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Economic Effect of Coronavirus (COVID-19) Outbreak on Airline Businesses

Coronavirüs (COVİD-19) Salgınının Havayolu İşletmelerine Ekonomik Etkisi

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Abstract: As a result of the COVID-19 pandemic, as of June 30, 2020, there are 10 million cases and 510 thousand people have died. Many countries had to suspend airline flights due to the pandemic. Airline businesess have had to reduce their flights due to the countries' banning flights and the decrease in passenger airline demand. Although some countries, especially the USA, provide financial support to airline businesess, all airline businesess worldwide suffer great losses in this process. The main purpose of this study is to reveal the relationship between the share prices of airline companies and the COVID-19 pandemic. The dependent variable of this research is the stock price (ASP), the independent variables of this research are the number of case (CASE) and number of deaths (DEATH) of the countries that suffer from COVID-19. After that, daily data between 25.02.2020 - 30.06.2020 has been used for our research topic. At the same time, 9 airline companies have been chosen among the countries that have the highest number of cases. As a result of the panel data analysis conducted according to the constant effects, it has been determined that the CASE variable has a negative effect on ASP by a 5% significance level. And similarly, the DEATH variable has a negative effect on ASP by a 10% significance level. According to this result, it is seen that the deaths caused by the Coronavirus pandemic negatively affected the share prices of airline companies. From this point of view, COVID-19 affects the stock prices of airline companies negatively and, thus it is an economic proof of the crisis experienced in the airlines.

Structured Abstract: The occurrence of the SARS outbreak in 2003, the 2008 global financial crisis, and the 2009 H1N1 (swine flu) outbreaks caused major damage to airline companies. COVID-19 infectious disease, which appeared in late 2019 but was declared a pandemic by the World Health Organization (WHO) in March 2020, has a major impact on the airline industry, making it a worldwide impact. As a result of the COVID-19 pandemic, as of June 30, 2020, there are 10 million cases and 510 thousand people have died. Many countries have had to suspend airline flights due to the pandemic. Airline businesess have had to reduce their flights due to the countries' banning flights and the decrease in passenger airline demand. Although some countries, especially the USA, provide financial support to airline businesess, all airline businesess worldwide suffer great losses in this process.

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Global crises deeply affect countries and businesses. 1970 oil shock, 1990 Gulf war, 1998 Asian Crisis, 2001 attack on twin towers, 2003 SARS epidemic, and 2008 global financial crisis have been among the biggest crises affecting the airline sector. The volatility in stock markets in all crises changes a lot. Stock prices of airline companies have also negatively affected by these crises, and stock prices have shown volatility. In this context, it is aimed to investigate the effect of the COVID-19 pandemic on the stock prices of airline companies in this study. It is seen that there is no relevant study or research that examines the stock prices of airline companies in the COVID-19 pandemic. At this point, it is thought that this study would make important contributions to academic literature. In this context, firstly, the pandemic has been explained in case of a major crisis. Then the developments in airline transportation due to the Coronavirus pandemic and previous related studies on the subject have been mentioned. Finally, the research has been concluded by presenting the method, analysis, and findings.

The aim of this study is to reveal the relationship between the stock prices of airline companies and the COVID-19 epidemic. The data on the number of cases (CASE) and the number of deaths (DEATH) of the countries where the airline companies associated with the epidemic disease are located. In the study, daily data between 25.02.2020 - 30.06.2020 were used. Stock price data of airline companies were obtained from Thomson Reuters Datastream database. Case and death numbers were obtained from worldometers.com site. The data were analyzed using panel data analysis method. In this study, panel data analysis has been preferred, because it enables building a model that takes into account multiple airline companies (horizontal section data). Thus, a more general inference could be made with the findings of the panel data analysis. The airline companies in the study have been selected from 9 countries with high rates of cases and deaths related to the Coronavirus pandemic. Panel data analysis has been used as a method, and findings have been obtained using GAUSS-10, STATA-15 and EViews-9 software packages.

The panel data model is essentially the regression model estimated by panel data. For this reason, when the regression model is mentioned, the tests, assumptions and other features are also valid for panel data models. In panel data models, there is one dependent and one or more independent variables. In addition, since the model is a statistical or econometric model, the error term is also included in the model. Since the variables in the model will show the change according to both units and time, different indices will be used in the representation of both. In panel data analysis, i, sub-indices are used to indicate the units and t, sub-indices to indicate the time period (Güriş, 2015: 4-5).

Daily data between 25.02.2020 - 30.06.2020 has been used for our research topic. At the same time, 9 airline companies have been chosen among the countries that have the highest number of cases. As a result of the panel data analysis conducted according to the constant effects, it has been determined that the CASE variable has a negative effect on ASP by a 5% significance level. And similarly, the DEATH variable has a negative effect on ASP by a 10% significance level. Accordingly, it has concluded that the number of cases and deaths caused by the Coronavirus pandemic negatively affects the stock prices of airline companies. From this point of view, COVID-19 affects the stock prices of airline companies negatively and, thus it is an economic proof of the crisis experienced in the airlines.

The most important of the internal economic indicators of the airline companies are the indicators that express profitability. The profitability of businesses depends on the relationship between costs and incomes. Cost items are very important in airline businesses as in all businesses. Cost is one of the most critical factors affecting business profitability. Airline companies have to minimize costs as much as possible in order to make profits, maximize share value, ensure sustainability, and gain a competitive advantage over rival airline businesses. Performing cost control is a factor preventing airline businesses from major damages, especially in times of economic fluctuations, terrorist attacks, and risky activities. Although the operational costs of airline companies have decreased significantly due to COVID-19, their fixed, and semi-fixed costs continue. These costs such as personnel, leasing, station, and maintenance constitute approximately 50% of the total costs. Even if airline companies cease their activities due to the pandemic, they would continue to pay staff wages, parking fees for aircraft, routine aircraft maintenance costs, and aircraft rental costs. During the COVID-19 pandemic, passenger revenues, which are the main revenue item of airline companies, have also decreased because of the travel restrictions and the decrease in flights. Thus, airline companies are unable to afford these costs. At the final stage, the majority of airline companies suffer losses and, because of that stock prices are negatively affected. As a result of the analysis that is done in this study, it has been proven as an economic analysis that the number of cases and deaths of countries negatively affects the stock prices of airline companies.

Keywords: Social Sciences, Coronavirüs (COVİD-19), Airlines, Stock Price, Panel Data Analysis

Öz: COVİD-19 salgını neticesinde 30 Haziran 2020 tarihi itibariyle 10 milyon vaka ve 510 bin kişi hayatını kaybetmiş bulunmaktadır. Birçok ülke salgından dolayı havayolu seferlerini askıya almak durumunda kalmıştır. Hem ülkelerin uçuşları yasaklaması hem de yolcuların havayolu taşımacılığı talebindeki düşüşlerden dolayı havayolu işletmeleri uçuş seferlerini azaltmak durumunda kalmıştır. Amerika başta olmak üzere bazı ülkeler havayolu işletmelerine mali destekte bulunmalarına rağmen, Dünya genelindeki tüm havayolu işletmeleri bu süreçte büyük zararlar görmüştür. Bu çerçevede çalışmanın temel amacı, havayolu işletmelerinin hisse senedi fiyatları ile COVİD-19 salgın hastalığı arasındaki ilişkinin ortaya konulmasıdır. Analizde kullanılan bağımlı değişken hisse senedi fiyatı (ASP) iken, bağımsız değişkenler ise COVİD-19'dan kaynaklanan ülkelere ait vaka sayısı (CASE) ve ölüm sayısı (DEATH) verileridir. Çalışmada 25.02.2020 – 30.06.2020 tarihleri arasındaki günlük veriler kullanılmıştır. Çalışmada en fazla vaka sayısına sahip ülkeler arasından 9 havayolu işletmesi tercih edilmiştir. Sabit etkilere göre yapılan panel veri analizi yönetimi sonucunda, CASE değişkeninin ASP üzerinde %5 anlam düzeyinde negatif bir etkiye sahip olduğu tespit edilmiştir. Benzer şekilde DEATH değişkeninin de ASP üzerinde %10 anlam düzeyinde negatif bir etkiye sahip olduğu tespit edilmiştir. Buna göre, Coronavirüs salgın hastalığından kaynaklanan ölümlerin havayolu işletmelerinin hisse senedi fiyatlarını negatif etkilediği sonucuna varılmıştır. Buradan hareketle, COVİD-19 salgın hastalığın havayolu işletmelerinin hisse senedi fiyatlarını olumsuz etkilediği ve dolayısıyla havayollarında yaşanan krizin ekonomik olarak kanıtı niteliğindedir.

Anahtar Kelimeler: Sosyal Bilimler, Coronavirüs (COVİD-19), Havayolu İşletmeleri, Hisse Senedi Fiyatı, Panel Veri Analizi

Introduction

The most important matter about airline transportation is that it provides the opportunity to travel faster to places that are far and difficult to go. And, this is its distinctive property from other transportation types. This feature provides significant benefits to global economic prosperity, to increase efficiency, to the development of multicultural societies, and to the interaction of different countries with each other. Because of that, air transport has become one of the indispensable means of transportation for countries. However, air transport is highly affected by international crises. Moreover, during these crisis times, it is seen that many airlines have gone bankrupt. To give an example, as a result of the terrorist incident that took place in 2001 on September 11, the airline industry experienced a great crisis and so, many airlines around the world suffered losses, while some had to go bankrupt (Doganis, 2009: 46). The occurrence of the SARS epidemic in 2003, the global financial crisis in 2008, and the H1N1 (swine flu) epidemics in 2009 have caused great damage to airline companies. Finally, the COVID-19 infectious disease, which has emerged in late 2019, however it was declared as a pandemic by the World Health Organization (WHO) in March 2020. It has covered all around the world, so it has made large-scale damage to the aviation sector.

The SARS pandemic that emerged in China in 2003 is evaluated that it is the first contagious epidemic crisis to affect the airline industry internationally. However, because of this epidemic, particularly airline companies in China and the Asia Pacific region were negatively affected mostly. During this crisis of epidemic, there was a 45% reduction in flights to China. On the other hand, from a general view, there was a 2.4% decrease in international air transport compared to 2002 (Clegg, 2010: 441). The other epidemic that is the H1N1 (swine flu) infectious disease, which started to spread in Mexico in 2009, had a short-term effect on the airline industry, it did not have major effects on all over the world. However, it is assumed that the impact of the last crisis that is named COVID-19 pandemic would be greater than these two epidemics. Detailed information about this is given in the following.

As a result of the COVID-19 pandemic, there are 1.5 million cases and 88 thousand dead people as of 8 April 2020. Many countries have had to suspend their airline flights due to this

pandemic. Airline operators have had to reduce their flights, because of the countries banning flights and decreasing passengers' demand for air transport. Although some countries with the leadership of America have provided financial support to airline companies, all airline companies around the world have suffered greatly in this process.

Global crises deeply affect countries and businesses. 1970 oil shock, 1990 Gulf war, 1998 Asian Crisis, 2001 attack on twin towers, 2003 SARS epidemic, and 2008 global financial crisis have been among the biggest crises affecting the airline sector. The volatility in stock markets in all crises changes a lot. Stock prices of airline companies have also negatively affected by these crises, and stock prices have shown volatility. In this context, it is aimed to investigate the effect of the COVID-19 pandemic on the stock prices of airline companies in this study. It is seen that there is no relevant study or research that examines the stock prices of airline companies in the COVID-19 pandemic. At this point, it is thought that this study would make important contributions to academic literature. In this context, firstly, the pandemic has been explained in case of a major crisis. Then the developments in airline transportation due to the Coronavirus pandemic and previous related studies on the subject have been mentioned. Finally, the research has been concluded by presenting the method, analysis, and findings.

Effects of Coronavirus on Airline Sector

As mentioned in the introduction part, COVID-19 Pandemic has had a major negative impact on the aviation sector. Airline businesess have experienced major problems during the crisis. The main problems are; reduction of airline capacities, liquidity shortage of airlines, disruption of airline operations, failure to pay airline personnel. Although many countries have provided substantial financial support to their own airlines, this effect has not diminished. The situations of major airline companies in the face of this crisis are listed below:

• American Airlines announced that it is going to lower the domestic flights by at the range of 60-70% in April and between 80-90% in May and to apply for $ 12 billion in state aid[1].

• Air Canada has informed that it has laid off of 5100 employees as a temporary, and has ceased the most of its international flights[2].

• Air France-KLM has announced that it is an unprecedented crisis for them and that they are going to reduce airline capacity by 70-90%[3].

• For British Airways, Alex Cruz who is the CEO of it has stated that they are facing a more devastating crisis than the SARS and the 9/11 twin-tower attack[4].

• Turkish Airlines has suspended its all international flights since 28 March 2020[5].

• Lufthansa has reduced by the range of 90% its long-distance flight capacity. In addition to this, it has announced that it is going to handle just 20% of the flights within Europe.[6].

• Qathay Pacific has canceled by the range of 75% of flights in March. It has also canceled by the range of 96% of them in April and May[7].

[1] https://www.dallasnews.com/business/airlines/2020/03/27/american-airlines-could-get-12-billion-in-government-aidbut-still-cutting-schedules-80-for-may-ceo-says/ (Access Date: 09.04.2020)
[2] https://globalnews.ca/news/6725938/westjet-air-canada-layoffs-covid-19/ (Access Date: 09.04.2020)
[3] https://www.ft.com/content/1aa77406-661c-11ea-a3c9-1fe6fedcca75 (Access Date: 09.04.2020)
[4] https://www.bbc.com/news/business-51875271(Access Date: 09.04.2020)
[5] https://www.turkishairlines.com/tr-tr/duyurular/coronavirus-salgini/iptal-seferler/index.html (Access Date: 09.04.2020)
[6] https://www.reuters.com/article/us-health-coronavirus-lufthansa/lufthansa-cuts-90-of-long-haul-flights-statement-idUSKBN21326V (Access Date: 09.04.2020)
[7] https://asia.nikkei.com/Spotlight/Coronavirus/Coronavirus-hammers-Asian-airlines-as-passenger-numbers-plummet (Access Date: 09.04.2020)

• Singapore Airlines has informed that it has canceled by the range of 96% of its flights until the end of April. In addition to this, Most of the employees have taken off on unpaid leave by Singapore Airlines. In response to this, The Singapore government has provided $ 19 billion to the airline business[8].

It could be said that there is an economic recession in big airline companies mentioned here. Moreover, this situation is valid for other airline companies. When the situation of the airline companies in the face of the crisis is evaluated in general, it is understood that it is the biggest economic crisis that the airline sector has faced so far. The effects of COVID-19 on airline demand on a global scale are presented in the Table 1.

Table 1: Change in Global Scheduled Flights (weekly % change compared to 2019)

Country	3 Febr.	10 Febr.	17 Febr.	24 Febr.	2 March	9 March	16 March	23 March	30 March	6 April
All	-3.6	-9.9	-10.7	-10.1	-7.9	-10.1	-12.4	-28.7	-47.7	-59.2
Germany	-7.9	-8.0	-6.6	-5.1	-5.0	-15.4	-30.2	-71.9	-88.6	-92.6
Spain	-3.8	-2.5	0.6	-1.6	-1.4	-2.9	-13.7	-74.3	-88.5	-92.6
Hong Kong	-20.6	-44.7	-57.7	-63.3	-70.4	-77.5	-80.8	-81.7	-88.3	-92.3
England	-4.3	-4.0	-3.0	-1.9	-2.7	-15.5	-19.3	-53.5	-75.6	-90.7
Singapore	-8.2	-15.4	-18.5	-22.4	-25.4	-35.7	-35.5	-76.9	-90.8	-89.9
Italy	-4.3	-3.5	-2.8	-6.2	-8.8	-21.6	-73.9	-88.0	-89.2	-89.0
France	-0.3	0.6	1.7	-0.5	-2.0	-3.8	-13.7	-41.3	-81.4	-87.0
UAE	-1.9	-3.3	-3.5	-3.3	-2.9	-8.3	-24.4	-57.6	-85.8	-84.4
Sweden	-5.7	-5.4	-6.4	-4.9	-4.8	-6.4	-14.1	-65.3	-77.1	-84.2
Australia	-3.6	-5.0	-1.7	-2.5	-1.7	-2.3	-2.9	-15.9	-63.1	-78.1
India	1.9	6.2	10.8	6.7	9.9	10.0	8.3	1.8	-68.0	-71.1
South Korea	-3.4	-9.3	-15.7	-17.9	-34.1	-52.1	-56.1	-55.7	-56.6	-59.3
China	-22.7	-63.3	-70.8	-62.3	-41.6	-42.9	-38.7	-37.5	-43.9	-46.2
USA	1.5	1.3	1.5	0.6	-2.1	-1.3	-0.5	-48.0	-23.0	-45.2
Japan	-0.8	-3.2	-4.6	-5.6	-7.6	-15.0	-19.2	-24.3	-27.9	-32.0

Source: OAG, 2020. https://www.oag.com/coronavirus-airline-schedules-data

Table 1 shows the changes in scheduled flights compared to the same week of last year between February 03, 2020 - April 06, 2020. Globally, it is observed that there is a 59% decrease in flights as of 06 April. On the other hand, Germany, Spain, England, and Hong Kong are understood to be operating under 10% capacity compared to the same week of the previous year. From Table 1, it is seen that the decline would continue and the dimensions of the financial crisis are expected to increase for airline companies.

At the result of the effects of Coronavirus pandemic, there are two scenarios that are generated by ICAO about airline passenger demand. And these both are shown in Table 2:

[8] https://www.channelnewsasia.com/news/business/covid-19-singapore-airlines-suspend-flights-coronavirus-12566248 (Access Date: 09.04.2020)

Table 2: Airline Passenger Traffic Scenarios Possible to Happen until the First Half of 2020

Scenario 1 (V-Shape)	Scenario 2 (U-Shape)
• 41% reduction in airline capacity (ASK)	• 51% reduction in airline capacity (ASK)
• 443 million passenger demand declines	• 561 million passenger demand declines
• $ 98 billion decrease in operational income	• $ 124 billion decrease in operational income

Source: ICAO, 2020. https://www.icao.int/sustainability/Documents/COVID-19/ICAO_Coronavirus_Econ_Impact.pdf

According to the given explanations above, it is thought that the economic effects of the COVID-19 pandemic would have an enormous range. In this sense, whether the stock prices of airline companies are affected by the global pandemic is considered an issue worth on study.

As examined in the literature, epidemics surround not only one country, but also countries farther away. The reason behind this is that these epidemics, which started at a single point, took over the whole world, aviation, and its development accelerating globalization. The ability to move farther and infect millions of people is that people could arrive from one place to another in the shortest time possible (Grais, 2003). It is inevitable that a sector that causes such epidemics would not see an economic impact during the fight against the epidemic process. To give an example, during the SARS epidemic, it is observed that Asian countries such as Hong Kong and China have experienced an economic loss of 30 to 140 million dollars due to the decrease in aviation investments (Clegg, 2010: 465).

It is seen that the SARS epidemic, in which measures had to be taken massively in countries where it spread in 2003, had great effects on the economies of countries in terms of finances. In the study of Keogh-Brown and Smith (2008), the macroeconomic effects of SARS have been investigated in affected countries mostly. Many concepts such as gross national product (GNP), domestic and foreign trade revenues, the state budget, and related sectors have been used to determine the effects. In this study conducted for infected countries, when the losses in the gross national product are examined, Hong Kong lost 3.7 billion dollars compared to the previous year. Likewise, the Chinese government also lost 3.1% on the previous year. It is seen that the SARS epidemic has affected these two countries most economically. In addition to this, it is reported that the Chinese government has experienced a huge decline in the tourism sector with a loss of $ 3.5 billion. For the accommodation and food sectors, except for these two countries, Canada suffered a loss of 5.272 million dollars, while Australia, which has a lower number of cases, has lost 178 million dollars. It is observed that SARS negatively affected the economies of many countries in different sectors.

The avian flu epidemic that emerged in 2006 also has spread rapidly to large masses and has caused great damage to state budgets. Investigating the short-term impact of avian flu on Taiwan economy, Chang et al. (2017) have a study to monitor the economy in certain sectors by creating "input-output analysis" and "calculable general equilibrium models". As a result of the input-output analysis, it is reported that there has been a decrease of by the range of 6.5% in GNP and especially the agricultural service sector, banking, and medical sectors are greatly affected.

SARS in 2003, avian flu in 2006, and H1N1 (swine flu) in 2009 have caused damage to airline companies and airport operations because of a decrease in passenger traffic. Chung (2015), on the other hand, evaluates this in terms of airports and accepts that the passenger traffic at the airports is proportional to the economy of the airport in his study. In this study, the passenger traffic at 12 airports determined in the period from 2002 to 2010 has been calculated. According to this, it has been observed that there is a 15% decrease in the number of passengers at Singapore Changi Airport, and 20% at Hong Kong International Airport. About avian flu, Hong Kong, which has

prepared after the SARS epidemic, has not shown a significant decrease, while the density of Tokyo International Airport decreased by 7.2% during the H1N1 (swine flu) epidemic. From a direct proportion, The aviation sector has also experienced losses at approximately these rates.

In addition to the negative effect of the epidemic, there may also be positive effects. Chen et al. (2009) has conducted the Taiwan example. This research has conducted on stocks in a determined period of 9 months. It has stated that tourism, aviation sectors have been sensitive to the SARS epidemic and have shown a decrease. On the other hand, the profit in the business shares in the biotechnology field has been calculated and has proved to be positively affected by this epidemic.

Countries that face an epidemic again in 2020, as a first measure, have stopped their civil aviation activities in order to cut their connection with the outside world and to prevent the distribution within the country. These measures remind the example of SARS in the literature and the loss of billions of dollars by airlines such as the Asia Pacific due to the reduction of air traffic (ICAO, 2020: 5). It is observed that this situation is the same for the COVID-19 pandemic, and there are billions of losses from airlines for countries where the spread is high in just a few months. To give an example, even within 15 days, the passenger transport capacity of Asian airline companies has decreased by 30% (Statista, 2020: 27).

Data Set, Model and Methodology

The aim of this study is to reveal the relationship between the stock prices of airline companies and the COVID-19 epidemic. The data on the number of cases (CASE) and the number of deaths (VEFAT) of the countries where the airline companies associated with the epidemic disease are located. In the study, daily data between 25.02.2020 - 30.06.2020 were used. Stock price data of airline companies were obtained from Thomson Reuters Datastream database. Case and death numbers were obtained from worldometers.com site. The data were analyzed using panel data analysis method.

The data resulting from the combination of time series and horizontal section data is called longitudinal data or polled data. The time and horizontal cross-section dimensions of such data may differ. Longitudinal or pooled data, in which the horizontal section units remain unchanged, is called panel data (Güriş, 2015: 2). In economic researches, panel data usage has many advantages over horizontal section or time series. Accordingly, more observations are obtained in panel data usage compared to horizontal section and time series. This increases the degree of freedom and reduces the collinearity between the independent variables. It increases the efficiency of econometric forecasts in researches using panel data. In addition, the use of longitudinal data allows the researcher to perform a series of analyzes that cannot be obtained using a horizontal section or time series (Hsiao, 2003: 3).

The panel data model is essentially the regression model estimated by panel data. For this reason, when the regression model is mentioned, the tests, assumptions and other features are also valid for panel data models. In panel data models, there is one dependent and one or more independent variables. In addition, since the model is a statistical or econometric model, the error term is also included in the model. Since the variables in the model will show the change according to both units and time, different indices will be used in the representation of both. In panel data analysis, i, sub-indices are used to indicate the units and t, sub-indices to indicate the time period (Güriş, 2015: 4-5). The linear panel data model made with panel data, where the dependent variable Y is indicated by independent variable or variables X, can be shown as follows (Erol, 2007: 33).

$$Y_{it} = \alpha_{it} + \beta_{it} + X_{it} + \varepsilon_{it}$$

The airline companies in the study were selected from 9 countries with high case and mortality rates related to Coronavirus epidemic disease. Panel data analysis was used as a method, and findings were obtained using GAUSS-10, STATA-15 and EViews-9 software packages.

Table 3: Sample Included in the Study (Countries)

Airline	Country
Turkish Airlines	Turkey
Air China	China
Air France-KLM	France
Lufthansa	Germany
Ryanair	Italy*
IAG	Spain
Swiss Air	Switzerland
Easyjet	England
American Airlines	USA

Not: Since the current stock data of Alitalia enterprise in Italy could not be reached, Ryanair enterprise that was frequently flying to Italy was chosen.

Table 4: Measurement Indicators and Abbreviations of Variables

Variables	Symbol	Measurement Indicators
Airline Stock Price	ASP	Stock Price
The number of Coronavirus Cases of Countries	CASE	Daily Number of Cases/ Country Population
The number of Coronavirus Deaths of Countries	DEATH	Daily Number of Deaths/Country Population

In the study, stock price data of airline companies was used as the dependent variable. CASE and DEATH data are independent variables. In the model, the relationship between independent variables and dependent variable was investigated. The established model formulation is shown below:

$$ASP_{it} = \beta_0 + \beta_1 CASE_{it} + \beta_2 DEATH_{it} + \varepsilon_{it}$$

Hypotheses about the variables involved in this study are listed below:

- Ho: There is a relationship between the coronavirus epidemic and the stock prices of the airlines.
- H1: There is no relationship between coronavirus outbreak and airline stock prices.

The relationship between explanatory variables and air cargo demand was estimated:

- There is a negative relationship between the number of coronavirus cases (CASE) and stock price (ASP).
- There is a negative relationship between the number of coronavirus deaths (DEATH) and stock price (ASP).

Results

Before the panel data time series of cross-sectional dependence between the variables, as in analysis and determination of stability is required. Then tests are made on which panel data model (fixed or random effects) to choose. After choosing the appropriate model, heteroskedasticity and autocorrelation tests are performed. Finally, depending on the heteroskedasticity and autocorrelation results, the model is estimated with a resistant estimate suitable for the model.

Table 5: *Correlation Matrix of Variables*

	ASP	CASE	DEATH
ASP	1	0.09411	0.13588
CASE	0.09411	1	0.45013
DEATH	0.13588	0.45013	1

The high correlation between the variables in the regression model causes multiple linearity problems. Looking at the correlation between all variables, it is observed that they are below the critical value (0.80 and above).

Table 6: *Cross-Sectional Dependence Test Results*

Variable	CDLM adj.		
	Statistics	P-value	Decision
ASP	4.150	0.000	Ho Red
CASE	2.052	0.020	Ho Red
DEATH	5.504	0.000	Ho Red

According to the horizontal section dependency test results, the horizontal section dependence of all variables is determined and CADF 2nd generation unit root test is applied.

Table 7: *CADF Panel Unit Root Test*

Variable	Model	Stat.	Critical Values		
			1%	5%	10%
ASP	Constant	-4.590	-2.53	-2.32	-2.21
	Constant and Trend	-4.690	-3.03	-2.83	-2.73
ΔASP	Constant	-10.290	-2.53	-2.32	-2.21
	Constant and Trend	-10.253	-3.03	-2.83	-2.73
CASE	Constant	-5.242	-2.53	-2.32	-2.21
	Constant and Trend	-5.462	-3.03	-2.83	-2.73
ΔCASE	Constant	-10.103	-2.53	-2.32	-2.21
	Constant and Trend	-10.049	-3.03	-2.83	-2.73
DEATH	Constant	-7.127	-2.53	-2.32	-2.21
	Constant and Trend	-7.166	-3.03	-2.83	-2.73
ΔDEATH	Constant	-11.153	-2.53	-2.32	-2.21
	Constant and Trend	-11.084	-3.03	-2.83	-2.73

Note: The critical values of CADF test statistics were obtained from Pesaran (2007). In all hypothesis tests, 0.05 (5%) significance level was taken as basis.

According to the result of the CADF panel unit root test, which is the 2nd generation unit root test, it was determined that the values of all variables, including ASP, CASE and DEATH, are lower than the critical values.

After the cross-sectioanl dependence and stationarity tests, it should be determined which of the classical model, fixed effects model and random effects models is suitable for use. In this context, the F-test was used to test the validity of the classical model against the fixed effects model, the Breusch-Pagan LM test was used to test the suitability of the classical model against the random effects model, and the Hausman test was used to choose between fixed effects and random effects models.

Table 8: *Model Identification (classical, fixed and random effects) Test*

F Test			
Test Hypotesis	**Stat.**	**Prob.**	**Decision**
There is no fixed unit effect.	0.5784	0.9993	Ho Kabul
There is no fixed time effect.	998.7063	0.0000	Ho Red
There is no fixed time and unit effect.	7.9387	0.0003	Ho Red
LM Test			
Test Hypotesis	**Stat.**	**Prob.**	**Karar**
There is no random unit effect.	28185.570	0.0000	Ho Red
There is no random time effect.	24.000	0.0000	Ho Red
There is no random time and unit effect.	28209.570	0.0000	Ho Red
Hausmann Test			
Test Hypotesis	**Stat.**	**Prob.**	**Karar**
Random effects model is suitable.	25.6000	0.0000	Ho Red

According to the results of the model determination tests, the fixed effects model was found to be suitable, since the Ho hypothesis was rejected as a result of the Hausman test. Before proceeding with model estimation, variance and autocorrelation tests should be done, and model estimation is made in accordance with it (changing variance and autocorrelation state).

Table 9: *Heteroskedasticity and Autocorrelation Tests*

Modified Wald Test		**Durbin Watson**	**Baltagi-Wu**
Stat.	**Prob.**	**Stat.**	**Prob.**
2.6e+09	0.0000	0.2457595	0.51481213

According to the Modified Wald Test variance test result for the model for which the fixed effects model is suitable, the Ho hypothesis is rejected and it is concluded that there is a changing variance. At the same time, it was determined that Durbin Watson and Baltagi-Wu test statistics are less than 2, so there is an autocorrelation problem.

Analysis was performed with Driscoll and Kraay resistive estimator, which takes into account the variance and autocorrelation problem in the model established according to fixed effects.

Table 10: Driscoll and Kraay Resistant Estimayor Results by Fixed Effects

Variable	Coefficient Estimate	Driscoll and Kraay Standart Error	t	p-value	(95% Confidence Interval)	
CASE	-379732.1	134540.5	-2.82	0.022	-689982.9	-69481.25
DEATH	-2367627	1107124	-2.14	0.065	-4920660	185406.6
C	131.8726	8.45337	15.60	0.000	112.379	151.3661
Number of observations: 819		F (2,8) = 5.32			R^2= 0.0829	
Grup Sayısı: 9		Prob > F = 0.0340				

According to the fixed effects model in which the coronavirus epidemic affects the stock prices of airline businesses, it has been determined that the CASE variable has a negative effect on HSF at the 5% significance level, similarly, the VEFAT variable has a negative effect at the 10% significance level on HSF. With this result, the hypothesis "There is a relationship between the coronavirus epidemic and the stock prices of airlines" is accepted.

Conclusion

The infectious disease of Coronavirus that emerged in China at the end of 2019 has turned into a global crisis that affects the whole world in March 2020. As a result of the COVID-19 pandemic, there are millions of COVID-19 Positive cases and are thousands of deaths. This affects all sectors, however particularly, it also has large-scale effects on air transport. Many countries have had to suspend airline flights due to the pandemic. Airline companies have had to reduce their flights, because of the countries banning flights and decreasing passengers' demand for air transport. During this crisis, the biggest problem for airline companies has been liquidity risk. Despite the financial support of governments, all airline companies worldwide have suffered great losses in this process.

With the spread of the coronavirus pandemic, the scheduled flights of airline operators have decreased by 60% (in some countries, it is about 90%) worldwide. However, according to ICAO's estimation, there is a decrease in operating income of $ 125 billion and the crisis rhetoric of airline managers. Based on this, it is understood that there is a serious impact of the COVID-19 pandemic on the aviation industry. In this context, the effect of the COVID-19 pandemic on the stock prices of airline companies has been investigated.

Daily data between 25.02.2020 - 30.06.2020 has been used for our research topic. At the same time, 9 airline companies have been chosen among the countries that have the highest number of cases. As a result of the panel data analysis conducted according to the constant effects, it has been determined that the CASE variable has a negative effect on ASP by a 5% significance level. And similarly, the DEATH variable has a negative effect on ASP by a 10% significance level. Accordingly, it has concluded that the number of cases and deaths caused by the Coronavirus pandemic negatively affects the stock prices of airline companies. From this point of view, COVID-19 affects the stock prices of airline companies negatively and, thus it is an economic proof of the crisis experienced in the airlines.

The most important of the internal economic indicators of the airline companies are the indicators that express profitability. The profitability of businesses depends on the relationship between costs and incomes. Cost items are very important in airline businesses as in all businesses. Cost is one of the most critical factors affecting business profitability. Airline companies have to

minimize costs as much as possible in order to make profits, maximize share value, ensure sustainability, and gain a competitive advantage over rival airline businesses. Performing cost control is a factor preventing airline businesses from major damages, especially in times of economic fluctuations, terrorist attacks, and risky activities. Although the operational costs of airline companies have decreased significantly due to COVID-19, their fixed, and semi-fixed costs continue. These costs such as personnel, leasing, station, and maintenance constitute approximately 50% of the total costs. Even if airline companies cease their activities due to the pandemic, they would continue to pay staff wages, parking fees for aircraft, routine aircraft maintenance costs, and aircraft rental costs. During the COVID-19 pandemic, passenger revenues, which are the main revenue item of airline companies, have also decreased because of the travel restrictions and the decrease in flights. Thus, airline companies are unable to afford these costs. At the final stage, the majority of airline companies suffer losses and, because of that stock prices are negatively affected. As a result of the analysis that is done in this study, it has been proven as an economic analysis that the number of cases and deaths of countries negatively affects the stock prices of airline companies.

It could be inevitable for airline companies to face the risk of bankruptcy due to the pandemic. Many of them around the world need government support against the risk of bankruptcy. As a matter of fact, IATA emphasized that airline businesses whose cash flows have been disrupted due to COVID-19 should be urgently supported. At this point, the USA has guaranteed $ 58 billion in cash support to its own airlines. Similarly, the Canadian government has decided to support both airport and airline businesses. The Republic of Turkey has declared that domestic flight reduces from 18% to 1% of the KDV rate and it would support the deteriorating airlines. These financial supports and the others are measures of governments to prevent their bankruptcy of airline. From this point of view, the extent to which the airline companies, which are supported by the governments, affect the stock prices may be the subject of research in future studies.

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