



FORECASTING & IMPACT OF COVID-19 ON AIRLINE SECTOR: A CASE STUDY OF TURKEY

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ABSTRACT

Purpose- An infectious virus called COVID-19 originated in China spread over the globe in a short time and became a pandemic. The aim of this study is to determine the relationship between the COVID-19 and the airline companies in Turkey. Thus, we went over daily stock prices of the companies as well as daily COVID-19 cases reported across the nation. As a result, two companies were chosen among all of them. From 11 March 2020 to 30 May 2022, we retrieved data of daily stock prices, COVID-19 cases and COVID-19 deaths recorded.

Methodology- Regression analysis was used to determine the association between COVID-19 and prices. The results were as expected; both companies demonstrated significance, and we concluded that they responded to the COVID-19. The second aim of the study is to utilize regression analysis to predict, between June 2022 and June 2023, both the number of verified COVID-19 cases and the prices of Airline companies.

Findings- The results were as expected; both companies were found significant, and we concluded that they responded to the COVID-19. By June 30, 2023, it is likely to see more verified cases if the corona virus spread rate in Turkey does not change. Data for COVID-19 instances will differ depending on the transmission rate. Briefly stated, COVID-19 cases and BIST 100 Travel Sector cases have a direct relationship. Because of a rise in COVID-19 vaccinations, both businesses exhibit an increasing tendency.

Conclusion- The Travel Sector in BIST 100 also exhibits a favorable correlation with COVID-19 cases. But both businesses exhibit a bullish or rising tendency as a result of vaccination which started in 2021. To stop the corona virus from spreading, precautions should be taken, such as keeping a safe social distance, washing hands regularly, and avoiding unwanted facial contact.

Keywords: COVID-19, BIST-100 Index, travel & leisure sector, forecasting, relationship between price and COVID, regression analysis.

JEL Codes: G15, G17, H84

1. INTRODUCTION

An infectious virus known as COVID-19 that started in China quickly spread throughout the world and became a pandemic. As a result, all business activities ceased around the globe. Travel & Leisure was one of the industry influenced mostly by the COVID-19 outbreak worldwide. It was either an established market, such as the New York Stock Exchange (NYSE), the London Stock Exchange (LSE), or an up-and-coming market, such as the Pakistan Stock Exchange and the National Stock Exchange of India (NSE). Although there have been other pandemics, COVID-19's effects on the travel and leisure sector are more detrimental and severe than those of severe acute respiratory syndrome (SARS) (Lee, C. C., & Chen, M. P., 2020). The following industries are included in this sector: travel and tourism, restaurants and bars, gaming, hotels, leisure services, and airlines. Researchers study various issues and find solutions to problems that are currently affecting stock markets, what the factors that affect the functioning of the market are, which industries are generally affected, and which are anticipated to be safe in a global crisis in order to understand the COVID-19's influence on the travel and leisure sector as well as the impact on different industries. The Stock Market, where businesses register to raise their capitals, is frequently regarded as a reliable indicator of economic health of a nation. It typically works in harmony with other aspects of economy of a nation, such as unemployment, interest rates, GDP, exchange rates, etc.

Even though it is a crucial component of an economy, it is notorious for being unstable, unpredictable, and easily influenced by a few rumors since it depends so heavily on unpredictable human behavior. Political issues, bond prices, inflation, company earnings, dividend policy, and many other factors influence the stock market. Similarly, COVID-19 has had a significant impact on stock markets all over the world, without an exception of developed, developing or underdeveloped countries. Almost all stock markets across the globe have displayed an unusual high volatility in recent years. COVID-19 has had a significant impact on the world economy. Furthermore, COVID-19 consistently disrupts Turkey's banking system. The stock market is a reliable economic indicator. Therefore, it would be helpful for the traders to discuss the effects on the airline industry as reported by the Istanbul Stock Exchange and analyze any trends in the growth or decline of the stock market because of COVID-19. In this study an attempt was made to research impact of COVID-19 on airline industry which encompasses the companies, Turkish Airline and Pegasus Airline. Economists and financial professionals are continually retaining COVID 19 accountable for any downturn witness in the stock market since its outbreak. The main cause behind the decreasing trend turned into complete lockdown and as a result, corporations started to shut down and investors started to take out their investment from the stock market.

Istanbul Stock Exchange (ISE) is regarded as one of the top stock markets, so it is crucial for us to observe stock market behavior in this situation and how to handle this case in the best possible way. For this reason, we have concentrated on the impact of COVID-19 on Istanbul Stock Exchange registered firms. In this case, or in any similar situation regarding magnitude and effectiveness that is of COVID-19, it is safer to analyze the travel businesses in a similar way. This study is conducted to assist traders in dealing with COVID-19 situation with which the number of positive cases rise, the stock market starts to fluctuate, and authorities enforce a total or partial lock down. In order to assist the investors in developing the appropriate mindset on how to approach this circumstance and how to be problem-free in this crucial situation, we decided to compare the impact of COVID-19 cases and stock prices in order to examine the trajectory of the stock market. For potential investors searching for capital on the Istanbul Stock Exchange, this study could be crucial. After reviewing a few articles, we formulated our null hypothesis, which was that the airline sector will not be affected and that there may be an influence on the travel industry if the value of p is less than 10%; otherwise, our null hypothesis could be rejected.

2. LITERATURE REVIEW

For developing hypothesis, we conclude a few research associated with Covid-19 and travel & leisure sector, financial markets, and other sectors. Chen et al. (2020) aimed to examine the impact on US travel and entertainment companies' stock returns because of authorities' regulations and restriction stirring from the COVID-19 pandemic. He used Linear regression models and took a sample of 137 airlines, casinos and gambling, lodges, recreational services, restaurants and bars, and travel and Tourism companies indexed at the U.S. from DataStream for the duration of January 2020 to April 2020. The Fama and French three-component model was used to compare the importance of the stringency measures. The findings conclude that the rigorosity of government policies and regulations impact negatively on stock returns. Also, after controlling the pandemic factors Lee and Chen (2020) analyzed the relationship among the COVID-19 variables and returns of travel and leisure sector changing distributions. The statistics used include a pattern of 65 countries from December 2019 to May 2020 and the Quantile Regression was employed for estimations. The results display that the impact from the number of confirmed cases rate have low effects on sector returns at majority quantile, however COVID-19 death rates have greater significant negative impacts on industry return. Further study concludes that there may be no correlation between travel and leisure sector returns and the variety of cases recovered. Also, there might be an effective correlation between industry returns and government response stringency index (GRSI).

Wang et al. (2021) studied the impact on travel and leisure stock market returns due to authorities' interventions in times of COVID-19 pandemic. He used the panel quantile regression model and took a sample panel of pinnacle 9 most important tourism countries which incorporates (Sweden, America, France, UK, Italy, Denmark, Turkey, Greece, and Spain) from database DataStream throughout January 2020 to November 2020. There are three government interventions indices which are economic support index, containment and health index and stringency index and two stock market variables which are volatile and returns used effectively to examine the significance of the version. The findings show that the intervention of presidency had a significant positive impact on sector stock returns, whilst marketplace was underneath adverse occasions. According to Ali et al. (2020), the corona outbreak had a significant negative impact on capital markets because as the pandemic spread, millions of people died, which had an impact on both market performance and stock price. According to studies, the market was significantly impacted by the COVID pandemic deaths from March 1, 2020, to March 30, and after April not many effects were found.

According to He et al. (2020), the pandemic had an impact on the major stock market sectors, including those related to transportation, electricity, and the environment. However, the impact of the coronavirus was ignored and the responses from the

IT, healthcare, education, and non-environmental businesses were positive. The government's quick responses and well-thought-out strategies helped to stabilize the situation for the Chinese markets. Topcu & Gula (2020) noted that the performance of emerging stock markets is at an all-time low, and that the performance of those same markets is beginning to improve by MARCH 30, 2020, eventually showing positive results.

Al Awadi et al. (2020) concluded that COVID-19 had effect on the Chinese stock market. They used regression methods to determine the relationship between stock price returns and mortality rates. After investigating the situation, they discovered that the epidemic had a negative impact on the stock market and that as the death toll rose, so did stock prices and daily returns. According to Waheed et al. (2020), the situation worsened at the beginning of the pandemic and had a negative impact on stock prices, but after some time, when the government began to take action, things started to improve. Since Pakistan is a developing nation, things might have been even better if precautions had been taken earlier.

According to Liu et al. (2020), COVID-19 had an impact on investors as well as the operations of a company. COVID-19 is rapidly spreading, and we need to take action to address both the public health issue and the financial issues facing the industries. During the pandemic, many labor-intensive industries reduced their operations and working hours in order to protect their employees, but this resulted in a decline in productivity, which ultimately led to losses for the businesses. If the businesses had been unable to absorb losses, they would have completely shut down their premises. In 2020 Onali investigated COVID-19 on a few stock markets. Using the VAR model, we found that the number of fatalities had a negative impact on the stock market and a positive impact when using the VIX model in the first three months (China, Italy, Spain). Ozturk et al. (2020) concluded that COVID-19 had a significant impact on the global market. Nearly all sectors of the Turkish economy experienced negative effects on the financial markets. Among them sports, tourism, transportation, banking, and insurance were those most affected.

Chaouachi (2020) focused on applying an ARDL estimate approach to model the impact of the Corona virus spillover on the stock market in KSA from 2 March 2020 to 20 May 2020. He examined the long-term causality as well as the short-term link between COVID-19 and the Saudi Arabian Stock Market. Since there is always a gap between an actual impact on the nature of a pandemic and a conceptual knowledge of that influence, Ruiz Estrada et al. (2020) provided a main clarification and prediction of infectious disease behavior and added new hypothetical proof about the nature of epidemics. The examination of ten of the largest stock exchanges worldwide revealed that COVID-19 impacts could be destructive to society. According to Elahi et al. (2021), COVID-19 had a significant impact on the entire world. Financial markets, in particular, have faced a significant reaction. Additionally, the outcome demonstrated a decline in market liquidity and had a statistically negative influence on daily return on the markets. To determine the impact of COVID-19, the authors used various econometric models and sets of equations. Additionally, information was gathered from the WHO website and economic statistics handbooks.

The financial markets around the world are incredibly turbulent and unpredictable, according to Zhang et al. (2020). Moreover, he asserted that if all nations cooperated, it would be easier to develop remedies and end the pandemic. We can identify numerous strategies to restore the financial markets to their pre-pandemic condition by cooperating, as COVID-19 is closely tied to the financial markets. According to A Sans (2020), the coronavirus outbreak spread practically all over the world. Their article demonstrates how COVID-19 relates to developed financial markets. To calculate the effect of COVID-19 on financial markets, they used a variety of formulae and analytical methods. The findings of the study state that COVID-19 and all Capital Markets have a substantial positive link based on the body of existing knowledge. According to Shah Syed, Fatima (2020), there is no question that COVID-19 has had a minimal impact on the stock market. It is evident from the aforementioned article that the authors used a VAR MODEL in calculation of effect of COVID-19 on the stock market. volatility of the stock market is demonstrated in the outcome. Volatility is gradually rising as returns are falling. In contrast to other stock markets that are well developed, Pakistan's stock exchange was not severely affected by COVID-19. Numerous studies have been conducted on COVID-19 and its effects on various industries and financial markets around the world. According to Lee and Chen (2020), Wang et al. (2021), and Chen et al. (2020), government policies and activities are crucial in the fight against COVID-19. The primary goal of this study is to identify and address this problem and to show research gap. However, A Sans (2020), Ruiz Estrada et.al (2020), He et.al (2020), Topcu & gula (2020), Al Awadi et.al (2020), and Onali (2020) confirmed that there is evidence that travel companies and other sectors did not perform well during this time.

3. DATA AND METHODOLOGY

The goal of this project is to determine whether there is a correlation between the daily stock prices of companies in the travel sector and the number of COVID-19 cases and deaths that are reported on a daily basis in the nation. To do this, a regression analysis using the ordinary least square method must be performed separately between the prices of each company from each

sector and the number of COVID-19 cases and deaths, after which the regression results must be analyzed to determine which regression shows sig. Additionally, as both are international airlines and have an impact on industry, we employed exchange rates as a control.

3.1. Data Collection

The data used in this research is Secondary Data. The main source of data collection is from Thomson Reuters and some information was collected from FT Data Portal. The sample used for this research are the companies listed under the Istanbul Stock Exchange 100 (BIST-100) Index. Furthermore, we chose only airlines industry firms, Turkish Airline and Pegasus Airline. The frequency of the data is daily. The time-period of the data used is between 2020 March to 2022 May i.e., data for a period of 3 years. The main source of data collection regarding COVID-19 is from World Health Organization Website (<https://Covid19.who.int/data>). The time-period of the data used is from the beginning of pandemic to May 2022. In Covid-19 cases and death figures (1 & 2) you can see there are Covid waves, in which cases are on the highest and every new wave was higher than the previous one.

Figure 1: Covid Cases from March 2020 to May 2022

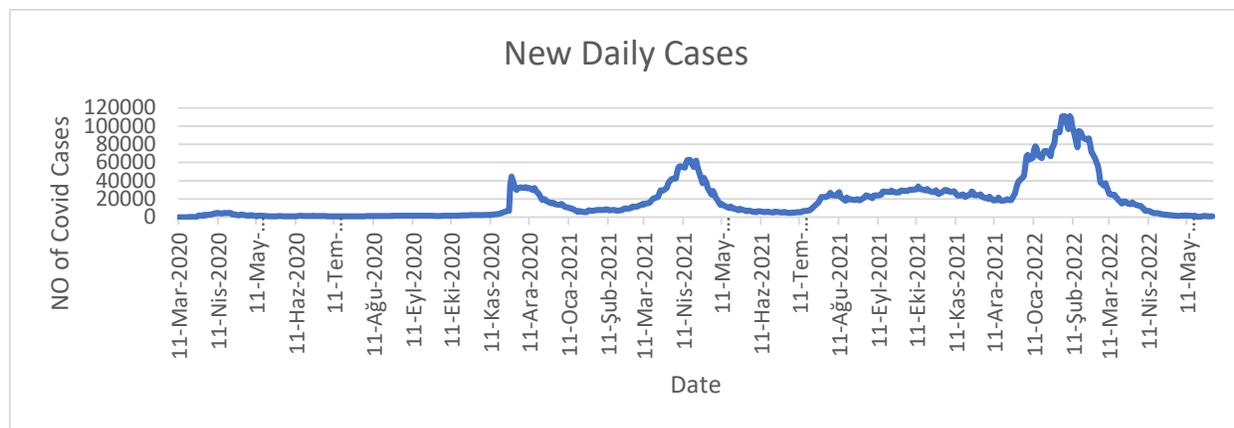
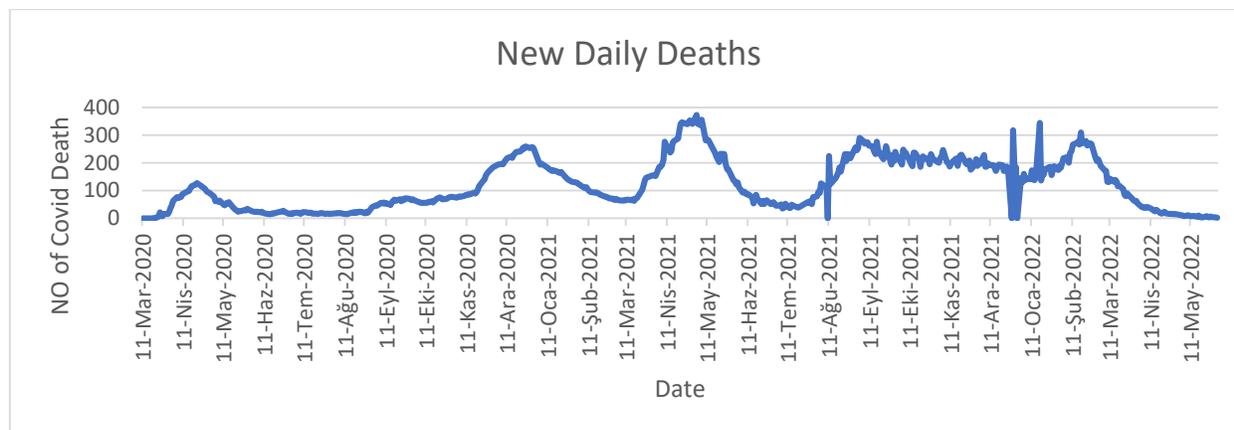
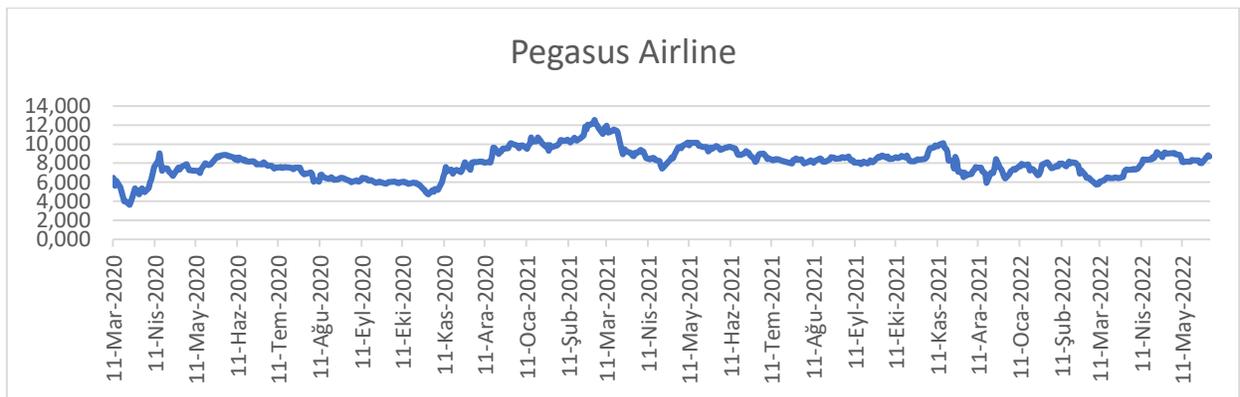


Figure 2: Covid Deaths from March 2020 to May 2022



If we analyze the figures (3 & 4), we can see that stock prices of both companies were affected since there was lockdown and air traffic was closed in the initial wave. Then in 2021 Covid vaccination started and everything went normal. As a result, Covid waves did not have so much influence on the prices starting from 2021, whereas 2020 was in a shadow of Covid-19.

Figure 3: Prices of Turkish Airline from March 2020 to May 2022**Figure 4: Prices of Pegasus Airline from March 2020 to May 2022**

3.2. Equation for Performing Regression

We created different models to show that first one price is directly regressed with COVID-19 cases. Then we added one more variable which is COVID-19 deaths and obtained Model-1. Finally, we added a control variable which was exchange rate and obtained Model-2, where COVID-19 cases, COVID-19 deaths and Exchange rate were the same for each regression, but stock price variable was different for both companies.

$$(Price)_{it} = \beta_0 + \beta_1(Covid - 19_Cases)_{it} + \beta_2(Covid - 19_Death)_{it} + (\epsilon)_{it} \quad (1)$$

$$(Price)_{it} = \beta_0 + \beta_1(Covid - 19_Cases)_{it} + \beta_2(Covid - 19_Death)_{it} + \beta_3(Exchange_rate)_{it} + (\epsilon)_{it} \quad (2)$$

Some regression findings might not match our expectations for the reason of several potential issues. First, we checked the autocorrelation. There were several methods or tests to do that. The most often used tests to examine the autocorrelation are

- 1) Durbin- Watson test
- 2) Run test
- 3) Graphical method
- 4) The Breusch- Godfrey serial correlation test

To determine whether the autocorrelation is adequate or not in our study, we utilized the Breusch-Godfrey serial correlation LM test. In the case of autocorrelation, it was eliminated. There are other approaches to eliminate autocorrelation, however we chose the HAC (Newy-West) test.

After eliminating autocorrelation, we ran a heteroscedasticity test to determine whether or not there is heteroscedasticity. There are various techniques for determining heteroscedasticity, including

- 1) Residual plots
- 2) Breusch-pagan test
- 3) White test

We use white test to check heteroscedasticity whether exists or not. If so, we removed it by using Huber white method. These are some of the problems which might have arisen while performing regression.

4. FINDINGS AND DISCUSSIONS

The regressions were performed on our data by using software named excel, the following results and their interpretations were observed including significance of each model which showed whether daily stock prices of a company representing their corresponding sector responded to the change in daily COVID-19 cases or not. If not, then what might be the problems with the results that make it non-significant.

Table 1: Regression Analysis of Turkish Airline

	MODEL 1	MODEL 2
$(Covid - 19_Cases)_{it}$	0.000006*** (0.0000)	0.000001*** (0.0000)
$(Covid - 19_Death)_{it}$	-0.001754*** (0.0000)	-0.001107*** (0.0000)
$(Exchange_Rate)_{it}$		0.080931*** (0.0000)
Constant	1.787483*** (0.0000)	1.065661*** (0.0000)
R-squared	0.15144	0.51337
F-statistic	49.2576	193.76178
S.E. of Regression	0.31160	0.23618

Note: *: significance at 10%, **: significance at 5% and ***: significance at 1%

As you can see in Table 1, there are two models. Model-1 variables are significant, but the entire model does not demonstrate any relevance, thus we chose Model-2. The regression results for Turkish Airlines can be analyzed using the likelihood of the t-statistic and the p-value. The model also displays overall significance. When an independent variable demonstrates individual significance at 1 percent (shown by ***), 5 percent (represented by **), and 10 percent (represented by *), it is considered significant in the model. The independent variable coefficient demonstrated a positive relationship between the independent and dependent variables and explained how a rise in the independent variable of 1-unit resulted in an increase in the dependent variable of 1.065661 value units. The coefficient of COVID-19 Cases was significant, demonstrated a positive relationship between the independent and dependent variables, and explained how a change in the independent variable of one unit corresponded to a change in the dependent variable of 0.000001 units, which was very small. A reduction of one unit in the independent variable caused an increase of 0.001107 units in the dependent variable, according to COVID19 Death, which was significant and exhibited a negative relationship between the independent and dependent variables. The solely employed control variables exchange rate had an impact on the dependent variables and was also significant. Finally, we observed the R-Square and F-statistic values, which helped demonstrate relevance of the model.

Table 2: Regression Analysis of Pegasus Airline

	MODEL 1	MODEL 2
$(Covid - 19_Cases)_{it}$	-0.000011*** (0.0007)	-0.00001** (0.0413)
$(Covid - 19_Death)_{it}$	0.006246*** (0.0000)	0.005822*** (0.0000)
$(Exchange_Rate)_{it}$		-0.053091** (0.0296)
Constant	7.472753*** (0.0000)	7.94627*** (0.0000)
R-squared	0.08683	0.09464
F-statistic	49.25760	19.2014
S.E. of Regression	1.44310	1.43822

Note: *: significance at 10%, **: significance at 5% and ***: significance at 1%

As you can see in Table.2, there are two models. Model-1 variables were significant, but the entire model did not demonstrate any relevance, thus we chose Model-2. The regression results for Pegasus Airlines can be analyzed using the likelihood of the t-statistic and the p-value. The model also displayed overall significance. The independent variable was significant in the model if it exhibited individual significance at 1 percent (shown by ***), 5 percent (represented by **), and 10 percent (represented by *), The independent variable coefficient demonstrated a positive relationship between the independent and dependent variables and explained how an increase in the independent variable of 1-unit resulted in an increase in the dependent variable of 7.94627 value units. A decrease of one unit in the independent variable causes an increase of 0.00001 units in the dependent variable, which was very low, compared to the coefficient of COVID-19 Cases, which was significant and showed a negative relationship between the independent and dependent variables. The independent and dependent variables were positively correlated, and COVID19 Death demonstrate this. It describes how an increase of one unit in the independent variable corresponds to a rise of 0.00582 units in the dependent variable. Exchange rate was the only control variable we utilized, and it had a great impact on the dependent variables. Finally, we analyzed the R-Square and F-stat values, which likewise demonstrated that the Model-2 was still generally not significant.

Turkish Airline thus exhibited significance based on these values, and Pegasus failed to explain the model, leading us to the conclusion that the travel sector responded to the change in COVID-19 cases as well as with another control variable known as the exchange variable.

4.1. Forecast of COVID-19 Cases correlated with Stock Prices

A forecast is a numerical, probabilistic prediction about an unknown occurrence, outcome, or trend. It is based on previously known data. There are many forecasting techniques for infectious disease outbreaks, and which one to use depends on the key questions of the assessment, which are: (a) scope of the system, specifically how many parallel data series are to be monitored- this number can range from 1 to N-; (b) the quality of the data available; (c) the frequency of the data; and (d) the duration of various pandemic situations. The most popular statistical forecasting techniques include regression, time series, statistical process control, and methods that use geographic data. All these factors can be used as forecasting goals, including expected epidemic lifespan, intensity, peak timing, recurrence, geographic risk distribution, and short-term patterns in incidence. Forecasts for infectious diseases assist individuals in making plans for, avoiding, and dealing with illness, hospitalization, and death, as well as the financial burden associated with epidemics.

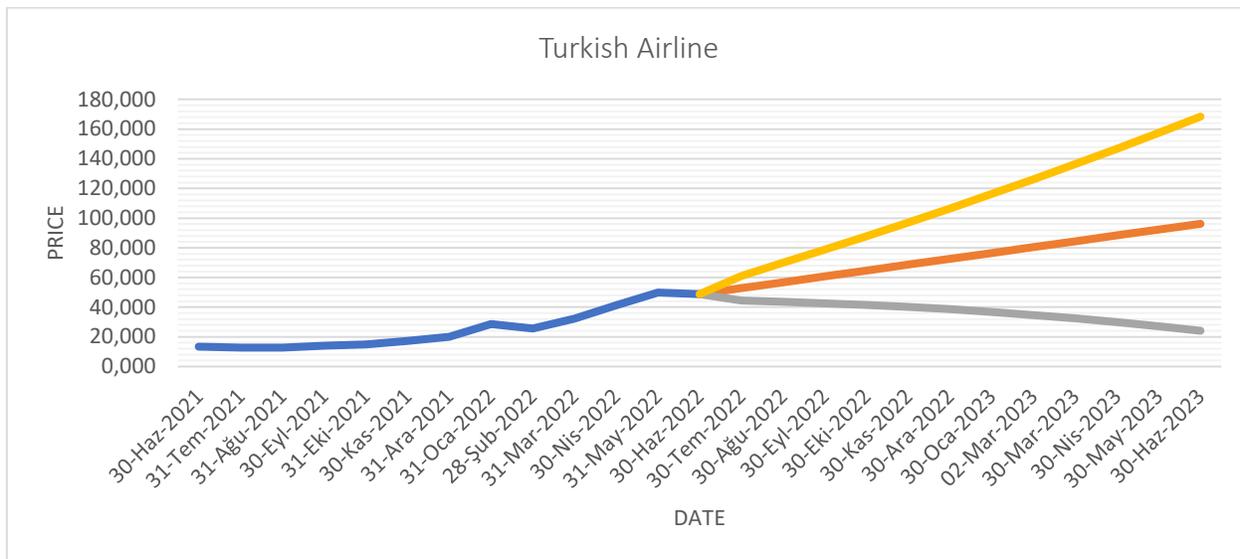
The three main categories of forecasting are causal models, time series analysis and projection, and qualitative research approaches. Regression analysis was employed in this study to anticipate company stock prices, and it was also used by Ghosal et al. (2020) to forecast COVID-19. Regression analysis is a technique used in statistics to identify patterns and trends in data. Ideal justification of Regression analysis for trend is the link between the explained variable and explanatory variable. Many different applications and programs can be used for forecasting, but for this case study, we chose Microsoft Office Excel.

In this study, one of the variables we forecasted was the stock values of the two companies. The information was gathered everyday between the beginning of the epidemic on March 11, 2020, and May 30, 2022. We chose to forecast the upcoming 12 months, from June 2022 to June 2023.

We forecasted the performance of both BIST 100-listed companies. As a result, we found out how COVID's past use of the Delta Variant and other factors affected the prices of these companies. Here, we provide a prognosis for the same period of time—June 2022 to June 2023—with a 95% confidence level. Additionally, we used data from one year ago, when immunization began.

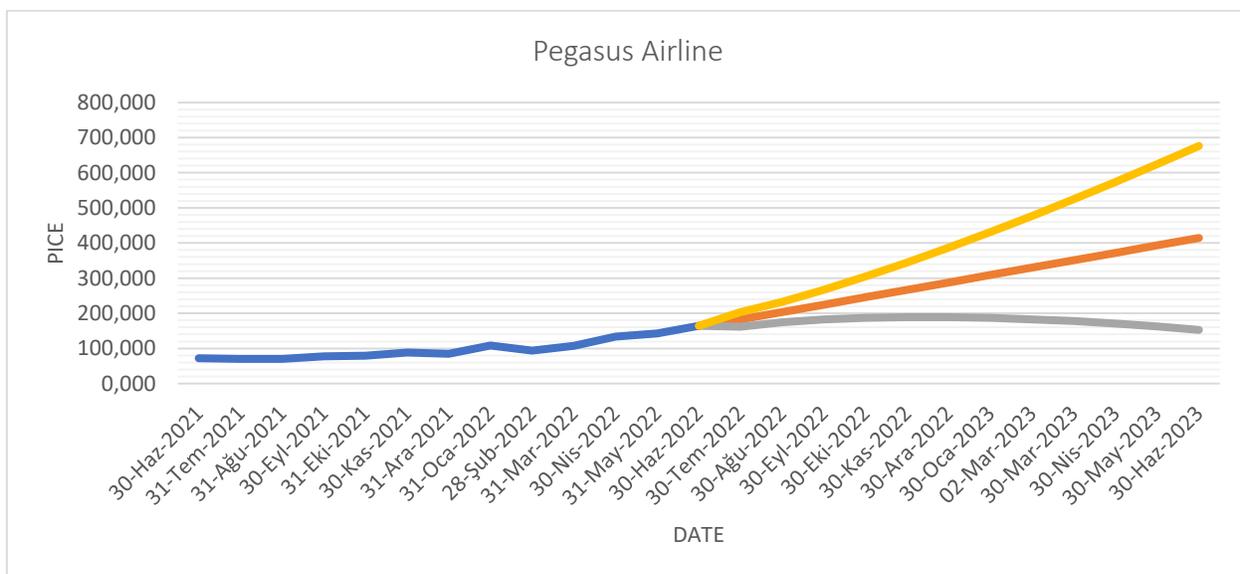
In both figures 5 & 6 R-square is perfectly significant. If we talk about forecasting of prices in next year from June 2022 to June 2023 both firms' Turkish and Pegasus Airline shows a substantial increasing trend that price is going to increase within next year.

Figure 5: Forecast of the Turkish Airline Prices from June 2022 to June 2023 with Lower and Upper Confidence Bound



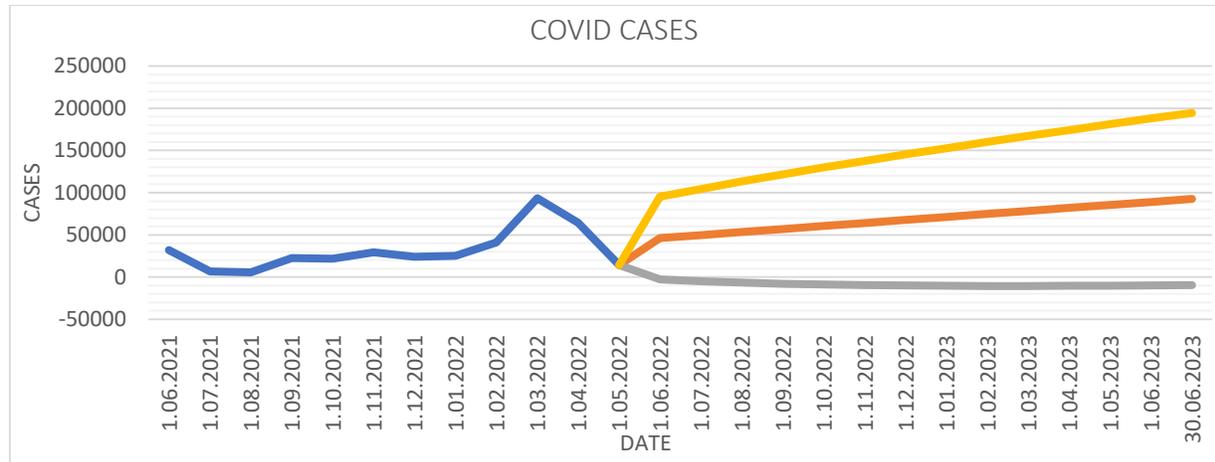
Considering overall Bist 100 Travel sector, we can say that COVID-19 cases had negative effect in times of Covid. But after that when vaccination started, it supported again Airline industry leading especially Turkish Airline to break many old records. It seems that in the future, the prices are going to increase.

Figure 6: Forecast of the Pegasus Airline Prices from June 2022 to June 2023 with Lower and Upper Confidence Bound



In figure 7 there was a downward trend in April and May 2022, but after June there was a rise in COVID-19 cases again.

Figure 7: Forecast of the Covid-19 Cases from June 2022 to June 2023 with Lower and Upper Confidence Bound



5. CONCLUSION

This study aimed to establish a link between the airline industry and COVID-19. For this purpose, we went over companies daily stock values as well as daily COVID-19 cases reported across the nation. The Istanbul Stock Exchange's Bist 100 Index and its listed companies in the travel industry were the main subjects of our investigation. Among all, there were only two companies. We also downloaded data for daily COVID-19 cases and COVID-19 deaths recorded in the country during the same time period from the WHO website for COVID-19. We extracted the daily stock prices of the two firms from 11-March-2020 to 30-May-2022.

Regression analysis was conducted after gathering all the relevant data. We utilized the ordinary least square method, and performed the analysis separately for each model and company. Model 1 failed to provide satisfactory results, so we switched to Model 2. Assumed daily COVID-19 cases, daily COVID-19 fatalities, exchange rates, and stock prices for each company were the dependent and independent variables, respectively. In order to get and evaluate the findings of the regression, a number of procedures were followed, including determining the likelihood of the F-statistic and R-square for the model's overall significance, T-statistics for individual significance of the variable, which should be less than 10%, 5%, or 1%, and the coefficient of the independent variable to check for its sign, which should be negative to show an inverse relationship between the dependent and independent variables in accordance with our requirement and theoretical premise.

Abbas et al. (2021) also supported our interpretation of the results, which demonstrated that responses of the two firms to the COVID-19 were significant. However, overall model for Pegasus Airlines did not exhibit any relevance.

This study could be useful to investors and institutions, particularly mutual fund companies, investment firms, and fund management firms that can manage their portfolios by taking the implications of COVID-19 on the travel industry into consideration. As you can see, COVID-19 cases are on the rise in China once more, and it is likely that the world would soon see another significant Covid-19 wave that are supposed to have an impact on the financial markets. This study enables users to create a desirable risk-adjusted portfolio by letting them know which subsectors were stable in earlier waves of COVID-19.

The research indicates that our second aim is to predict the pricing of businesses in the BIST 100 Travel industry. Therefore, if the corona virus transmission rate in Turkey does not change, more cases might be reported by June 30, 2022, according to the authors a research, Lodangi et al (2020). Data for COVID-19 instances could differ depending on the transmission rate. The Travel Sector in BIST100 also exhibits a favorable correlation with COVID-19 instances. However, both businesses exhibit a bullish or rising tendency as a result of vaccination starting in 2021.

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