

The Impacts of COVID-19 on the Indexes: Economic Effects in the U.S. and China

Jialong Chen^{1, †}, Qiqi Li^{2, *, †}, Xiajie Yu^{3, †}

¹ Information Technology & Informatics major, Rutgers University, Piscataway 08854, United States

² Clinical Psychology major, University of Wisconsin-Milwaukee, Milwaukee, 53201, United States

³ Finance major, School of Economics, Jilin University, Changchun 130012, China

*Corresponding author. Email: qiqili@uwm.edu

†These authors contributed equally.

ABSTRACT

This article analyses the industry indexes in the U.S and Chinese stock market during COVID-19 to research the impact of COVID-19 on different industries in the U.S. and China. The data was collected based on the industry indexes during four selected periods of COVID-19. We analyzed the difference in mean return using the t-test method at a significance level of 5%. Our analysis discovered that for China and the United States, COVID-19 has the least impact on the consumer goods industry and the greatest impact on the energy industry. Compared with other stock industries, major consumer goods, real estate, and utility industries are less affected by covid-19. In addition, industries such as energy, finance, telecommunications, materials, industry, healthcare, consumer staples, and consumer discretionary indexes are more affected by covid-19. As a result, investors can choose the stocks of countries with good resistance to the epidemic, which can not only reduce the risk of investors to some extent but also allow other countries to learn from the country's policies and some measures to control the epidemic to promote the global stock market and economic growth.

Keywords: COVID-19, Financials, Stock market, Indexes

1. INTRODUCTION

In 2008, investors were hit hard in fixed income and stocks [1]. A situation similar to the 2008 financial crisis struck again, which was the beginning of the COVID-19 pandemic. In March 2020, the financial industry was blown three times [2]. Therefore, it can be seen that the economic impact of COVID-19 on our society is huge. In addition, the macro dynamics are changed, whether it is the national economy or other public facilities and other social industries [3]. The COVID-19 has influenced our society for a very long time. No matter is an individual or public system. The novel coronavirus pandemic known as COVID-19 has been officially reported to get started in December 2019. The disease developed in Hubei Province, China, and within a brief period, spread to all continents except Antarctica [2]. As of May 1, 2020, the total number of people affected globally is 3.26 million, with 234 thousand deaths across 212 countries and territories [3]. The number of newly affected countries and patients is increasing day by day. In the beginning, the world saw

how China was struggling to combat this disease, with the number of patients increasing exponentially. On January 23, 2020, China announced a strict lockdown in Hubei province, including the complete closure of tourist attractions, a ban on international and domestic tourism, and the closure of educational and financial institutions. After relaxing the lockdown several times, China finally lifted the lockdown on 8th April after ensuring zero new domestic cases. However, the spread of the disease and the subsequent lockdown brought tremendous financial loss to the Chinese economy, resulting in a 6.8% fall in their GDP in the first quarter of this year compared to the same in last year [4]. Although in the beginning, the COVID-19 virus attacked countries around the East Asian region, that is, China, Hong Kong, South Korea, and Japan, as days passed, the center of the virus moved to Europe and then to North America. To date, the worst affected victims of this disease are in the continents of North America and Europe, namely the United States, Italy, France, Spain, Germany, and more [2]. With one-third of the total affected patients of COVID-19 and the highest number

of deaths globally, the United States is still at the pick of the spread of the disease [3]. To control the spread of this highly contagious disease, many countries worldwide have followed the same path as China, implementing lengthy lockdowns [3]. In this era of globalization, the withdrawal of international events, international movements, and international trade has caused the world to witness the division of nations. Freights by air, sea, and land have come to a halt. The tourism and airline industry has experienced zero purchasing deals for weeks and months. Even the sports industry has fallen victim to this disaster. Global sports events such as the Tokyo 2020 Olympics have been suspended [2].

This "resting" world mode has caused a tremendous financial crisis. It has already surpassed the economic turmoil of the 2008–09 recession. In addition, the International Monetary Fund (IMF) has declared that the world is facing the worst economic crisis since the Great Depression of the 1930s [2]. With the increasing rate of infection every day, the world must prepare even for a worse outcome. As of 24 February 2020, the sharp increase in novel coronavirus cases outside China has caused another "Black Monday" in global stock markets. U.S. stock indexes fell more than 3% on average. The Dow closed down 3.35%, its biggest intraday decline in the past two years. The Nasdaq fell 3.71 percent, while the S&P 500 fell 3.35 percent. The volatility index, known as the 'fear index,' rose 45% to close at 24.84 [5]. For now, the pandemic appears to be having a major impact on the global economy and stock markets. With the continuous spread of the epidemic and the collapse of the global stock market, which country's stock market should investors choose to invest in has become the most concerning thing for many investors.

With the impact of the epidemic, many countries have adopted lockdown policies. In the era of economic globalization, almost all industries are highly dependent on opening up. Now, trade flows worldwide have come to a standstill, which is a serious blow to the global economy. The fluctuation of the stock market represents the psychological expectation of investors. To make the economy of each country rebound, stimulate the economy and promote consumption, it is necessary to analyse which country's stock market is more resistant to the epidemic. Investors can choose the stocks of countries with good resistance to the epidemic, which can reduce the risk of investors to some extent and allow other countries to learn from the country's policies and some measures to control the epidemic to promote the global stock market and economic growth.

We analyse the industry indexes in the U.S and Chinese stock markets during COVID-19 to research the

impact of COVID-19 on different industries in the U.S. and China. Because of the changes in policies, the forms in society have become complicated, especially in the euro zone countries [6]. Due to differences in how developed and developing countries deal with COVID-19, conflicts arose during the pandemic. We analyzed the difference in mean return using the t-test method at a significance level of 5%. Before our research, we found that the IT industry was not greatly affected during the COVID-19 pandemic. According to How COVID-19 is changing the world: a statistical perspective, TU calculated the number of people using computers worldwide, and the comparison from 2005 to 2019 is an increase of 36% [7]. It is not difficult to find that IT industry trends have increased significantly during the COVID-19 period. Not only that, but the medical economy has also seen positive growth. During this period, the social economy was hit. In 2021, the medical subsidy expenditure was very high, and it is still rising. The medical subsidy cost will probably continue to increase by 29 billion US dollars [7]. Therefore, based on the different policy issues that each country faces, we compared the economic effects of China and the United States under the influence of different policies. Improving the economy requires government intervention. Current differences are due to the impact of the quality of the country's attitude towards the pandemic [10].

In the following, we have three main research structures, namely data and methodology, empirical results, and conclusion.

2. DATA AND METHODOLOGY

2.1. Data

The data we choose to analyse is the sector indexes of CSI 300 and S & P 500 as they represent the economics of China and the U.S, respectively [11]. The CSI 300 sector indexes were retrieved from the China Security Stock Index company's website. The China Security Stock Index company first published the CSI 300 index on April 8, 2005. As shown in **Table 1**, the CSI 300 index includes component stocks from different industries in 10 classified sectors, representing Chinese stock market performance. The S&P 500 sector indexes were retrieved from spglobal.com. The S&P 500 index tracks the performance of 500 large-cap listed companies in the U.S stock market. As shown in **Table 2**, the 500 large-cap listed companies are classified into 11 sectors. Thus, the individual sector index represents the stock performance of such sector, and the S&P 500 index represents the whole U.S. stock market performance.

Table 1. CSI 300 sectors and their abbreviations

Sector Indexes	Abbreviation
CSI 300 Index	
CSI 300 Consumer Discretionary Index	CSI300CD
CSI 300 Consumer Staples Index	CSI300CS
CSI 300 Health Care	CSI300HC
CSI 300 Industrials Index	CSI300IN
CSI 300 Information Technology Index	CSI300IT
CSI 300 Materials Index	CSI300MT
CSI 300 Telecommunications Index	CSI300TC
CSI 300 Utilities Index	CSI300UT
CSI 300 Financials Index	CSI300FS
CSI 300 Energy Index	CSI300EN

Table 2. S&P 500 sectors and their abbreviations

Sector Index	Abbreviation
S&P 500	
S&P 500 Consumer Discretionary Index	S&P500CD
S&P 500 Consumer Staples Index	S&P500CS
S&P 500 Health Care Index	S&P500HC
S&P 500 Industrials Index	S&P500IN
S&P 500 Information Technology Index	S&P500IN
S&P 500 Materials Index	S&P500MT
S&P 500 Real Estates Index	S&P500RE
S&P 500 Telecommunications Index	S&P500TC
S&P 500 Utilities Index	S&P500UT
S&P 500 Financial Index	S&P500FS
S&P 500 Energy Index	S&P500EN

2.2. Methodology

2.2.1. Pre-event and Post-event Periods

This research examines the impact of covid-19 on different industries in the U.S. and China by researching the sectoral indexes' differences before and after the

outbreak of covid-19. To retrieve sample data precisely for the study, we divided the timeline of COVID-19 into two periods: pre-event and post-event for both U.S. and Chinese stock sector indexes. The post-event period for both countries is set to be from December 31, 2019, to March 23, 2020, because according to WHO, the coronavirus was first identified on December 31, 2019, and on March 23, 2020, both S & P 500 and CSI 300

indexes plunged to a dip due to the outbreak of COVID-19. The pre-event period for China is designed to be from October 17, 2019, to December 30, 2019. This is because the end date of December 30, 2019, was the last day before the outbreak of Covid. In addition, to keep the sample size (number of trading days) before and after the outbreak date of Covid for a paired t-test, the start date is set to be October 17, 2019, for CSI 300. Similarly, the pre-event for the United States is designed to be from October 9, 2019, to December 30, 2019.

Previous research indicated that observations around 40 to 60 days would be suitable for our research. "stock markets react strongly during early days of confirmed cases and then between 40 and 60 days after the day of initial confirmed cases" [12]. The number of observations for Chinese sectoral indexes is 53, while this number is 57 for U.S. sectoral indexes. Therefore, both numbers are within the span of 40 to 60 days which represents a period that Covid-19 strongly influences different industries.

2.2.2. Paired T-Test of Difference in Daily Stock Returns Between Pre-event and Post-event Periods

To find out the difference in Covid's impact on different sector indexes of CSI 300 and S&P 500, we need to compare the stock return of those sector indexes during and before the Covid-19. Therefore, we first used a stock return formula to calculate the daily return of different stock sector indexes,

$$R_t = \frac{P_t - P_{t-1}}{P_{t-1}} \tag{1}$$

where R_t is the stock return on day t , P_t is equal to the closing price on day t , P_{t-1} is equal to the closing price on day $t - 1$.

Since the pre-event and post-event periods include the same number of trading days, the sample size for both periods is the same. Therefore, we used a paired T-

Test method to discover the difference in stock return before and after the outbreak of Covid-19,

$$t = \frac{(x_1 - x_2)}{S\sqrt{n}} \tag{2}$$

where t is t value, x_1 is equal to the mean of the first sample, x_2 is equal to the mean of the second sample, S is equal to standard deviation, \sqrt{n} is equal to the square root of the sample size.

In the following tables 3-6, we calculated the difference in stock return in different sector indexes of CSI 300 and S&P 500 after the outbreak of Covid-19(post-event period) against the non-Covid-19 period(pre-covid period). To precisely compare the difference in stock return, we conducted both one-tailed and two-tailed T-Tests and compared the result of p value to the significance level of 1%, 5%, and 10% to find out whether there is a significant difference in stock return and at what significance level will the stock return be different before and after the event of Covid-19. In general, if the calculated $p < 0.1$, there is a statistically significant difference. On the contrary, if the calculated $p > 0.1$, the stock return before and after the outbreak of Covid-19 is not significantly different.

3. EMPIRICAL RESULTS

"Some panic among consumers and firms has distorted usual consumption patterns and created market anomalies" [3]. Under the impact of COVID-19, we compared the performance of various industries between China and the United States. At the same time, we were able to study the effects of panic on the nationals between China and the United States. And let the market change. This study analyses the daily stock return of sector indexes before Covid-19 against after Covid-19. Through a paired t-test method comparing the difference in daily stock return between these two periods, we were able to find the p values and concluded that what Covid-19 more negatively influenced sectors while others were less affected.

Table 3. CSI 300 sector indexes from 2019-10-17 to 2019-12-30

stock sector	trade days	mean return	standard deviation	p-value one tail	p-value two tail
CSI300	53	0.0008	0.0074		
CSI300CD	53	0.0015	0.0104		
CSI300CS	53	0.0004	0.0102		
CSI300HC	53	1.63e ^{-0.6}	0.0119		
CSI300IN	53	0.0006	0.0079		

CSI300IT	53	0.0021	0.0138
CSI300MT	53	0.0025	0.0091
CSI300TC	53	0.0011	0.0114
CSI300UT	53	1.49e ^{-0.5}	0.0570
CSI300FS	53	0.0005	0.0087
CSI300EN	53	0.0003	0.0078

Table 4. CSI sector indexes from 2019-12-31 to 2020-3-23

stock sector	Trade days	mean return	standard deviation	p-value one tail	p-value two tail
CSI300	53	-0.0150	0.0187	0.1163	0.2327
CSI300CD	53	-0.0251	0.0271	0.0737*	0.1475
CSI300CS	53	-0.0112	0.0148	0.2401	0.4801
CSI300HC	53	0.0045	0.0185	0.4409	0.8818
CSI300IN	53	-0.0121	0.0185	0.1641	0.3282
CSI300IT	53	-0.0030	0.0357	0.3469	0.6939
CSI300MT	53	-0.0115	0.0213	0.0330**	0.0660*
CSI300TC	53	-0.0125	0.0255	0.4808	0.9617
CSI300UT	53	0.0002	0.0020	0.0647*	0.1295
CSI300FS	53	-0.0162	0.0141	0.0727*	0.1454
CSI300EN	53	-0.0084	0.0110	0.0284**	0.0567*

Notes: *** is significant at the 1% level, ** is significant at the 5% level and * is significant at the level of 10%.

The difference in daily stock return before and after the outbreak of Covid-19 for different CSI 300 sector indexes is presented in Table 3-4. As shown in the table, the mean return for sectors during the pre-event period were all positive numbers, while most of them were negative during the post-event period in response to the outbreak of Covid-19. In a further analysis on each sector's stock performance using the p value from comparing their daily stock return during the pre and post event period, we discovered that the Energy and Material Sector of CSI 300 was the most affected by Covid-19 since their one-tailed p values were less than 0.05. Their daily stock returns were significantly different at a 5% level between pre-event and post-event

periods in a one-tailed t-test. In addition, sectors of Consumer Discretionary, Utility, and Financials were moderately affected by Covid-19 since their p values(one-tailed) were less than 0.1. In contrast, their p values in the two-tailed t-test were bigger than 0.1. Therefore, there was a significant difference for Consumer Discretionary, Utility, and Financials in a one-tailed t-test. However, there was no statistically significant difference in daily stock returns in CSI 300 indexes and many sectors like Consumer Staples, Health Care, Industrials, Information Technology, and Telecommunications since their p-values were all bigger than 0.1. Therefore, it is suggested that Covid-19 less influenced CSI 300 index and these sectors.

Table 5. S&P 500 sector indexes from 2019-10-09 to 2019-12-30

stock sector	trade day	mean return 1	standard deviation 1	p-value one tail	p-value two tail
S&P 500	57	0.0019	0.0044		
S&P500CD	57	0.0012	0.0055		
S&P500CS	57	0.0008	0.0038		
S&P500HC	57	0.0026	0.0059		
S&P500IN	57	0.0067	0.0017		
S&P500IT	57	0.0027	0.0071		
S&P500MT	57	0.0018	0.0063		
S&P500RE	57	-0.0002	0.0076		
S&P500TC	57	0.0017	0.0057		
S&P500UT	57	0.0001	0.0060		
S&P500FS	57	0.0024	0.0062		
S&P500EN	57	0.0017	0.0011		

Table 6. S&P 500 sector indexes from 2019-12-31 to 2020-3-23.

stock sector	trade day	mean return 2	standard deviation 2	p-value one tail	p-value two tail
S&P 500	57	0.0329	-0.0058	0.0404**	0.0807*
S&P500CD	57	0.0303	-0.0052	0.0620*	0.1240
S&P500CS	57	0.0285	-0.0050	0.1130	0.2261
S&P500HC	57	0.0380	-0.0038	0.0233**	0.0466**
S&P500IN	57	0.0331	-0.0075	0.0131**	0.0262**
S&P500IT	57	0.0373	-0.0064	0.1026	0.2052
S&P500MT	57	0.0295	-0.0044	0.0189**	0.0378**
S&P500RE	57	0.0373	-0.0064	0.1146	0.2292
S&P500TL	57	0.0295	-0.0044	0.0636*	0.1272
S&P500UT	57	0.0363	-0.0056	0.1324	0.2649
S&P500FS	57	0.0408	-0.0088	0.0210**	0.0421**
S&P500EN	57	0.0469	-0.0148	0.0062***	0.0123**

Notes: *** is significant at the 1% level, ** is significant at the 5% level, and * is significant at the level of 10%.

Based on the data given by P value, the p value of the S&P 500 is greater than 0.1, which indicates the performance of the COVID-19 in the US economy from 2019 to 2020. Furthermore, it can be seen from the figure that the United States has not been greatly affected by COVID-19 in terms of Consumer Discretionary, Cons Staples, Information Technology, Real Estates, Technology, and Utilities.

4. CONCLUSION

We researched the economic aspects of the US S&P500 Index and China CSI300 in the two time periods of 2019-2020 through the form of a T-test and P-value. The two indexes show China's p -value in daily consumption, medical care, industry, IT, and telecommunications is greater than 0.1. In other words, China's economy in these areas is relatively less affected by COVID-19. Comparing the various industries of the S&P500 in the United States, the United States has a p -value greater than 0.1 in terms of non-essentials, essentials, information technology, real estate, technology, and Utilities. In other words, the U.S. economy has been least affected in these areas. Judging from the way the two countries deal with COVID-19, they have had different economic impacts. But this is only our preliminary result, and there will be more different changes in the future.

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