



The Impact of COVID-19 on Chinese Airlines' Stock Market

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Abstract. When the COVID-19 outbreak occurred in late 2019 and early 2020, China took a series of epidemic prevention measures such as quarantine and flight restrictions to control the epidemic and prevent the further spread of the epidemic. This series of measures has increased the domestic airline industry's flight costs and reduced citizens' desire to travel. Based on this background, our work conducts a regression analysis on the stock price changes of several representative large airlines and several small and medium-sized airlines in China's airline industry. Specifically, our work takes a horizontal and vertical comparison method to conclude that the outbreak of COVID-19 has a negative impact on the stock market of the Chinese airline industry and has a greater impact on small and medium-sized airlines. This study's results can provide a reference for the development of Chinese future aviation industry and a certain investment reference for investors.

Keywords: COVID-19 · Airline Industry · China · Stock Price Influence · Stock Market

1 Introduction

The current outbreak of COVID-19 lasted about three years, and it has had a huge impact on different areas of the Chinese market. The first domestic case of COVID-19 was reported in Wuhan, Hubei Province, on 21 December 2019. At the time, it was only reported that an unknown infectious virus had been found. The estimated date of the first COVID-19 cases has been reported as around 2 January 2020, while other data indicate cases starting in December. On 31 December 2019, pneumonia of unknown origin was first reported by the World Health Organization (WHO) [1]. After the widespread outbreak of COVID-19, the Chinese government implemented a policy of lockdown and quarantine to prevent the further spread of the epidemic until now. Under prolonged isolation and quarantine, many papers [2, 3] show that the outbreak of COVID-19 has negatively impacted many industries in China. Furthermore, Warnock-Smith et al. [4] illustrate that due to the outbreak of COVID-19 and the need for anti-epidemic policies, domestic airline passenger traffic has decreased in recent years. This impact is more significant for small and medium-sized airlines with relatively little capital than for large airlines with sufficient capital.

The outbreak of COVID-19 is a serious social problem in recent years. The emergence of COVID-19 has had a certain impact on the original operating mode of society, especially the stock market. Some previous researches [5, 6] focus on the impact of COVID-19 on the overall stock market and draws conclusions by comparing domestic and foreign. Some researchers [2, 3] studied the impact of COVID-19 on the stock market of some industries in China. By comparing the data of different industries, it was concluded that COVID-19 had a positive impact on some industries and a negative impact on other industries. Based on these results, some investment recommendations are given to investors. Some researchers [7, 8] use a mixed micro and macro approach or a comparison of early and modern methods to illustrate the impact of COVID-19 on Chinese stock market.

According to current researches, we find a knowledge gap that these researches all study the macro stock market or a wide range of data from multiple industries, and no single study has focused on the impact of COVID-19 on the stock market in one industry. To fix the knowledge gap, our work focus on the impact of COVID-19 on the stock market of a specific industry in the country.

Our research aims to find out the impact of COVID-19 on the stock market of the domestic aviation industry. To achieve the purpose, we suppose to investigate from two aspects. On the one hand, our work collects the stock price data of 3 representative large domestic airlines from 2018 to 2021 and the stock price data of 3 representative domestic small and medium-sized airlines and analyze their stock prices, respectively—regression analysis. We analyze the fluctuations of stock prices of large airlines and small and medium-sized airlines before and after the epidemic from a horizontal comparison (time series). On the other hand, we analyze whether there is a difference in the degree of impact of COVID-19 on the stock prices of large airlines, and small and medium-sized airlines from a vertical comparison.

This paper explores the impact of COVID-19 on the domestic aviation industry stock market and draws out the changing trend of the domestic aviation industry stock market in the past four years. At the same time, this study compared the impact of the epidemic on large airlines with relatively stable funds and small and medium-sized airlines with relatively unstable funds. This study's results can provide a reference for the development of Chinese future aviation industry and a certain investment reference for investors.

2 Related Works

At present, many researchers [5, 6] on the influence of COVID-19 on the domestic stock market focus on the influence of the overall stock market at home and abroad. Liu et al. [5] conclude that the COVID-19 outbreak had a negative impact on investors' appetite for investment in the Chinese stock market, which in turn negatively impacted several of my major stock indexes. Furthermore, He et al. [6] find that the impact of COVID-19 have a significant negative impact on the European, American and domestic stock markets, and these negative impacts will intensify in the future. These works have in common that a valuation of the stock market is usually carried out at a macro level. Then a regression analysis is performed to determine the impact of COVID-19 on the stock market.

Recently, many researchers [2, 3] select one or more specific industries for analysis when studying the influence of COVID-19 on the domestic stock market. Zhu et al. [3] focus on the oil stock market and concluded that the risk spillover effect of the oil stock market in China and the United States increased significantly with the outbreak of COVID-19. Furthermore, Sun et al. [2] perform regression analysis on the stock market data of multiple industries under the epidemic and then summarize the industries with the same trend and make an investment recommendation to investors based on the results. These two studies have in common that they based on one or more experiment's data to analyze the impact of the epidemic on a group of industries to draw conclusions and give investors some investment advice.

There are also some researchers [7, 8] who study the impact of COVID-19 from macro to micro, or compare the impact of COVID-19 with the impact of previous epidemics on the stock market and then draw conclusions. He et al. [7] find that Overall, the epidemic had a negative impact on the stock price of the Shanghai Stock Exchange, while it had a positive impact on the stock price of the Shenzhen Stock Exchange. This result shows that the new crown pneumonia epidemic has brought a negative and more serious impact on China's traditional industries, but it has also created opportunities for the development of high-tech industries. This article explores the impact of COVID-19 on Chinese stock market from macro to micro. However, Feng and Li [8] illustrate time-evolving causal effects of COVID-19 and SARS on Chinese stock markets. Their article examines the impact of COVID-19 on the Chinese stock market from a novel dimension-different effects of different viruses.

According to previous papers, the limitation in those works is the impact of the COVID-19 epidemic on the stock market in the domestic airline sector. Our research analyzes this limitation and use the stock price fluctuations of several representative airline companies in China to obtain the airline industry's overall stock market fluctuations.

3 Methodology

Existing research mainly focuses on the impact of COVID-19 on the macro stock market or the comparison of the impact of multiple industries but does not focus on the detailed research on the impact of a certain industry. To fill this gap and give some advice on investors' future investment in aviation stocks, our work focuses on the influence of COVID-19 on Chinese airline industry' stock price. Our work purposes to find out the impact of COVID-19 on Chinese airline industry's stock market based on four-year stock price changes of several representative Chinese airlines. Furthermore, we compare the extent to which the share prices of large airlines and small and medium airlines are affected by COVID-19.

3.1 Data Information

The resources of our data is Bloomberg Database. Our research collects Chinese three major airlines Air China, China Eastern Airlines, China Southern Airlines, and three representative small and medium-sized airlines Spring Airlines, Shandong Airlines, China Express Airlines. Then, we collected the stock price values of these eight airlines in 2018–2021 for analysis.

3.2 Data Processing

Considering our research is to explore the impact of COVID-19 on Chinese aviation industry, when we filter the data, we focus on whether the stock prices of the airlines we selected have increased or decreased significantly around 2019, and whether there is an increase of the magnitude of the decline. The definition of change significantly is that the earnings per share (EPS) is changed more than 1 RMB per year.

3.3 Data Analysis Method

3.3.1 Liner Regression Analysis

The first research method of our work is linear regression analysis [9]. In this paper, we perform linear regression on the stock prices of eight airlines over time to observe the trends of stock prices before and after COVID-19. The formulation of linear regression analysis is shown in Eq. (1), where y denotes stock price, x represents time, β_0 denotes the intercept of y , β_1 denotes the slope of x , and ε denotes the random error.

$$y = \beta_0 + \beta_1 x + \varepsilon \quad (1)$$

3.3.2 Support Vector Machine

To further improve the accuracy of the regression, we used the Support Vector Machine (SVM) [10] tool on python to analyze the stock price of each company. Then figure out how each company's stock price fluctuated before and after COVID-19. The formulation of SVM is shown in Eq. (2), where y represents stick price and X represents time.

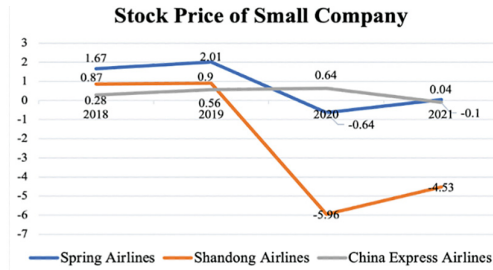
$$y(XW + b) = 1 \quad (2)$$

3.4 Data Analysis Process and Result

After using linear regression analysis and SVM, we have drawn the changing trends of the stocks of three large airlines and three small and medium-sized airlines from 2018 to 2021, respectively, as shown in Fig. 1(a) and Fig. 1(b).

In Fig. 2, we put together the stock price trends of six companies for a vertical comparison to analyze the differences between large airlines and small and medium-sized airlines affected by COVID-19.

Based on the analysis of Fig. 1(a), (b), and Fig. 2, we draw the following conclusions in Table 1.



(a)



(b)

Fig. 1. Four-year stock price trends six Chinese airlines. (a). Stock price of major company. (b) Stock price of small company

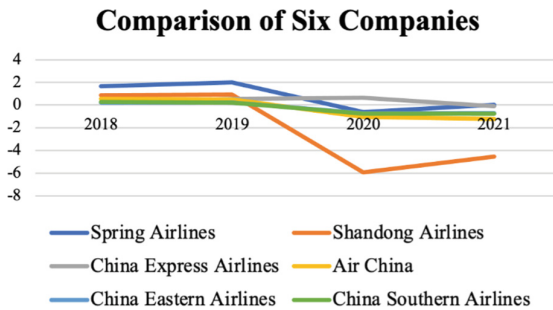


Fig. 2. The stock price trend of the six chosen companies(EPS)

Table 1. The impact of COVID-19 on share prices of individual airlines

Company Name	Change of Stock Price after COVID-19	Extent
Air China	Decrease	Small
China Eastern Airlines	Decrease	Small
China Southern Airlines	Decrease	Small
Spring Airlines	Decrease	Huge
Shandong Airlines	Decrease	Huge
China Express Airlines	Increase	Huge

4 Discussion

In some existing studies, researchers analyse the macro impact of COVID-19 on the stock market and have not focus on the impact on the stock price of a specific industry in detail. This gap makes investors who want to invest in a certain industry unable to judge the investment prospects and miss some investment opportunities accurately. Our research, which focuses on the impact on the stock market of China's aviation industry, can fill some of the gaps in this area. Moreover, our research can also make some suggestions for the future development of the aviation industry.

In our analysis of the impact of COVID-19 on stock prices in the aviation industry in China, we first performed a regression analysis on the changes in stock prices of three representative Chinese airlines over the four years from 2018 to 2021. The results are shown in Fig. 1 (a). From Fig. 1(a), we can see that the stock prices of Air China, China Eastern Airlines, and China Southern Airlines all experienced a significant decline in 2019–2020. This result suggests that COVID-19 has had a negative impact on the stock prices of major airlines. Then we conducted regression analysis on the EPS of Spring Airlines, Shandong Airlines, and China Airlines, three small and medium-sized airlines over time, and obtained Fig. 1 (b). From Fig. 1 (b), we can see that most of the stock prices of small and medium-sized airlines are. It was also after the 2019 COVID-19 outbreak that there was a notable drop. From this information, we can conclude that the outbreak of COVID-19 has had a negative impact on the stock prices of the Chinese aviation industry, leading to a decline in airline stocks after 2019. This result is like previous researchers' findings that the positive economic impact of COVID-19 on the transportation industry has been significantly weakened [2]. Still, we explored the impact of COVID-19 on the aviation industry in relative detail. We put the trends of the six companies we selected together in Figure for longitudinal analysis. We found that in 2019–2020, the share prices of small and medium-sized airlines fell much more than large airlines. We analyze that this trend may be because small and medium-sized airlines are not as well funded as large airlines and cannot respond in time to emergencies such as COVID-19. Based on the above analysis, we have come to the second conclusion that the negative impact of COVID-19 on the share prices of small and medium airlines is greater than that of large airlines. This conclusion is like the impact of COVID-19 on the passenger flow of small

and medium-sized airlines that has been mentioned by some researchers earlier than that of large airlines [8].

Through this research, we can judge whether a certain airline belongs to a large airline or a small and medium-sized airline by observing the change in the stock of a certain airline between 2019 and 2020 - that is, the degree of impact of COVID-19. For example, the EPS of Hainan Airlines fell from 0.01 to -3.83 in 2019–2020, a large decline. We can conclude that Hainan Airlines is a small and medium-sized airline rather than a large airline. At the same time, according to this research, it is recommended that investors choose to invest in aviation stocks carefully. If investors want to invest in airline stocks, it is recommended to choose large airline stocks with less volatility.

Our research fills a gap in previous research on the impact of COVID-19 on airline stocks and concludes that COVID-19 has had a negative impact on the overall airline stock market, with a greater impact on small and mid-sized airlines. However, our research still has great limitations. First, our research only analyses the stocks of airlines and does not analyse stocks such as aviation manufacturing and airports. Second, our research is based on historical data. An analysis that does not forecast future trends. Our investment advice is based on past data. Therefore, in the following research, researchers can focus on predicting the future development trend of aviation stocks and suggest investors' future investments.

5 Conclusion

In conclusion, our research focuses on the impact of COVID-19 on China's aviation stock market, and conducts regression analysis on several representative companies in Chinese aviation industry. In order to fill the gap of previous research on the impact of COVID-19 on China's aviation industry, this paper selects three large Chinese airlines and three small and medium-sized Chinese airlines to analyse the changes in EPS in the four years before and after COVID-19. Our research results can provide a certain reference for investors to invest in Chinese aviation industry stocks, and our research results provide certain suggestions for the future aviation industry to deal with emergencies like COVID-19. This conclusion provides a reference for subsequent researchers to study the impact of large emergencies on the stock market of Chinese aviation industry. Subsequent researchers can predict the future stock trend of Chinese aviation industry on the basis of this research, and give investors more investment advice.

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