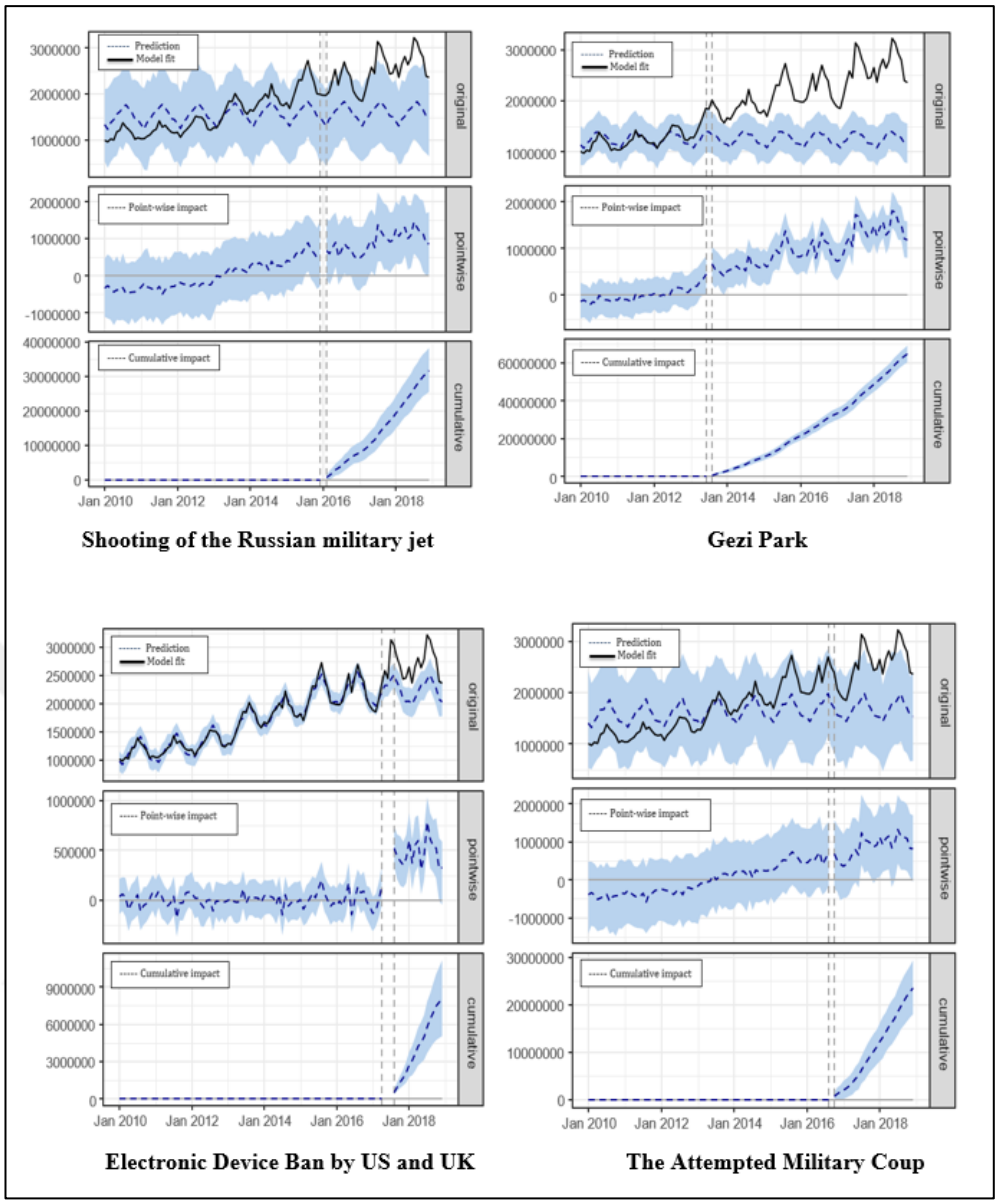

Figure 5. 9 Causal Impact Analysis of the PC in the Domestic Region

5.2.3. European Region

- **Causal impact of shooting of the Russian military jet**

Between 2010-2012, the actual value of the PC is below the model. After the breaking point in 2013, the number of PC was in the same direction as expected, but more positive. The impact of the event on the number of PC in Europe was negative, showing a short-term downward trend as expected. After the intervention term, the

average of answer variable 1.75M. Without intervention, the total expected value would be 1.25 M with 95% interval of [1.10M, 1.40M].

To figure out the estimated value of the causal effect on the carried passenger, the observed value is subtracted from the expected value. The value of impact is 0.49M by 95% interval of [0.35M, 0.65M]. When we sum the data points throughout after intervention term, the total value of the variable obtained (61.11M). If there were no intervention, the expected total value would be 43.87M with the 95% interval of this prediction is [38.40M, 48.99M]. According to these results, the response variable rise of 39% with 95% interval of [+28%, +52%]. The P value presents the information that the fluctuations during the response time did not occur randomly and that the changes were considered statistically significant. (p = 0.003)

- **Causal impact of Gezi Park**

Throughout the time of after interposition interval, the mean of answer variable that PC 1.66M. If there were no intervention, the expected average value would be 0.98M. The 95% interval of this counterfactual prediction is [0.88M, 1.08M]. The difference between estimated and observed value gives the predictive value of causal effect on the response variable. The value of impact is 0.68M with 95% interval of [0.58M, 0.78M]. When we collected singular data points throughout the post-intervention term, the total passenger caried is 107.94M. Without intervention, the total expected value would be 63.55M with 95% interval of [57.46M, 70.09M].

The results showed that the response variable rise of 70% as relatively (with the 95% interval of [+60%, +79%]). The positive effect observed during the intervention can be considered to statistically significant as the probability of random occurrence is small. (p = 0.003).

- **Causal impact of the electronic devices ban**

After the intervention term, the average of answer variable 1.88M. On the other hand, if there were no intervention, the expected average value would be 1.57M with 95% interval of prediction that counterfactual is[1.42M, 1.71M].

The differentiation among estimated and observed value gives the estimated value of causal effect on the response variable. The value of impact is 0.31M with 95% interval

of [0.17M, 0.45M]. The total value of the responding variable is 31.90M. Without intervention, the total expected value would be 26.65M with 95% interval of [24.22M, 29.05M].

The results showed that the response variable rise of 20% as relatively with 95% interval of [+11%, +29%]. The positive effect observed during the intervention can be considered to statistically significant as the probability of random occurrence is small. (p = 0.003).

- **Causal impact of the attempted military coup**

Throughout the time of after intervention interval, the mean of answer variable that 1.75M. if there were no intervention, the expected average value would be 1.68M with 95% interval of [1.53M, 1.87M].

To find the estimated value of the causal effect on the response variable, the observed value is subtracted from the expected value. The value of impact is 0.08M with 95% interval of [-0.12M, 0.22M]. When we sum the data points during the after intervention term, the total PC obtained (47.32M). If there were no intervention, the expected total value would be 45.28M with 95% interval of [41.39M, 50.52M].

The results showed that the response variable rise of 5% as relatively with 95% interval of percentage is [-7%, +13%]. When we check p value, it shows the fluctuations during the response time would be occur randomly and that the changes were considered not statistically significant (p=0.216).The apparent effect could be the result of random fluctuations that are unrelated to the intervention. This situation can also occur when the control variable is not sufficient or when the variables do not have a strong correlation with the response variable.

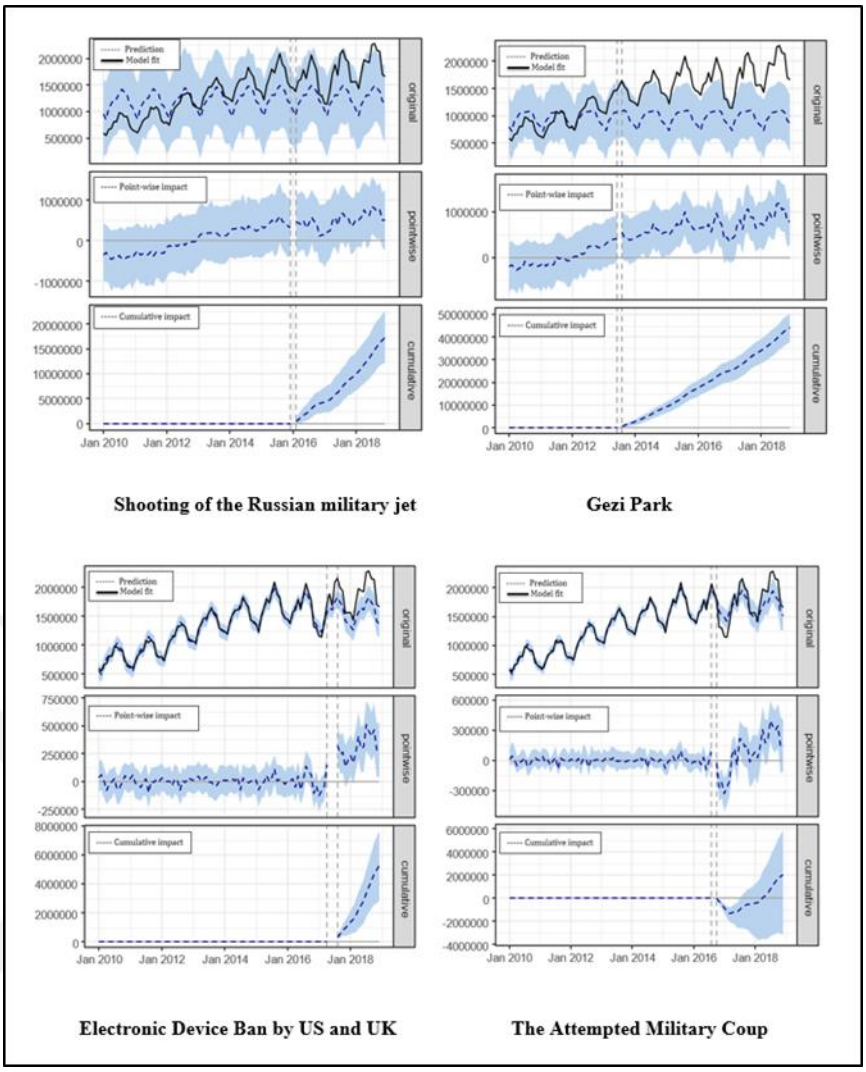

Figure 5. 10 Causal Impact Analysis of the PC in the European Region

5.2.4. Far East Region

- **Causal impact of shooting of the Russian military jet**

After the intervention term, the average of answer variable 425.72K. Without intervention, the total expected value would be 266.93K with 95% interval of prediction that counterfactual is [228.90K, 305.69K]. The difference among estimated and observed value gives the predicted value of causal effect on the response variable. The value of impact is 158.79K with 95% interval of [120.03K, 196.82K]. When we sum the data points after the intervention term, the total passenger carried number

obtained (14.90M). Conversely,if there were no intervention, the expected total value would be 9.34M. The 95% interval of this prediction is [8.01M, 10.70M]. The results showed that the response variable rise of 59% as relatively(95% interval,[+45%, +74%]). The P value confirms the information that the fluctuations during the response time did not occur randomly and that the changes were considered statistically significant. (p=0.003). Moreover, the importance of the impact that detected increase on the number of passengers is obtained by comparing only the definite effect (158.79K) with the real intervention target.

- **Causal impact of Gezi Park**

In the term of post-intervention, the average value of the response variable is 388.56K. On the other hand, if there were no intervention, the expected average value would be 202.94K. The 95% interval of this counterfactual prediction is [181.78K, 222.22K]. To find the predicted value of the causal effect on the response variable, the observed value is subtracted from the expected value. The value of impact is 185.63K with 95% interval of [166.34K, 206.78K]. To obtain the importance of impact, the singular data points were collected throughout after intervention term. The total passenger carried after the intervention was 25.26M. On the other hand, if there were no intervention, the expected total value would be 13.19M. The 95% interval of this prediction is [11.82M, 14.44M]. There detected an increase of 91% in the response variable (with 95% interval of [+82%, +102%]). When we check the P-value, it can say this positive effect consider as statistically significant. (p=0.002).

- **Causal impact of the electronic devices ban**

Throughout the time of after intervention interval, the mean of answer variable that 458.82K. if there were no intervention, the expected average value would be 405.69K (with 95% interval of [371.53K, 441.54K]). The forecast of the causal effect on the value of response is 53.13K with 95% interval of [17.28K, 87.29K]. To understand the importance of impact, the singular data points were collected throughout the time of after intervention term. The total passenger carried after the intervention was 7.80M. On the other hand, if there were no intervention, the expected value would be 6.90M. The 95% interval of this prediction is [6.32M, 7.51M].

The results showed that the response variable rise of 13% as with 95% interval of percentage is [+4%, +22%]. The p value shows the fluctuations during the response time did not occur randomly and that the changes were considered statistically significant (p = 0.014).

- **Causal impact of the attempted military coup**

In the time of after the intervention, the average value of response variable is 436.97K. By the contrary, if there was no intervention, the expected average response would be 281.53K. The 95% interval of prediction that counterfactual is [243.18K, 320.87K]. The estimate of the causal effect on the response variable is 155.43K with 95% interval of [116.10K, 193.79K]. When the data points collected post-intervention term, the total carried passenger 11.80M. On the other hand, if there were no intervention, the expected total value would be 7.60M (with 95% interval of [6.57M, 8.66M]).

According to the results, the answer value increased by 20% as relatively with a 95% interval of percentage [+41%, +69%]. Moreover, the p value confirms the information that the fluctuations during the response time did not occur randomly and that the changes were considered statistically significant (p = 0.003).

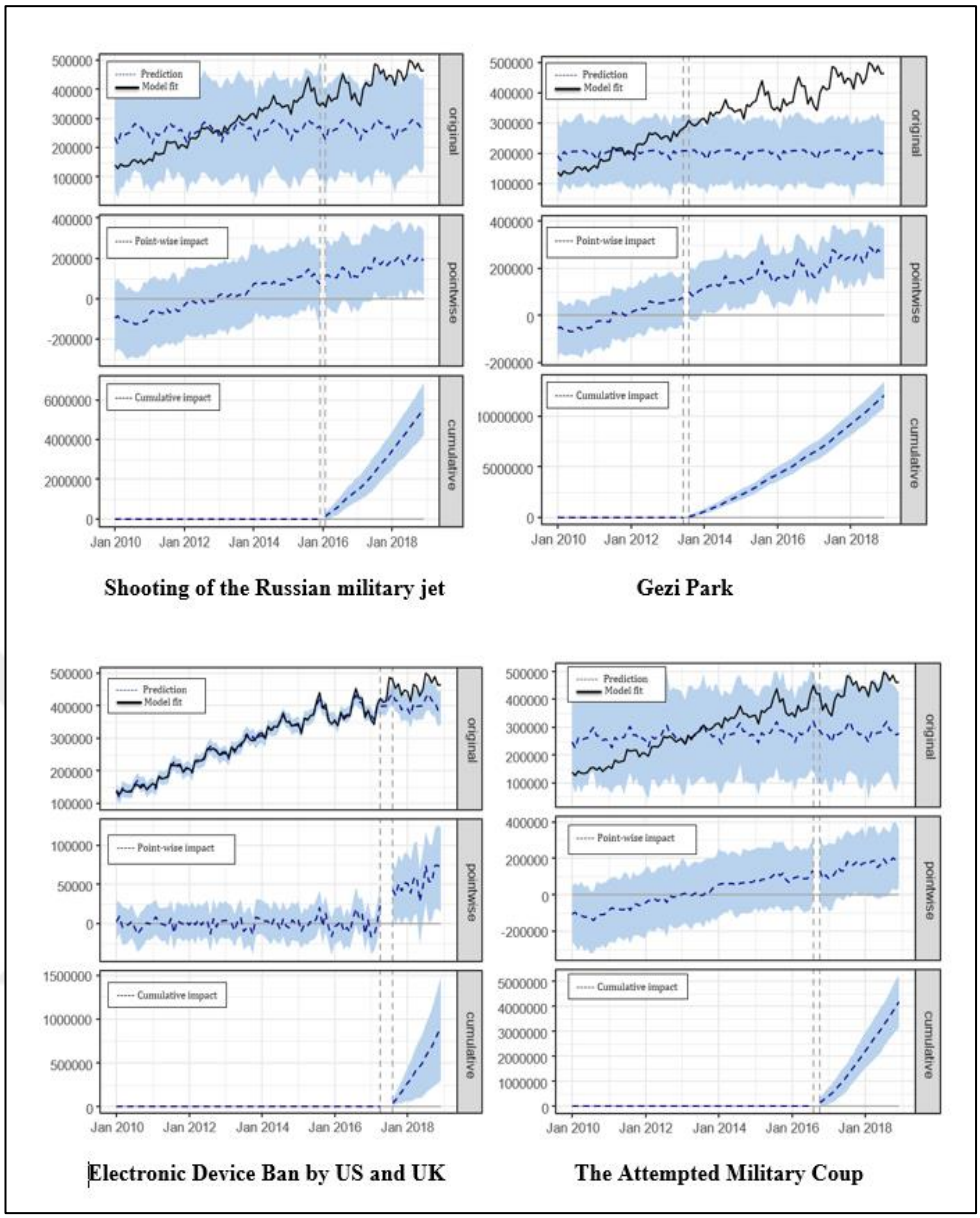

Figure 5. 11 Causal Impact Analysis of the PC in the Far East Region

5.2.5. Middle East Region

- **Causal impact of shooting of the Russian military jet**

Throughout the time of after interposition interval, the mean of answer variable that PC 468.61K. Without intervention, the average expected value would be 304.56K with 95% interval of this counterfactual prediction is [265.82K, 338.67K].

The difference between estimated and observed value gives a forecasted value of causal effect on the response variable. The value of impact is 164.05K with a 95% interval of [129.93K, 202.79K]. To obtain importance of impact, the singular data points were collected throughout the after intervention term. The total answer variate after intervention was 16.40M. On the other hand, if there were no intervention, the expected value would be 10.66M. The 95% interval of this prediction is [9.30M, 11.85M]. The results showed that the response variable rise of 54% as relatively. (95% interval of this percentage is [+43%, +67%]). It is decided whether it is statistically significant or not by considering the probability of being obtained randomly(p=0.003).The analysis results show that the positive effect after the interposition is not caused by occasional waverings, that is to say, this change is statistically significant.

- **Causal impact of Gezi Park**

After the intervention term, the average of answer variable 430.43K. If there were no intervention, the expected average value would 235.44K with 95% interval of this counterfactual prediction is [210.05K, 257.19K]. The estimate of the causal effect on the response variable is 194.99K with 95% interval of [173.24K, 220.38K]. When we collected singular data points throughout the time of after intervention term, the total value of the response variable is 27.98M. Without intervention, the total expected value would be 15.30M with 95% interval of [13.65M, 16.72M].

The response variable rised by 83% with 95% interval of percentage [+74%, +94%]. When we check bayesian probability(p), we can say the causal effect is statistically significant (p=0.002).

- **Causal impact of the electronic devices ban**

Along after intervention, the average passenger carried is 502.00K. If there were no intervention, the expected average value would be 424.94K with a 95% interval of forecast that counterfactual is [386.86K, 464.51K]. The difference among estimated and observed value gives envisaged value of causal effect on the response variable. The value of the effect is 77.07K with a 95% interval of [37.49K, 115.14K]. When we sum the data points throughout after the intervention term, the total passenger carried obtained (8.53M).

Without intervention, the total expected value would be 7.22M with 95% interval of this prediction is [6.58M, 7.90M].

The results showed that the response variable rise of 18% as relatively with 95% interval of [+9%, +27%]. The p value shows the fluctuations during the response time did not occur randomly and that the changes were considered statistically significant (p=0.004).

- **Causal impact of the attempted military coup**

Throughout the time of after interposition interval, the mean of answer variable that 472.57K. On the other hand, if there were no intervention, the expected average value would be 319.20K. The 95% interval of this counterfactual forecasting is [282.66K, 367.79K]. The estimate of the causal effect on the response variable is 153.37K with 95% interval of [104.78K, 189.90K].
The total value of response variable 12.76M. On the contrary, without intervention, the total expected value would be 8.62M with 95% interval of prediction is [7.63M, 9.93M].

According to the results, the answer value increased by 48% as relatively with a 95% interval of percentage [+33%, +59%]. The p value shows the impact were considered statistically significant (p=0.003).

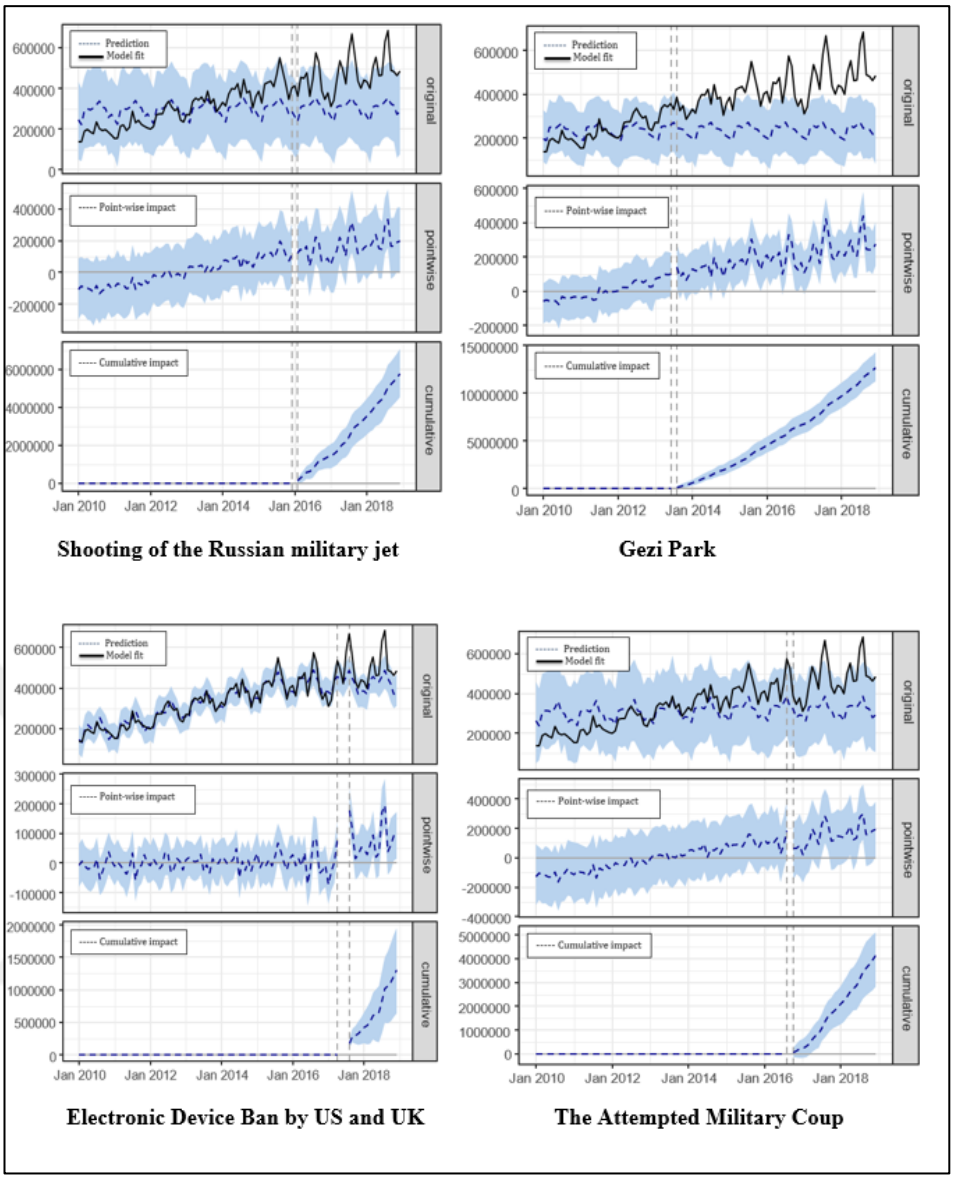

Figure 5. 12 Causal Impact Analysis of the PC in the Middle East Region

5.2.6. North America Region

- **Causal impact of shooting of the Russian military jet**

In the time after intervention term, the average value of PC of 186.98K. If there were no intervention, the expected average value would be 99.64K. with 95% interval of this counterfactual prediction [80.16K, 117.56K].

The estimated value of the causal effect on passenger carried is 87.34K(with a 95% interval of [69.43K, 106.82K]). When the data points collected after the intervention term, the total value of the response variable 6.54M. On the other hand, if there were no intervention, the total expected value would be 3.49M(95% interval of [2.81M, 4.11M]).

The results determined that there was a 88% increase in the response variable with a 95% interval of [+70%, +107%]. The causal effect is statistically significant(p=0.003).

- **Causal impact of Gezi Park**

In the time of the post-intervention period, the average value of response variable is 165.06K.. On the other hand, if there was no intervention, the expected average response would be 66.53K(with 95% interval of [55.23K, 77.96K]). The estimate of the causal effect on the response variable is 98.54K with 95% interval of [87.11K, 109.83K].When the data points sum after the intervention period, the total value of the response variable 10.73M. On the other hand, if there were no intervention, the expected total value would be 4.32M. (with 95% interval of [3.59M, 5.07M]). The results showed that the response variable had a growth of 148% (with 95% interval of [+131%, +165%]). The analysis results show that the positive effect after the interposition is not caused by occasional waverings, this change is statistically significant (p = 0.002).

- **Causal impact of the electronic devices ban**

After the intervention term, the average of answer variable 195.69K. Without intervention, the total expected value would be 169.42K with 95% interval of the counterfactual prediction is [151.72K, 190.06K].

The estimate of the causal effect on the response variable is 26.26K with 95% interval of [5.63K, 43.97K]. To obtain the importance of impact, the singular data points were collected throughout the time of after intervention term. The total value of the response variable after intervention was 3.33M. On the other hand, if there were no intervention, the expected value would be 2.88M (with a 95% interval of [2.58M, 3.23M]). The

findings showed that the response variable rise of 15% as relatively with 95% interval [+3%, +26%]. Changes were considered as statistically significant (p=0.025).

- **Causal effect of the attempted military coup**

Throughout the time of after interposition interval, the mean of answer variable that PC is 186.22K. If there were no intervention, the expected average value would be 110.33K(with 95% interval of [89.44K, 132.72K]).

The difference between estimated and observed value gives the forecasted value of causal effect on the response variable. The value of impact is 75.89K with a 95% interval [53.50K, 96.78K].

The total value of the reacting variable after intervention 5.03M. If there was no intervention, the total expected response value would be 2.98M (with 95% interval of [2.41M, 3.58M]). According to concludes, the answer value increased by 69% as relatively with a 95% interval of percentage [+48%, +88%].

The Bayesian probability is 0.003 so, this effect considered statistically significant.

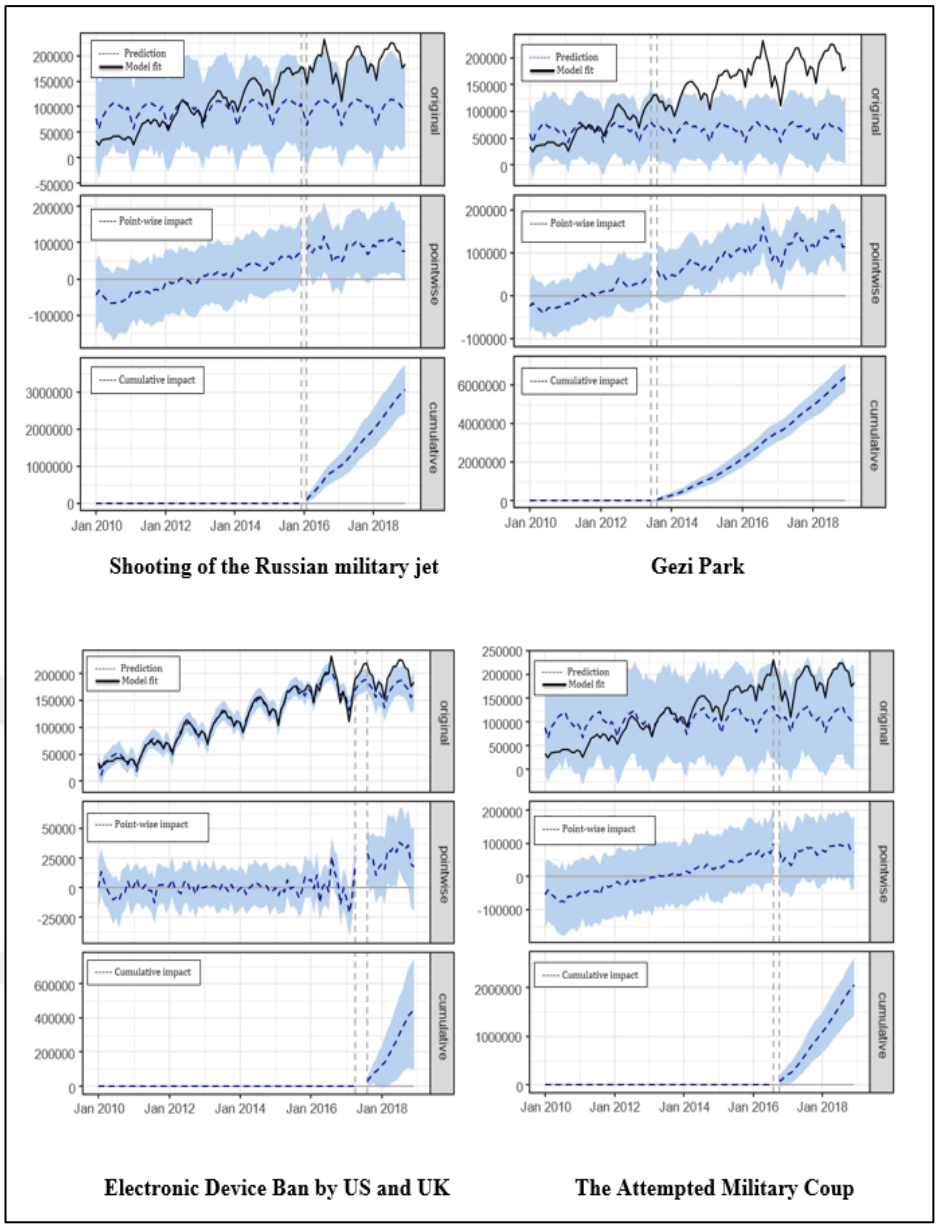

Figure 5. 13 Causal Impact Analysis of the PC in the North America Region

5.2.7. South America Region

- **Causal impact of shooting of the Russian military jet**

In the after intervention term, the average value of response variable is 30.24K. If there was no intervention, the average expected response value would be14.15K with 95% interval [11.02K, 16.94K].

The estimate of the causal effect on the response variable is 16.10K with 95% interval of [13.30K, 19.22K].

To obtain the importance of impact, the singular data points were collected throughout the time of after intervention term. The total value of the response variable after intervention was 1.06M. On the other hand, if there were no intervention, the total expected value would be 0.50M. (95% interval [0.39M, 0.59M]).

The results showed that the response variable rise of 11% as relatively with 95% interval of this percentage [+94%, +136%]. Moreover, the importance of the impact that detected increase on the number of passengers is obtained by comparing only the definite effect (16.10K) with the real intervention target. Besides that, the p value confirms the information that the fluctuations during the response time did not occur randomly and that the changes were considered statistically significant. (p=0.003)

- **Causal impact of Gezi Park**

In the post-intervention period, the average value of response variable is 26.14K. On the other hand, if there were no intervention, the expected average value would be 8.29K.(95% interval [6.97K, 9.62K]).

The differentiation between the estimated value and observed gives a forecasted value of causal effect on the response variable. The value of impact is 17.86K with a 95% interval [16.53K, 19.17K].

To obtain the importance of impact, the singular data points were collected throughout the post-intervention term. The total value of the reacting variable after intervention was 1.70M. On the other hand, if there were no intervention, the expected the value would be 0.54M.(95% interval [0.45M, 0.63M]).

The results determined that there was a 216% increase in the response variable with a 95% interval of [+199%, +231%]. The causal effect is statistically significant. (p=0.002).

- **Causal impact of the electronic devices ban**

After the intervention term, the average of answer variable 33.61K. On the other hand, if there were no intervention, the expected average value would be 26.76K with 95% interval of this counterfactual [24.23K, 29.16K].

The estimate of the causal effect on the response variable is 6.85K.(95% interval, [4.45K, 9.38K]). When we sum the data points during the after intervention term, the total value of response the variable obtained 571.34K. If there was no intervention, the total expected response value would be 454.94K. The 95% interval of this prediction is [411.87K, 495.73K].The result determined that there was a 26% increase in the response variable with a 95% interval of [+17%, +35%]. The analysis results show that the positive effect after the interposition is not caused by occasional waverings, that is to say, this change is statistically significant (p= 0.067).

- **Causal impact of the attempted military coup**

Throughout the time of after interposition interval, the mean of answer variable 31.58K. If there was no intervention, the average expected response value would be 15.59K with 95% interval of prediction that counterfactual is [11.78K, 18.89K]). The estimate of the causal effect on the response variable is 15.99K with 95% interval of [12.69K, 19.80K]. When we sum the data points in the post-intervention period, the total carried passenger is 852.70K. Without intervention, the total expected value would be 421.04K with a 95% interval of [318.16K, 510.00K].

According to the results, the answer value increased by 103% as relatively with 95% interval of percentage [+81%, +127%]. The analysis results show that the positive effect after the interposition is not caused by occasional waverings, that is to say this change is statistically significant. (p=0.003).

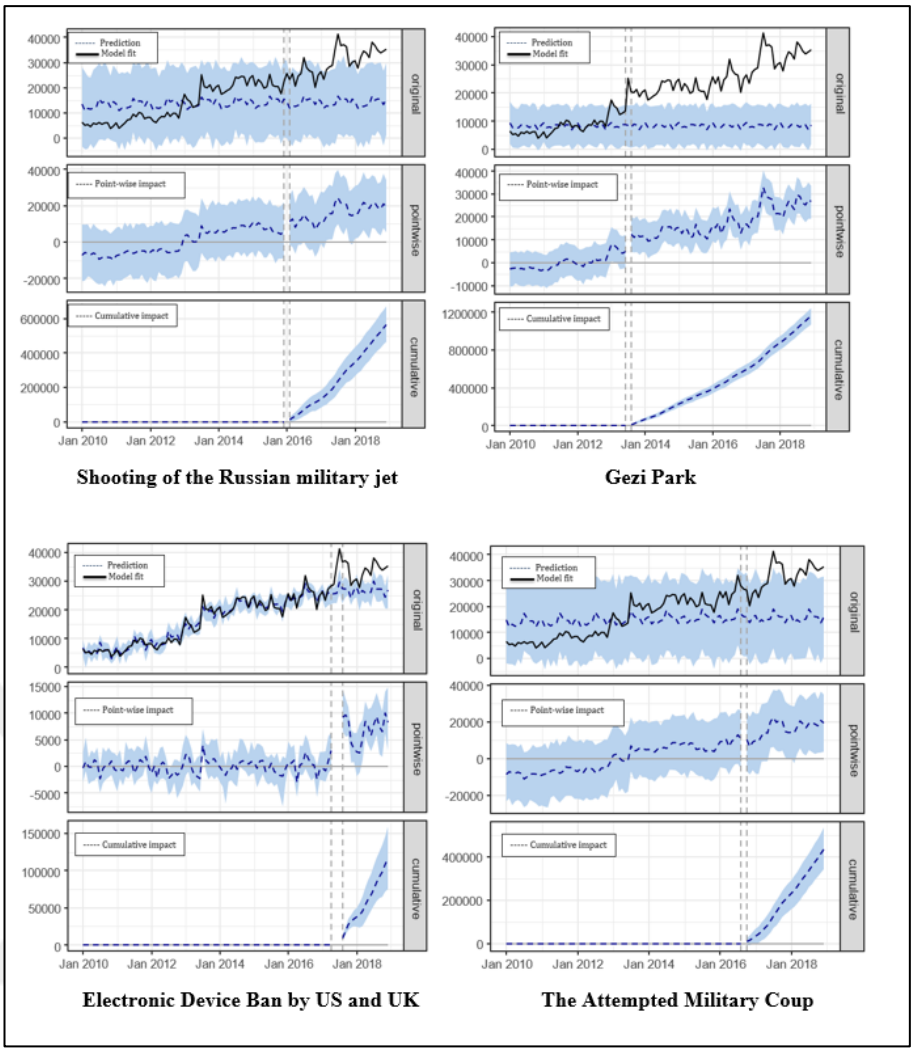

Figure 5. 14 Causal Impact Analysis of the PC in the South America Region

5.2.8. Russia Region

Figure 5.15 shows the negative impact of shooting of the Russian military jet on the PC. In the preceeding years before the event, the behavior of actual model is positive (except 2010-2012). After the break point, a dramatic short-term decline took place. The decrease in the number of PC then rapidly turned out and showed an upward movement. When we look at the Bayesian probability ($p = 0.267$), this effect is not considered statistically significant. In other words, it is more likely that there were external and internal factors affecting the change in the number of PC in the Russia region.

- **Causal impact of shooting of the Russian military jet**

In the after intervention period, the average value of response variable is 68.96K. On the other hand, if there were no intervention, the expected average value would be 70.87K.(95% interval [64.47K, 76.99K]).

To find the estimated value of the causal effect on the response variable, the observed value is subtracted from the expected value. The value of impact is -1.91K with a 95% interval of [-8.03K, 4.49K].

To understand the importance of impact, the singular data points were collected throughout the post-intervention term. The total value of the response variable after intervention was 2.41M. On the other hand, if there were no intervention, the expected value would be 2.48M.(95% interval [2.26M, 2.69M]). According to the results, the answer value decreased by -3% as relatively with a 95% interval of percentage [-11%, +6%]. But, when we check the Bayesian probability, ıt can understand this effect can not be considered statistically significant(p=0.267). The apparent effect could be the result of random fluctuations.

- **Causal impact of Gezi Park**

In the after of intervention term, the average value of the responding variable is 74.36K. If there was no intervention, the average expected response value would be 60.52K with 95% interval of prediction that counterfactual is [54.71K, 66.35K].

The difference between estimated and observed value gives the predicted value of causal effect on the response variable. The value of impact is 13.84K by 95% interval of [8.01K, 19.65K]. When we sum the data points after intervention term, the total value of the response variable obtained (4.83M).On the other hand, if there were no intervention, the expected total value would be 3.93M (with a 95% interval of [3.56M, 4.31M]).

According to analysis, the answer value increased by 23% as relatively with a 95% interval of percentage [+13%, +32%]. The probability of the effect to occur by chance is 0.002. This clearly demonstrates that the detected positive effect is statistically

significant. Moreover, the importance of the impact that detected increase on the number of passengers is obtained by comparing only the definite effect (13.84K) with the real intervention target.

- **Causal impact of the electronic devices ban**

Throughout the time of after interposition interval, the mean of answer variable is 80.63K. Without intervention, the average expected value would be 67.65K. with 95% interval of [59.28K, 76.22K]. The estimate of the causal effect on the response variable is 12.99K (with 95% interval of [4.41K, 21.35K]).

When the data points collected after the intervention period, the total value of the response variable 1.37M. But, if there was no intervention, this value would be expected to be 1.15M. The 95% range of this estimate is [1.01M, 1.30M]. Relatively, the response variable increased by 19% in the 95% range [+ 7%, + 32%]. When we look at the possibility of Bayesian, it can be said that this effect is statistically significant and does not consist of random fluctuations. (p = 0.003).

- **Causal impact of the attempted military coup**

After the intervention term, the average answer variable 72.84K. If there was no intervention, the average expected response value would be 68.05K. The opposite factual estimate is in the 95% range [59.90K, 74.69K].

The difference between the estimated and observed value gives the estimated value of the causal effect on the response variable. The value of impact is 4.78K by 95% interval of [-1.85K, 12.93K]. When data points were collected in the after the intervention period, the total the affected value found to be 1.97M. But, if there was no intervention, this value would be expected to be 1.84M. The 95% range of this estimate is [1.62M, 2.02M]. Relatively, the response variable increased by 7% in the 95% range [-3%, +19%] When we check at the possibility of Bayesian, it can be said that this effect is not statistically significant and it can be consist of random fluctuations. (p = 0.123). This situation can also happen when the control variable is not sufficient or when the variables do not have a strong relationship with the response variable. In addition, at times when the response time is too long and the impact is

already over, individual days or short times can still have a significant impact on the response time.

Table 5.3. provides the summary of the causal impact analysis results by region. As one may see from the Table 5.3., for the shooting of the Russian military jet, we found positive causal impacts in PC in all regions except in Russia, and they are statistically significant. In Russia, we detect a negative and statistically insignificant causal impact. This effect may be the result of random fluctuations. For the Gezi Park, we have statistically positive significant causal impacts in PC in all regions. As to the electronic devices ban, we found a positive significant causal impact in PC for domestic, Europe, Far East, Middle East, Russia and North America regions. We also see a positive causal impact in Africa and South America, but it is not statistically significant. Finally, for the attempted military coup, we found statistically significant positive causal relationship for Africa, Middle East, North America, Domestic, Far East and South America. We also detect a positive causal impact in Europe and Russia, but they are not statistically significant. This effect may be the result of random fluctuations.

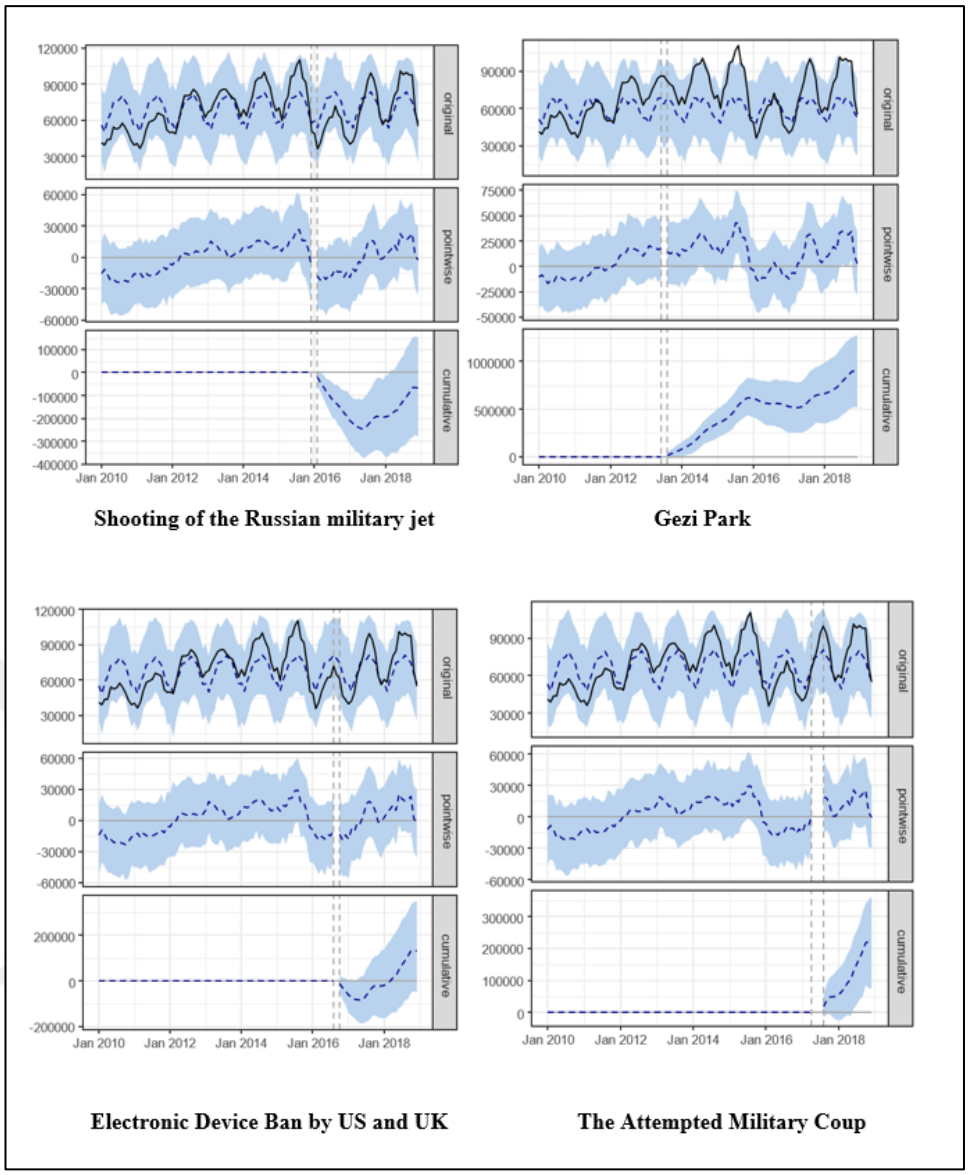

Figure 5. 15 Causal Impact Analysis of the PC in Russia

Table 5. 4 Bayesian one-sided tail-area probability (p)

(p)	Africa	Domestic	Europe	Far East	Middle East	North America	South&Central America	Russia
Shooting of the Russian military jet	*0.0031	*0.0029	*0.003	*0.0031	*0.0029	*0.0029	*0.003	0.2667
Gezi Park	*0.0025	*0.0025	*0.0031	*0.0025	*0.0025	*0.0025	*0.0025	*0.0025
Electronic devices ban by US and UK	0.0556	*0.0032	*0.0029	*0.0144	*0.0036	*0.0248	0.0667	*0.0025
The attempted military coup	*0.003	*0.003	0.2157	*0.003	*0.003	*0.003	*0.0031	0.123

***:** Statistically significant

5.3. Financial Performance Attributes

5.3.1. Financial Performance of the Turkish Airlines

The socio-political events do not only affect the operational performance of the airline companies, but also their financial performance. The Turkish Airlines is not an exception. Figure 5.16 shows the evolution of the Turkish Airlines financial performance from 2010 Q1 to 2018 Q4. When we refer to the effects of the selected events on operating and net profit, we noticed that the most detrimental effects took place after the shooting of the Russian military jet. After that event, the Earnings Before Interest, Taxes, Depreciation, Amortization and Restructuring or Rent Costs (EBITDAR) and return on assets had seriously decreased by 14.69% and 8.99% respectively. This is the highest drop in profitability since 2013 Q1. Although the attempted military coup and the electronic devices ban did not have a violent effect on the operational and financial profitability of the company, their incremental effect led to a late recovery in the profitability. The company restored its profitability by September 2017. However, one should also note that the company did not reflect the detrimental effects of the attempted military coup and the electronic diveces ban to its profitability. This may be an evidence of the resilience of agile company management. They successfully managed these indicents, not reflecting their consequences to the passengers carried in domestic and international regions.

Another interesting finding is that although there is a considerable decrease in crude oil prices after June 2014, this decrease is fairly positively reflected in the ROA and ROE of the Turkish Airlines from September 2014 to December 2015, but then followed up by a huge decrease in profitability due to the shooting of the military jet and the attempted military coup (Figure 5.17). This is striking since the crude oil is the most crucial factor in operating costs of the airlines companies. Thus, the negative impact of the incidents in Turkey outweighted the positive effect of the global market conditions, leading to a decrease in the financial performance of the firm.

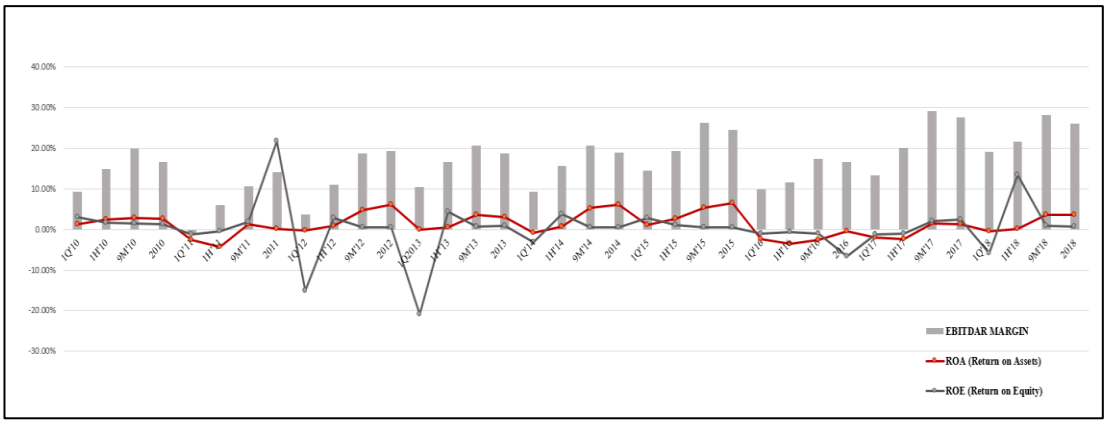

Figure 5. 16 Turkish Airlines Financial Performance (2010-2018)

Source: Turkish Airlines Company Finance Reports

5.3.2. Stock Market Performance of the Turkish Airlines

We also looked at the stock market performance of the Turkish Airlines to discover whether there is an impact of the incidents on stock price. As Figure 5.17 shows, we found that the stock price is highly negatively affected from the shooting of the Russian military jet and the attempted military coup events. The joint impact of these events was a 44% decrease on stock price from October 2015 to November 2016. One of the biggest drop took place in November 2015, where there was the shooting of the Russian jet crisis. The stock price also dropped by 9,62% on July 2016 during the military coup. However, we did not detect any significant price fluctuations in electronic devices ban crisis. The Turkish Airlines showed an overwhelmingly agile management during this incident by taking the necessary precautions on time.

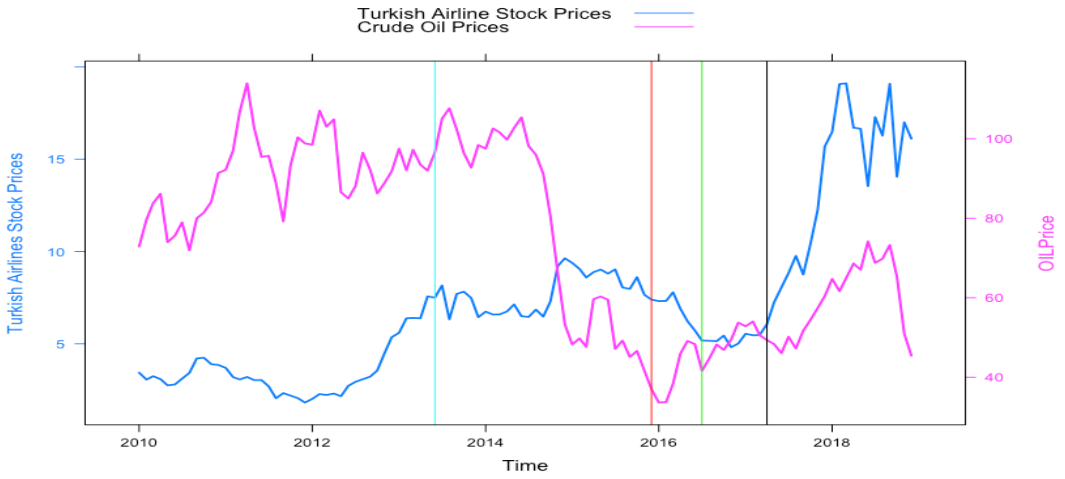

Figure 5. 17 Turkish Airlines Market Performance and Crude Oil Prices

Source: Borsa Istanbul and Bloomberg

CHAPTER VI

CONCLUSIONS

The aviation industry stimulates the economy and creates value in numerous industries. It significantly contributes to the social and economic growth of the countries by providing a variety of services and facilities to promote transportation for the sake of domestic and international passengers. However, global, regional and local social, economic and political crises seriously affect the aviation industry from time to time. In this study, we investigated the impact of socio-political events in Turkey, particularly on the operational performance of Turkish Airlines, over the period 2010-2018.

To conduct the study, we selected four critical events among many others that had a serious impact on the Turkish social and political environment. These events, by chronological orders, are; Gezi Park (May 26-June 16, 2013), the shooting of the Russian military jet (November 24, 2015), the attempted military coup (July 15, 2016) and the electronic device ban by the US and UK (March 25, 2017). We expected these events to have an influence on the operating performance of Turkish Airlines. To detect the outlier impact of these crises, we run four different outliers/anomalies detecting algorithms, namely outlier detection algorithm (ODA), breakout detection algorithm (BDA), change-point algorithm (CPA) and causal impact analysis.

The findings suggest that the socio-political crises have changing impacts on Turkish Airlines performance as operational regionally, depending on the outlier algorithm employed. CPA successfully detected the Gezi Park in domestic, Africa and North American regions for RPK and in domestic, Europe, Far East, and North America regions for ASK. The results indicate that domestic flights are highly affected from the incident. The results for the shooting of the Russian military shows that ODA detected a strong outlier impact in Africa and North America regions for RPK and ASK. This finding may be explained by the decrease in transit flights of Russian passengers to Africa and North America destinations by using the Turkish Airlines.

When we investigated the attempted military coup incident for RPK and ASK, we found ODA to have an outlier impact in Europe, the Middle East and North America regions. These findings support the strong association between this political event and fluctuations in the RPK and ASK, especially on international flights. Finally, we got interesting results for the electronic device ban incidence. While ODA successfully detects an outlier effect in domestic, North and South American regions, CPA reveals an impact in Africa, Far East, and South America regions for RPK. We found almost the same results for ODA for the ASK analysis. CPA has an impact only in Africa and Far East regions. Thus, the outlier algorithms show more or less consistent results on a regional basis. This is not surprising since the electronic device ban had its detrimental effects mostly on international flights to the American regions. The impact of the crises in passenger load factor (PLF) has been less visible and only temporary. It especially happens in the attempted military coup.

The general results indicate that the strategies of the hub may make them less dependent on local dynamics and reduce the impact of crises, in line with the findings of Dobruszkes and Hamme (2011). In the study, we also aim to contribute to the development of the causal impact analysis with the Bayesian model to obtain a counterfactual prediction of the PC.

For the shooting of the Russian military jet, we found positive causal impacts in PC in all regions except in Russia, and they are statistically significant. In Russia, we detect a negative and statistically insignificant causal impact. As to the electronic devices ban, we found a positive significant causal impact on PC for domestic, Europe, Far East, Middle East, Russia and North America regions. We also see a positive causal impact in Africa and South America, but it is not statistically significant. Finally, for the attempted military coup, we found statistically significant positive causal relationships for Africa, Middle East, North America, Domestic, Far East and South America. We also detect a positive causal impact in Europe and Russia, but they are not significant.

In summary, the findings show that Turkish Airlines have a strong capacity and ability to absorb the incremental effects of the socio-economic crises. The operational and financial performance of the company is quite resilient and the company follows an agile management approach to cope with unexpected situations. This study may be

extended to cover other airline companies traded in the stock exchanges to see the comparative strength of Turkish Airlines in similar situations.

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CAPA, Center for Airline, Airline Monitor, IATA, IMF

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