The Impact of Investor Sentiment on the Chinese Stock Market: Evidence form the COVID-19 Period

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Abstract

COVID-19 has a significant effect on the Chinese stock market. This paper uses event study and regression analysis to explore the effect of the pandemic on the Chinese stock market, as well as the impact of investor sentiment affected by the pandemic on financial markets. The results show that COVID-19 negatively affects the whole Chinese stock market, primarily when government policy is implemented. After the policy relaxation, the stock market starts a recovery period. Meanwhile, investor sentiment is more sensitive than before, especially after implementing strict epidemic prevention policies. During the epidemic, pharmaceutical and epidemic prevention and control material production industries are more affected by investor sentiment. However, investor sentiment does not sufficiently explain the abnormal returns of public utility-related industries, including electricity, heat, gas and water production and supply industries.

Keywords: Investor sentiment; COVID-19; Chinese stock market; Market reaction; Industry effects

Content

1. Introduction

Judging from the early timeline of the COVID-19 epidemic in China, the first patient infected with COVID-19 in China is diagnosed on November 17th, 2019. Still, it does not attract the attention of society and the government at that time. In early December 2019, a total of 27 Wuhan citizens are diagnosed. Some media begin to pay attention at this time, but it still does not attract special attention. On December 31st, 2019, the government releases official documents related to the epidemic for the first time. On January 20th, 2020, Academician Zhong Nanshan informs that this epidemic can be transmitted from person to person, and the epidemic begins to attract social attention. On January 23rd, 2020, Wuhan issues a city-wide closure notice. Chinese society is deeply affected by the COVID-19 epidemic throughout the Spring Festival holiday. After the stock market opens after a two-day delay on February 03rd, 2020, thousands of stocks in the market fall by the price limit and the Shanghai Composite Index falls by 7.7%. Since February 26th, 2020, many provinces in China lower their risk levels, and many regions begin to prepare for work resumption. On March 18th, 2020, Wuhan, as the last city to unblock, lift lockdown. On April 08th, 2020, the confirmed cases in China are cleared for the first time on that day. Since then, the living conditions of Chinese residents and market operations-basically return to normal.

The COVID-19 outbreak has a significant impact on the Chinese market. From the perspective of macroeconomic impact, figure 2.1 in the appendix shows the time series of China's quarterly GDP growth rates. After the outbreak of the COVID-19 epidemic, China's GDP falls sharply in the first quarter of 2020 and experiences negative growth, but the situation improves in the second quarter. As the speed of the spread of the COVID-19 epidemic and the number of cases are effectively controlled, enterprises begin to resume work and production, and the growth rate of GDP in the second quarter improves significantly. However, it is still far lower than the growth rate before the epidemic. Compared with the first quarter, the growth rate increases by 5.2%. In addition, the impact on the primary, secondary and tertiary industries is also

different. The secondary industry is most affected, followed by the tertiary industry. The primary industry is the least affected. Figure 2.2 shows the trend of China's 10-year treasury bond yields before and after the outbreak. It can be seen that before the epidemic, the interest rate of China's 10-year treasury bond already shows a downward trend. During the epidemic, the 10-year treasury bond rate bottoms out and falls to around 2.5%. Subsequently, with the improvement of the epidemic and the economy's recovery, the market's panic slightly decreases, and the 10-year Treasury bond yield rises. From the perspective of the impact on the exchange rate market, the exchange rate market is significantly impacted by the epidemic. Figure 2.4 shows the price trend of the RMB exchange rate. After the epidemic, the RMB stops the appreciation trend and begins to depreciate. The exchange rate falls below 700 and moves lower to below 690.

In addition, the COVID-19 epidemic has a more significant impact on commodities in the Chinese market. Among the commodities, gold and crude oil are affected more. Figure 2.5 shows the price movements of gold and crude oil before and after the epidemic. In terms of gold, due to the deterioration of US-Iran relations in the international market and the COVID-19 epidemic, the price of gold rises sharply in January. However, with the outbreak of the global epidemic in March and April, the liquidity is tight, and the cost of gold falls sharply in a short period. With the implementation of loose monetary policies in many countries and the high-risk aversion among the people, the price of gold begins to rise rapidly. The epidemic's impact on crude oil prices is also significant in petroleum. After the outbreak of the epidemic in China, the price of oil begins to decline continuously. The worsening of the epidemic exacerbates the slump in oil prices. At the same time, from the perspective of the global epidemic, because China is the world's largest oil importer, the outbreak of the epidemic in China leads to market concerns about the decline in oil demand. And superimposed on the breakdown of the production limit agreement between Saudi Arabia and Russia, the oil price accelerates to the bottom. On the other hand, from the perspective of China, the regional closure and control policies during

the epidemic significantly affect industries such as tourism and transportation, and the demand for crude oil drops significantly, resulting in a decline in prices. This situation alleviates substantially after resuming work and production and unblocking cities.

Despite the rapid spread of the COVID-19 virus, the Chinese government's stricter prevention and control measures and the relatively weak transmission capacity of the first-generation virus enable China to control the outbreak in a short period. From the specific trend of the number of confirmed cases per day in figure 2.3 in the appendix, in the early stage of the epidemic, that is, from January to the end of February, the number of confirmed cases in a single day is relatively high, and there are two peak periods. The first peak is the outbreak of the epidemic in Wuhan. The second time is at the end of January and the beginning of February, during the Spring Festival. During the Spring Festival, the number of confirmed cases peaks. Subsequently, with strict lockdown policies, the number of confirmed cases drops sharply and cleared for the first time on April 08th, 2020.

Therefore, in the first stage of the pandemic, in the Chinese market, the impact of COVID-19 on economic development is mainly in the first quarter, and the second quarter enters a recovery period. Accordingly, to analyze the effect of the COVID-19 epidemic on investor sentiment and China's stock market, I select the following key time points: December 31st, 2019, the first official announcement about the COVID-19 released in China. January 23rd, 2020, the Wuhan lockdown. March 18th, 2020, the Wuhan unblocks, and April 08th, 2020, the first day the new confirmed cases cleared in China. By constructing the investor sentiment by textual analysis and doing a robustness test by replacing the textual analysis index with the VIX index, I explore the impact of investor sentiment on different events. Eventually, the results of how the pandemic affect the Chinese stock market.

2. Literature Review

2.1 The impact of the epidemic on the economy

The spread of a significant epidemic has a greater impact on the economy, affecting many aspects of the macroeconomic and financial markets. The severity, spread, and impact time of the epidemic are often closely related to the panic in the capital market. Due to the development of the global economy and technology, the COVID-19 outbreak is the most widespread and economically costly in recent history. Most literature studies find that the epidemic has a negative impact on the stock market, and this negative impact will further affect the prevention and control of the epidemic. Shilova and Dye (2001) study the economic crisis in the Soviet Union at the end of the last century. They find that in times of economic crisis, people's living standards fall with the outbreak of serious infectious diseases. After the first round of declines, outbreak rates rebound again as the economy deteriorates. Goh and Law (2002) study the impact of the 1998 avian influenza outbreak in Hong Kong on tourism. They find that such public health events can significantly negatively affect tourism. Suhrcke et al. (2011) find that a large-scale outbreak of infectious diseases has a more significant negative impact on residents' income and a more significant impact on business operations and future cash flow. Therefore, it is easy to cause panic and a market crisis in the capital market. The market crisis further exacerbates the decline in public income and unemployment. The subsequent reduction in epidemic prevention investment further aggravates the spread of the epidemic. These conclusions demonstrate again in many national markets during the current COVID-19 epidemic. At the same time, this also shows that the epidemic's impact on the economy has commonalities in some aspects.

Due to the long duration of the COVID-19 epidemic and its vast impact on economic and social conditions, more and more researchers begin to study its specific effect on the economy. Houte and Heyden (2021) use an event study to examine the short-term

market response of the U.S. and European markets at the beginning of the COVID-19 outbreak. They find that from a macroeconomic perspective, the announcement of fiscal policy in a particular region hurts stock returns. Still, the implementation of monetary policy positively impacts the market. And from a micro perspective, the stock market has a significant adverse reaction to the epidemic. Sharif (2020) examines the link between U.S. oil prices, stock markets, and economic policy uncertainty during the COVID-19 pandemic. They find that the COVID-19 outbreak increases economic uncertainty. Oil prices is also affected more, which is possibly related to travel restrictions.

Baker et al. (2020) use a text-based approach to observe daily changes in stock market sentiment during the pandemic. They find that the U.S. stock market reacts more strongly to the COVID-19 outbreak than previous major pandemics. Liu (2020) and Heyden (2020) also find that the outbreak of COVID-19 negatively affects the stock market. I study the epidemic's impact on the Chinese market and conclude that the stock market is negatively affected by the epidemic. And in the middle of the first stage of the epidemic, the stock market is the most affected and gradually returns to normal in the later stage. Ashraf et al. (2020) study COVID-19 cases, and they find that the stock market reacts negatively to an increase in confirmed COVID-19 cases. As the number of confirmed cases increases, stock market returns decline. They further find that the stock market responds more positively to the increase in the number of confirmed cases than the increase in the number of deaths.

In the existing literature, there are relatively few studies on the industry impact of the COVID-19 outbreak on the stock market. In fact, during the COVID-19 epidemic, various industries are affected slightly differently due to differences in epidemic prevention policies and industry characteristics. Haroon and Rizvi (2020) study the impact of news coverage on the market. They find that the transportation, automotive, energy, travel, and leisure industries are most affected by the COVID-19 pandemic. However, most industries have not undergone significant changes.

I also divide industries and conduct industry effect research. They are considering that strict epidemic prevention and control measures bring about the shutdown of most industries in China. It is assumed in this article that enterprises can still operate normally during the epidemic, including the production of anti-epidemic materials, the pharmaceutical industry, and the essential living supply industry, will be positively affected, or the negative impact is less. At the same time, during the recovery period of the epidemic, due to the long-term closed life, there are short-term retaliatory consumption. During this period, the transportation, tourism and food service industries are positively affected.

2.2 The impact of special events on investor sentiment

Specific events, including natural disasters and public health events, may impact investor sentiment. With the help of big data analysis research methods and technologies such as web crawlers, researchers can quickly capture the changes in investor sentiment before and after these special events through the Internet. Further, they can explore what impact these events have on investor sentiment and whether this impact has a significant effect on security market return or volatility.

Hirshleifer and Shumway (2003) propose a significant correlation between sunny weather and investor optimism and further verify that sunshine is significantly related to stock market returns. They believe that weather-based strategies are a good option for traders with very low transaction costs. Grullon et al. (2004) study the relationship between company advertising and stock price. They find that companies with enormous advertisement spending have a relatively larger number of investors and more liquid stocks. Their finding shows that a company's advertising spending can increase investors' understanding of the company, affecting its stock price. In addition, many psychological studies show a strong link between football game outcomes and

emotions. Edmans et al. (2007) use the results of international football matches as a variable affecting investor sentiment to study the stock market's response to investor sentiment. They find that the stock market drops significantly after a football game is lost. Kaplanski and Levy (2010) study the impact of negative sentiment on stock prices during air crash events. It is found that when a locally significant adverse event occurs, the market overreacts in the short term. And this downward trend in the stock price will be reversed in a short period. In addition, research on the impact of the COVID-19 outbreak on emotions is published. Samuel et al. (2020) study the impact of the COVID-19 epidemic on people's emotions and find that the infection of the COVID-19 epidemic can lead to depression and mental health problems. The above research conclusions prove that investor sentiment, especially individual investor sentiment, is easily affected by external events, so studying the sentiment effect in the stock market under special events is valuable. I find through research that during the outbreak of COVID-19, the volatility of investor sentiment is significantly greater than before the epidemic. This shows that the epidemic outbreak has a greater impact on investor sentiment.

2.3 The evaluation of investor sentiment

Hirshleifer and Shumway (2003) propose a significant correlation between sunny weather and investor optimism and further verify that sunshine is significantly related to stock market returns. They believe that weather-based strategies are a good option for traders with very low transaction costs. Grullon et al. (2004) study the relationship between company advertising and stock price. They find that companies with enormous advertisement spending have a relatively larger number of investors and more liquid stocks. Their finding shows that a company's advertising spending can increase investors' understanding of the company, affecting its stock price. In addition, many psychological The study of investor sentiment always has a hot research topic in the field of behavioral finance. Unlike traditional financial theory, behavioral finance believes that investors are irrational and their behavior affects each other.

Levine and Zajac (2006) think that in the process of imitation and learning, investors' emotions and behaviors will tend to be consistent, leading to mispricing. De Long et al. (1990) point out that investor sentiment is a risk factor affecting the pricing of capital assets. Therefore, the research on investor sentiment measurement attracts the attention of many researchers. The research on the measurement methods of investor sentiment can be mainly divided into three types: one is to reflect the sentiment and behavior of investors through objective transaction data in the financial market; the second is to collect investors' subjective views on the future trend of the market through questionnaire surveys or big data text analysis and use this to reflect the current investor sentiment; the third is to integrate multiple single subjective or objective indicators to build a composite investor sentiment index.

In the earliest days, researchers mostly use sentiment-related transaction data directly collected in financial markets to construct corresponding sentiment indicators. They mainly use single indicators, including closed-end fund discount rate, IPO number and first-day rate of return, trading volume, etc. (Lee, Shleifer, and Thaler, 1991; Elton, Gruber and Busse, 1998; Brown and Cliff, 2004; Baker and Wurgler, 2006). In addition, regarding the construction of investor sentiment composite indicators, most of the current construction indicators are objective indicators, that is, the statistics of objective transaction data in the financial market. Among them, the composite sentiment index (BW index) constructed by Baker and Wurgler (2006) using principal component analysis has the greatest impact. That is, using six single indicators (closed-end fund discount rate, turnover rate, dividend premium, IPO number and first-day rate of return, new issue ratio and dividend, and principal component analysis of agency variables), taking the residual obtained after controlling the corresponding macroeconomic variables as the investor sentiment index value. Although this type of data is more objective and accurate than subjective data, objective data cannot directly reflect investors' expectations of the stock market and are mostly an after-the-fact reflection of investor sentiment and behavior.

The subjective measurement method of investor sentiment can compensate for the lag problem of the objective measurement method. The subjective measurement methods are mainly divided into questionnaire survey and big data text analysis methods. The former can be divided into investors' judgment on future trends and confidence in market prospects. The leading current subjective investor sentiment indicators based on questionnaires are the American Investor Association Index (AAII Index), the Investor Intelligence Index (II Index), Wall Street analyst sentiment index, Consensus Bullish Sentiment Index (CBSI), and CCTV Bullish Sentiment Index, etc.

Additionally, in recent years, with the widespread use of Internet-based big data analysis, the study of web text information has become one of the directions of academic research. Some scholars turn their research perspectives to online platforms regarding subjective investor sentiment research. Most textual information comes primarily from news, blogs, and forums. Wysocki (1999) collect more than 3000 stock-related online reviews published by Yahoo Finance. By conducting textual statistical analysis, they construct a subjective investor sentiment index based on textual information and study the impact of stock review information on stock returns and trading volumes. Dewally (2003) collects and categorizes information published by major news platforms. The corresponding investor sentiment indicators are constructed by extracting sentiment words in news texts. Dong and Xiao (2011) use crawler technology to extract stock-related text information from the Sina website and use relevant data to construct an investor sentiment index for studying the relationship between returns and investor sentiment. Yi, Lai, and Dong (2015) take text information in web blogs as the research object, support data mining technology, and create emotional keywords. They mainly use word frequency statistics to construct investor sentiment variables. Yu and Wang (2015) construct an indicator of investor sentiment using the information posted on Twitter. Li et al. (2020) constructe an investor sentiment index using textual information from the posts of the Eastern Fortune stock bar. Ruan and Wang (2019), support by artificial intelligence technology, obtain textual information from Sina Stock Bar (Sina Finance Stock Bar

and Eastern Fortune Stock Bar are both well-known stock financial forums in the Chinese market), analyze the information, and then construct investors Sentiment Indicator (ISI) that directly reflect investor sentiment. I also construct a daily investor sentiment index for individual stocks from textual information. The sources of text information are mainly commentary posts for individual stocks in Sina and Eastern Fortune Stock Bar. Through textual information analysis, this paper divides the daily comments of each stock into positive sentiment and negative sentiment and calculates the sentiment index of the stock on that day.

In the robustness test of this paper, I use the inverse VIX index as the investor sentiment index to test the sentiment effect, region effect, and industry effect of the epidemic on the stock market. The reason for using a negative VIX index is that when panic in the market is high, investor sentiment is generally low, so there is a negative correlation between the two. Baker (2010) uses the option implied volatility index VIX as a measure of the capital market panic effect. Gauvin et al. (2012) believe that the VIX index can be used as a proxy variable for global risk. This is because when the VIX index increases, it represents the intensification of market panic, and the index is sensitive to emergencies. Sha (2017) uses the weighted implied volatility of SSE 50ETF options to form a Chinese panic index. The VIX index used in this article is also composed of the implied volatility of SSE 50ETF options. Xu and Zhou (2018) take market panic as a proxy variable of investor sentiment and adopt the method of Baker and Wurgler (2006) to construct an investor sentiment index.

2.4 The impact of investor sentiment on stock market

As more and more researchers begin to study investor sentiment, literature looks at the impact of investor sentiment on the stock market. This article hopes to explore how the relationship between investor sentiment and the stock market has changed under the COVID-19 outbreak. Some literature studies the relationship between

sentiment and returns during the COVID-19 outbreak. Smales (2021) uses Google search volume as a proxy for investor sentiment to explore the relationship between investor sentiment and market returns during the COVID-19 pandemic. He finds that as investor attention increases, stock price volatility increases, and stock returns decrease. This may be because, during the epidemic, many individual investors search for relevant information on the Internet to avoid household uncertainty.

Moreover, he also study the relationship between investor attention and stock returns in 11 industries and found that the increase in investor attention would have a negative impact on the returns of some industries. Sun et al. (2020) also study the relationship between investor sentiment and the stock market during the COVID-19 epidemic. The results found a stronger positive relationship between investor sentiment and stock returns. In this paper, I study the relationship between investor sentiment and the stock market during the COVID-19 epidemic. The difference is that I divide the first stage of the COVID-19 epidemic into four periods and measure the relationship between the two at different stages in order to obtain more detailed conclusions. The hypothesis for this paper is that investor sentiment can partially explain the abnormal returns of the stock market during the epidemic. And after the implementation of strict epidemic prevention policies, the sensitivity of abnormal returns in the stock market to changes in investor sentiment increases significantly.

3. Data and Methodology

3.1 Data

I aim to examine the impact of investor sentiment on the Chinese stock market during the COVID-19 period. All stock-related data and data about epidemic development are retrieved from CSMAR (China Stock Market & Accounting Research Database) database. The sample stocks are all listed A-share stocks, excluding stocks with missing value and ST (special treatment) stocks.

The period is from August 05th, 2019, to April 22nd, 2020. This time covers four important events, including the first official announcement about the COVID-19 pandemic released in China on December 31st, 2019, the Wuhan lockdown on January 23rd, 2020, the first day clean the new confirmed cases on March 18th, 2020, and Wuhan unlock at April 08th, 2020. Four event windows are set, and an estimation window is set to compare the results. Then, set the assumption that the second and the third event may cause the most significant effect on the financial market. The possible reason why the first event may not be reflected more in the financial market is the backwardness of information reflection. In addition, pandemic announcements and lockdowns are generally regarded as events with worse effects. In contrast, the last two events could signal that the financial market will recover from the worse impact of COVID-19.

Besides, to control the number of factors during the industry regression, according to China Securities Regulation Commission 2012 Industry classification standard, I re-classify and consolidate industries except for the finance industry. Finally, there are 12 industries in this research, which are properties; pharmaceutical manufacturing; manufacturing of chemicals; raw materials and chemical products; electricity, heat, gas, water production, and supply industries; public utility; rubber and plastic products industry; transportation, warehousing, and postal industry; hotel and catering industry; culture, sports, and entertainment Industry; computer communication and other electronic equipment manufacturing; Information transmission, software, and information technology services; other industrial; and other business service industries. I report the industry code in table 1.

Regarding the measurement of investor sentiment, I obtain daily posts with a negative, neutral and positive attitude to individual stock from Sina Stock Bar and Oriental Fortune Internet Stock Bar in the CSMAR database. Then, following the method from Antweiler and Frank (2004), I construct the daily positive investor sentiment.

Specifically, I use the texture analysis approach to measure individual investor sentiment for each stock. Separately I obtain and accumulate the daily number of positive and negative posts of single stock from two stock bars. The investor sentiment calculation formula is as follows:

$$\mathrm{Sent}_{i,t} = \ln \frac{M^{buy}{}_{i,t} + 1}{M^{Sell}{}_{i,t} + 1}$$

Note:

$M^{buy}{}_{i,t}$: number of positive posts of single stock i at day t.

$M^{Sell}{}_{i,t}$: number of negative posts of single stock i at day t.

If the result is more than 0, there is positive sentiment. If the result is less than 0, then there is negative sentiment. Figure 1 plots daily investor sentiment and market excess return time series. The results show that investor sentiment and stock market volatility are relatively smaller before February 2020. However, around February 2020, stock market and investor sentiment start to have a relatively larger shock. This shock reaches the bottom at the beginning of February and lasts a high oscillation amplitude till April. Meanwhile, from April 2020, the market volatility tends to go back to the normal condition as the oscillation amplitude decreases. The result is consistent with my assumption on the four event windows, indicating that pandemics have the most significant influence between the second and the third event.

In order to confirm whether the result could be convincing to mass people, I replace the daily investor sentiment constructed by texture analysis with VIX data to conduct the robustness test. VIX data is obtained from Wind Information® (WIND). Generally, the VIX index is negative relative to investor sentiment. Higher VIX means investors believe that the market will frequently fluctuate with the panic sentiment. On the contrary, the VIX index will decrease when investors suppose that there is no possibility of rapid fluctuation in the financial market. Figure 2 is a time series graph of the VIX index from August 05th, 2019 to April 22nd, 2022. As can be seen in figure 2, from the beginning of February to the beginning of March, the VIX index rises

sharply. It shows that panic prevails in the market during this period. This period is after the occurrence of event 2. From mid-March to mid-April, the VIX index falls sharply, corresponding to the event 3-event 4 periods. This shows that as the epidemic improves, panic in the market ease.

3.2 Methodology

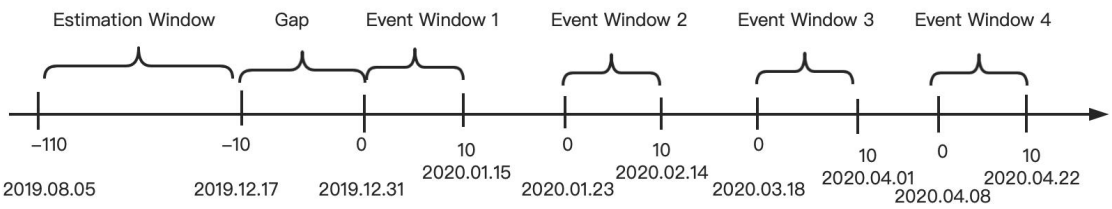
How does a pandemic event affect the stock market? Due to the different stages of COVID-19 and government pandemic prevention policies, would the influence on the stock market have any changes? Is there any difference between industries when they face a sudden pandemic? Besides the impact on industries, whether the investor sentiment would change with time, and whether the relationship between investor sentiment and the stock market will change during the pandemic period. If COVID-19 affects investor sentiment and stock market tendency, will this effect differ in different industries?

To answer these questions, my paper investigates the fluctuation of investor sentiment and the stock market during COVID -19. I will conduct an event study, then examine cross-sectional regression analysis. Firstly, calculate the abnormal return of the stock market at different event windows. Then, calculate the cumulative abnormal return(CAR). Through the significance test on CAR, if the CAR is significantly not equal to 0, the event is proved which event affects the stock market. Moreover, taking advantage of regression analysis to explore whether investor sentiment will be the explainable factor of abnormal return existing in CVID-19. Meanwhile, besides considering the effect of COVID-19 on different industries will be different, I also consider the particularity of Wuhan, then take the region into the analysis.

3.2.1 Event study

I divide four time periods during the whole epidemic into four event windows to measure whether there is any difference between industries influenced by COVID-19 in different event windows. Due to China's epidemic prevention policy, I divide the whole epidemic into four parts: the beginning, the Wuhan lockdown, the Wuhan unblocks, and the first day of new confirmed cases cleared. The first event is the beginning of the pandemic, which has limited influence on the stock market because the stock market reacts with a lag. This shows that investors (and markets) do not fully understand the implications of covid-19 during the first event. Therefore, they does not act on that message. The second and third event has a continuous negative effect on the financial market as this period is the most serious period of pandemic starting in China. The final event could be regarded as the first recovery period in China with gradually recovered investor sentiment.

In detail, the event dates are December 31st, 2019, and COVID-19 is officially announced by the government; January 23rd, 2020, Wuhan lockdown; March 18th, 2020, the first day clear new confirmed cases; and April 08th, 2020, Wuhan unlock. Set 10 days as the time window, then four event window construct. The first event day is December 31st, 2019, and 100 days before is August 05th, 2019, and the estimation widow is from August 05th, 2019 to December 17th, 2019 including a 10-day gap from December 17th, 2019 to December 31st, 2019. Setting a gap is to prevent data from being contaminated while obtaining the real abnormal return.



In this paper, I choose three-factor model (Liu et.al, 2019) containing MKT，SMB and VMG. Based on the method of Fama and French (1993), Liu, Stambaugh and Yuan construct size and value factors for china. The data comes from Stambaugh's website.

$$R_{i,t} = \alpha_i + \beta_1 MKT_t + \beta_2 SMB_t + \beta_3 VMG_t + \epsilon_{i,t}$$

Thus, abnormal return formula is as following:

$$AR_{i,t} = R_{i,t} - (\hat{\alpha} + \widehat{\beta_1} MKT_t + \widehat{\beta_2} SMB_t + \widehat{\beta_3} VMG_t)$$

$$AR_t = \frac{\sum AR_{i,t}}{N}$$

$$CAR_t = \sum_{t=1}^{n} AR_t$$

Note:

$R_{i,t}$: real return of stock i at time t in the event windows.

$\hat{\alpha}$, $\widehat{\beta_1}$, $\widehat{\beta_2}$, $\widehat{\beta_3}$: calculated through data of estimation window.

Thus, set the null hypothesis is CAR = 0. If there is a positive impact of epidemic on stock price, the result of the t-test is positive. If there is a negative impact, t-test is also negative.

3.2.2 Regression analysis and robustness test

In regression analysis process, this paper add some new variable to measure the impacts of sentiment and region on stock returns.

$$AR_{i,t} = R_{i,t} - (\hat{\alpha} + \widehat{\beta_1} MKT_t + \widehat{\beta_2} SMB_t + \widehat{\beta_3} VMG_t)$$

$$AR_{i,t} = \alpha_i + \gamma_{i,1} Sent_{i,t} + \epsilon_{i,t}$$

$$AR_{i,t} = \alpha_i + \gamma_{i,1} Sent_{i,t} + \gamma_{i,2} L_i + \epsilon_{i,t}$$

Note:

$R_{i,t}$: return of stock i at time t.

$Sent_{i,t}$: investor sentiment of stock i at time t.

α_i: the firm-fixed effects

$AR_{i,t}$: the abnormal return for stock i at time t

Firstly, in order to consider the sentiment effect, adding sentiment ($Sent_{i,t}$) which is single explainable variable into the three-factor model to conduct regression process. Then, adding region factor to examine the region effect. In China, except living essential companies, almost all companies and cities experience lockdown at the beginning of pandemic. As Wuhan is the first city experiencing the outbreak, no matter where face the government policy of lockdown or unlock, Wuhan need more time to be in lockdown and unlock later than other cities in China. Thus, this paper add region variable (L_i) to explore the region effect. If enterprise belongs to Wuhan, then the value of L_i is 1; or enterprise belongs to other city in China, then the value of L_i is 0.

Moreover, the impact of investor sentiment also has difference corresponding to the different industries (Baek et al., 2020). In this paper, It is worthy studying the industry effect at different pandemic period. I construct 12 equal-weighted portfolios by industry classification. Then, the model formula is as following:

$$AR_{i,t} = \alpha_i + \gamma_{i,1} Sent\_b_t + \epsilon_{i,t}$$

Note:

α_i: the industry-fixed effects

$AR_{i,t}$: the abnormal return for industry i at time t

Considering that the investor sentiment constructed by textual information and stock returns may simultaneously affect each other, this may affect internal validity and lead to estimation bias. To explore the convincing of textual analysis, this paper inducts the VIX index as a new investor sentiment proxy indicator bringing in the same regression model. Comparing the results obtained from different investor

sentiment indexes to further empirical discussion. Usually, the rise of the VIX index is caused by panic in the market, and the corresponding investor sentiment will decline. It can also be seen from the investor sentiment and VIX index time series line in figure 3. Since the VIX index is negatively correlated with investor sentiment, here I use the negative VIX index to measure market investor sentiment. For VIX, the formula is:

$$\mathrm{Sent\_b_t} = -\mathrm{VIX_t}$$

$$\mathrm{AR_{i,t}} = \alpha_i + \gamma_{i,1}\mathrm{Sent\_b_t} + \epsilon_{i,t}$$

$$\mathrm{AR_{i,t}} = \alpha_i + \gamma_{i,1}\mathrm{Sent\_b_t} + \gamma_{i,2}\mathrm{L_i} + \epsilon_{i,t}$$

Note:

α_i: the firm (industry)-fixed effects

$\mathrm{AR_{i,t}}$: the abnormal return for stock (industry) i at time t

$\mathrm{Sent\_b_t}$: the market investor sentiment status at time t

4. Empirical analysis

In order to study the impact of the epidemic on the stock market, I divide the first stage of the epidemic in China into four events, including the occurrence, aggravation, and recovery of the epidemic. While examining the differences in the test results before and after the epidemic, the responses of the stock market to the occurrence of the four events are reviewed separately. There are two test methods in this paper. The first is to use an event study to explore the impact on the capital market after the epidemic outbreak. With the change of epidemic prevention policy, what happen to this impact? At the same time, I explore whether there are differences in the extent to which different industries are affected by the epidemic. On the other hand, through regression, I can more accurately analyze the impact of changes in investor sentiment during the outbreak on returns and whether this impact varies across industries. At the same time, the effects on the region should also be considered due to the various

levels of lockdowns and work stoppages in multiple places during the epidemic.

4.1 Event study result

Table 2 is the summary statistics results. The table contains the average stock excess return in the sample, the market average excess return, and the average investor sentiment for an individual stock. During the estimation window period, stock returns and investor sentiment were positive, at 0.096% and 0.002, respectively. And compared with the other four window periods, the absolute value of investor sentiment is relatively small. Combined with the time series graph of investor sentiment (Figure 1), I find that the fluctuation of investor sentiment during this period is relatively small. In event window 1, investor sentiment and stock market returns are positive, 0.519% and 0.136, respectively, larger than in other window periods. However, from the perspective of stock returns, compared with the estimation window period, the value range of 25%-75% in window period 1 is wider (-0.881%-1.478%). This may be because there are few related reports in the early stage of the epidemic, and the public paid less attention to the event. The pre-disclosure of statements in the same period and the arrival of the new year may bring about an upward trend in the market. Investor sentiment and stock returns are negative during event windows 2 and 3, as we expected. Because during the 2-3 period of the event window, the epidemic break out across the country, and the successive lockdowns and corporate shutdown policies in various places are bound to bring panic among investors and a downturn in the market. However, I find that the 25%-75% range of stock sample returns has expanded significantly. This may be because different industries are affected differently during the epidemic. Some industries, such as the pharmaceutical industry, may receive higher attention and development during this period. In event window 4, Wuhan lift the lockdown, and the number of confirmed epidemic cases is cleared for the first time. Although stock returns turn positive, the investor sentiment remains negative and far below the

estimation window period. From the perspectives of stock returns and investor sentiment, this phenomenon can be understood as the market recovery, but the public still holds relatively pessimistic emotions.

Table 3 reports cumulative abnormal return (CAR) and T-value for different windows. Two window periods (0,3] and (0,10] are included for each event. This is because, according to previous literature studies, when an event occurs, the period most affected by the event is the next two to three days. But most of the literature studies the situation of developed markets. Considering that the Chinese market is a developing market, its market reaction speed is slower than other developed markets, so I consider three days and ten days simultaneously as two-time windows for each window.

From the results of table 2, the cumulative abnormal return in 4 window periods is all significant at the 1% confidence level, and all values are negative. Therefore, I conclude that the four events after the outbreak of COVID-19 all have a negative impact on the stock market, but with different degrees of influence.

First, although the CAR value of event 1 is negative, the value is larger than that of event 2. This may be due to the fact that event 1 is in the early stage of the epidemic, and the impact of the epidemic is relatively small. Therefore, the scope of negative effects it brings is also smaller. At event 2, the CAR in the window period is the lowest, corresponding to (0,3] and (0,10] are -0.99% and -1.17%, respectively. On the one hand, this may be due to the arrival of the Spring Festival and the speed of China's population movement reaching its peak in a year, so the scope of the epidemic expand rapidly. At the same time, the lockdown and company stoppage policies on epidemic prevention and a large number of relevant reports every day bring a greater negative impact on the market and have a significant impact on stock prices. Compared with window period 2, the CAR of event 3 window period increase slightly, which is from -0.99% to -0.45% at (0,3] and from -1.17% to -0.90% at (0,10].

Corresponding to the epidemic prevention and control policy at that time, the unblocking of Wuhan is good news and brings a certain recovery to the market. The CAR in the window period of event 4 is still significantly negative and is significantly higher than in window periods 2 and 3. This shows that the situation of the epidemic improve in stages, which positively impacts the stock market.

The results from panel A to panel H in Appendix 1 are the average CAR values in different industries after four epidemic-related events. Each event contains two window periods (0,3] and (0,10]. Overall, the epidemic has a strong negative impact on most industries, and this negative impact reached its maximum after event 2. And this shock is moderated after event 3. Three trading days and ten trading days after the event, most industries' cumulative excess return CAR is negative. Still, the overall absolute value is small, which is in line with the overall market situation. The main reason is that when event 1 occurred, due to the limited dissemination of epidemic-related information, it has little impact on the market. At this time, the CAR values of culture, sports and entertainment Industry, and other business service industries are positive, mainly because the entertainment service industry is more popular as the New Year approaches. But starting from event 2, except for the pharmaceutical industry, most other industries have significantly negative CAR values. At this time, the absolute value of CAR in most industries increases, indicating that all industries are greatly affected. The positive impact greatly affects the pharmaceutical industry, and its CAR values are 14.01% and 3.74% in the (0,3] and (0,10] window periods, respectively. In addition, the real estate, transportation, warehousing, postal, and hotel and catering industries are greatly negatively affected, and their CAR values are -4.24%, -1.69% and -3.29%, and -4.12% in the (0,3] and (0,10] windows, respectively. Other industries are also significantly negatively affected. This may be because, after the outbreak of the epidemic, a large number of extremely strict epidemic prevention measures to restrict the flow and gathering of people have caused a great impact on the consumption demand of residents and the production capacity of enterprises. At the same time, the expectation of losses in related industries has caused

investors' risk aversion in the stock market, which further lead to a sharp decline in some industries. After Event 3, although most industries are still significantly negatively affected. However, compared with event 2, the magnitude of the negative impact is significantly lower. Especially the CAR values of electricity, heat, gas, and water production and supply industries; transportation, warehousing, and postal industry, and hotel and catering industry change from negative to positive. This is because event 3 is the unblocking of Wuhan. Wuhan is the last city in China to lift the lockdown. Its unblocking means that China return to a state where people can move freely for the first time after the outbreak, which greatly impacts the industry's recovery. After event 4, although the CAR of most industries is still negative, the absolute value is further reduced. In addition to the industries that turn positive in event 3, CAR's value of public utility-related industries also turns positive. This shows that these industries take the lead in recovering during the epidemic and are relatively more positively affected. Unlike most industries, the various events of this epidemic bring a significant positive impact on the pharmaceutical manufacturing industry. Except for the event window of event 1, the CAR of the other selected event windows is all significantly positive. In addition, electricity, heat, gas and water production and supply industries and public utility industries are affected very closely in the eight-time windows of the four events, and both turn positive earlier. This may be because these two industries belong to the infrastructure industry, which can operate normally during the epidemic, and most of them are state-owned.

4.2 Panel regression result

In this part, I estimate regression to examine the differences in the market's sentiment, region, and industry effects before and after the outbreak. At the same time, I hope to explore further the differences in the impact of different epidemic prevention policies and different stages of the development of the epidemic on the stock market.

The results in Table 3 reflect how the stock market is affected by investor sentiment

and region before and after the outbreak. Investor sentiment has a significantly positive impact on the stock market, both before and after the pandemic. That is, ceteris paribus, returns will rise as investor sentiment increases. However, compared with the estimation window period before the outbreak, after the outbreak, the positive impact of investor sentiment on abnormal return increase significantly, from 0.72 to 0.87. This means that the exact change in investor sentiment after the outbreak will have a more significant impact on the stock market than before the outbreak. The stock market is more sensitive to changes in investor sentiment.

In addition, from the test results of the region effect, I find that the region variable (L) was not significant after the outbreak. This may be due to two reasons. First, after the outbreak of the COVID-19 epidemic, during the implementation of China's epidemic prevention and control policies, although Wuhan enter the lockdown earlier than other cities, the difference in date is not large. At the same time, with the approach of the Chinese New Year, the population movement accelerates, and the epidemic spreads rapidly, which makes Wuhan and other regions affected no significant difference. On the other hand, the distinction of regions in our sample refers to the places of registration of listed companies, some of which are registered in Wuhan, and their main business may not be in Wuhan. On the contrary, some companies whose main business is in Wuhan may be excluded because their registered place is not in Wuhan.

The results in Table 4 are the impact of investor sentiment and regions on the stock market at different stages after the outbreak. From an investor sentiment perspective, in the four stages of the epidemic, the regression coefficients of investor sentiment variables are all significantly positive. That is, it has a positive impact on abnormal stock returns. In the event 1 stage, the impact of investor sentiment on the stock market is lower than the estimation window period. This may be because the time of event 1 is before the Spring Festival, the population movement speed is not large, and the spread of The virus is limited. And the relevant reports are relatively few, and the public attention is relatively low. Therefore, the stock market is less sensitive to

investor sentiment at this time. During events 2 and 3, the sensitivity of stock returns to investor sentiment increase significantly, reaching a peak at event 2. And during this period, the regression coefficient of investor sentiment is higher than the parameters of the entire post-epidemic period. At this stage, due to the arrival of the Spring Festival, the speed of population movement reach its peak in a year, the epidemic spread rapidly across China, and the number of confirmed cases soar. At the same time, with the implementation of the Wuhan lockdown policy, the nationwide closure of businesses, schools, and production, as well as nationwide lockdowns, panic in the market spread rapidly. At this time, other conditions remain unchanged, the investor sentiment drop slightly, and the abnormal stock return may drop sharply. In the event four periods, the impact of investor sentiment is still large. But the impact of investor sentiment has declined compared to the previous period. At this stage, as the epidemic ease and the number of confirmed cases return to zero, the first stage of the epidemic in China is coming to an end, and business operations and people's lives enter a stage of recovery. In addition, from the perspective of the region effect, in the four stages, the influence of the region is not significant.

The above research results show that after the outbreak of the COVID-19 epidemic, the stock market is affected by the epidemic. Still, the degree of impact is slightly different in different epidemic stages. In fact, during the COVID-19 epidemic, various industries may be affected slightly differently due to the implementation of different epidemic prevention policies and the degree of harm caused by the epidemic. After the outbreak, the Chinese government adopted a policy of closing businesses. Except for related enterprises that guarantee people's basic life and are related to epidemic prevention and control, most of the remaining industries enter a shutdown stage. Due to the differences in the characteristics and operation methods of different industries, their impacts at this stage are also quite different.

Table 5 reports the impact of sentiment on abnormal stock returns in different industries before and after the outbreak and at different stages after the outbreak.

From the regression results, investor sentiment and stock prices are significantly positively correlated. Overall, before and after the outbreak, investor sentiment positively impacts abnormal returns. For most industrial industries, including pharmaceutical manufacturing, manufacturing of chemical raw materials and chemical products, and rubber and plastic products industry, after the outbreak, the coefficient of investor sentiment increase significantly, which means that the industry's abnormal returns are significantly more sensitive to investor sentiment. At the same time, compared with Event 1, during the period from Event 2 to Event 4, investor sentiment's impact on the industry's abnormal returns has increased significantly.

Additionally, in electricity, heat, gas, and water production and supply industries, before and after the epidemic and in various periods, abnormal returns are less sensitive to investor sentiment and have no major fluctuations. At the same time, public utility-related industries also have the above characteristics. Therefore, I believe the abnormal returns of these two industries are less affected by the fluctuation of investor sentiment during the epidemic. Moreover, Computer communication and other electronic equipment manufacturing industries are similar to Information transmission, software, and information technology services industries. Investor sentiment has a similar impact on abnormal returns in these two industries, before and after the epidemic and at various stages. And unlike other industries, investor sentiment in these two industries is less sensitive to abnormal returns after the epidemic. Compared with the early stage of the epidemic, the coefficient of investor sentiment in the transportation and tourism-related industries during the epidemic recovery period, namely event3-event4, increase significantly. This shows that the industry's recovery brings about a rise in investor sentiment, which in turn leads to an increase in abnormal stock returns.

4.3 Robustness test

The previous part used the investor sentiment of individual stocks constructed by text to study the investor sentiment, region, and industry impact on the stock market during the epidemic. However, there are two main problems in the subjective investor sentiment index constructed with text information. One is the individual stock investor sentiment index constructed as the text information of the stock bar, which is highly subjective, so it may lead to measurement error, affecting the internal validity and causing estimation bias. Second, there may be a simultaneous influence between individual stock investor sentiment and stock prices, leading to estimation bias. Therefore, the VIX index is used as an indicator of investor sentiment to conduct robustness tests in order to obtain more accurate estimation results.

Table 6 reports the regression results of the sentiment and region effect before and after the epidemic. Before the epidemic, there is a significant positive correlation between investor sentiment and abnormal stock returns. However, after the outbreak, the regression coefficient of investor sentiment decline and is negative. From the perspective of the region effect, after the epidemic outbreak, the regression coefficient of regional variables is not significant. Overall, when using VIX as investor sentiment for regression, investor sentiment variables have a significantly negative impact on abnormal stock returns during the full event period after the outbreak. In addition, I report the sentiment and region effect in the four events after the outbreak in table 7. As a result, both investor sentiment and regional variables are insignificant at the 10% confidence level, except for the sentiment coefficient during event 2. In event 2, investor sentiment significantly negatively impacts abnormal stock returns, and the impact is much larger than in other periods.

Table 8 reports the results of different industries in the stock market affected by investor sentiment after the outbreak. Here I replace the original investor sentiment index with the negative VIX index. Similar to the previous regression results, after the

occurrence of event 2, in most industries, the sensitivity of industry abnormal returns to investor sentiment increase significantly. Among them, the pharmaceutical industry has the largest growth rate. But the difference is that in the period of event 3-event 4, the relationship between investor sentiment and abnormal returns turns positive to negative in the pharmaceutical industry. It shows that during the recovery period of the epidemic, the rise in market investor sentiment will bring about a decline in the abnormal returns of the pharmaceutical industry. In addition, for electricity, heat, gas, and water production and supply industries, market investor sentiment has a negative impact on abnormal returns before and after the epidemic and at different stages. Except for Event 2, the magnitude of the impact does not change significantly.

5. Conclusion

I examine the impact of investor sentiment on the Chinese stock market before and after the COVID-19 outbreak and how this impact differs across industries. At the same time, to study the specific effect of epidemic prevention policies and the development trajectory of the epidemic during the epidemic, I divide the first stage of the outbreak into four key events according to the event axis of the epidemic process. These four events cover the outbreak, containment, and recovery phases. On the one hand, I observe the epidemic's impact from the cumulative abnormal returns before and after the epidemic and at different stages. On the other hand, regression is used to test the sentiment, region, and industry effects during the epidemic.

Overall, during event 2, the epidemic negatively impacts the stock market and most industries. This can be partly attributed to the increased spread of the epidemic brought about by the rapid population movement during the Spring Festival and the strict lockdown and shutdown policy. Except for the pharmaceutical industry, most industries are significantly negatively impacted during this period. During the epidemic recovery period, compared with other industries, warehousing,

transportation and hotel, and catering-related industries and other business service industries, as well as life security industries, including electricity, heat, gas, and water production and supply industries, recover quicker.

In studying whether investor sentiment can explain the abnormal returns of stocks during the epidemic, I find that during the epidemic, in the pharmaceutical industry and the industries related to epidemic prevention materials and raw materials, the sensitivity of abnormal returns to investor sentiment increases significantly, especially after events 2. This shows that the abnormal fluctuations in investor sentiment during the epidemic can explain the abnormal returns of these industries. In contrast, in public utility-related industries, including electricity, heat, gas, and water production and supply industries, the relationship between investor sentiment and abnormal return does not change significantly before and after the epidemic and at different stages. Therefore, I can not conclude that in these industries, the abnormal returns of the industry during the epidemic are due to fluctuations in investor sentiment.

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Figures and Tables

Figure 1
The daily investor sentiment index vs CSI300

The figure 1 plot the time series of daily investor sentiment (cumulative individual stock sentiment) vs CSI300 index. The sample period is from 2019.08.05-2020.04.22.

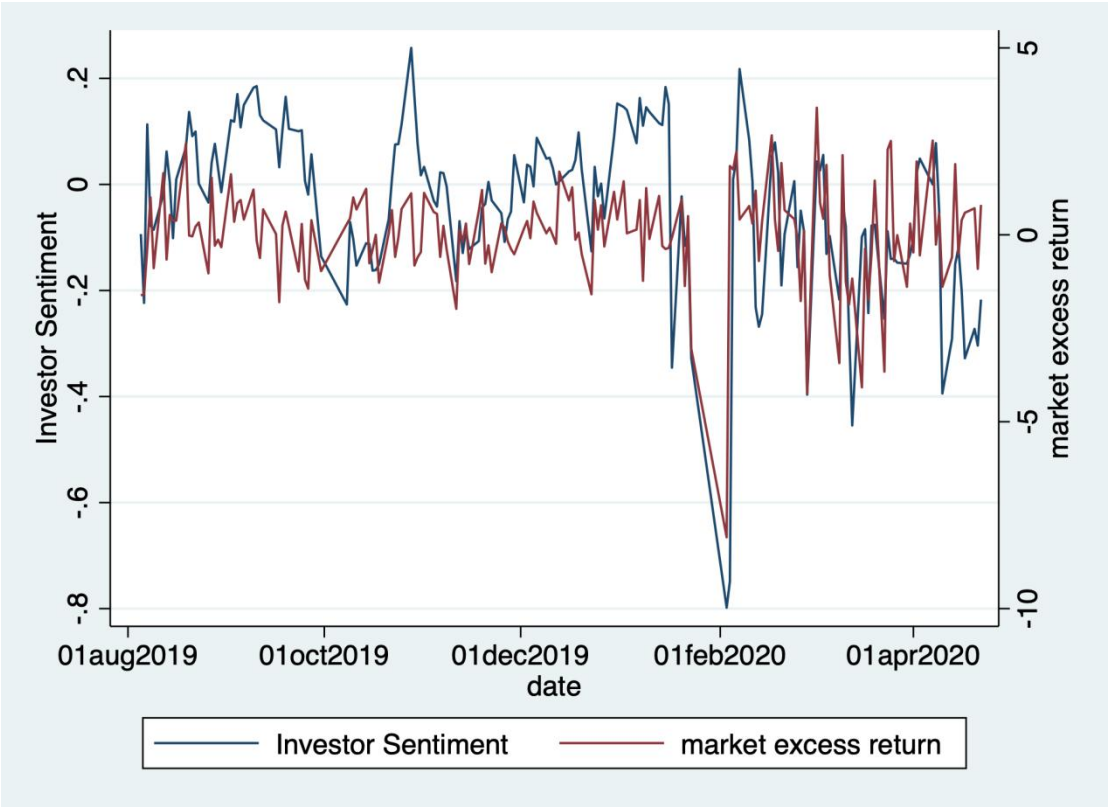

Figure 2
The daily VIX index during sample period

The figure 2 plot the time series of daily VIX index in Chinese option market (Implied Volatility of SSE 50ETF Options). The sample period is from 2019.08.05-2020.04.22.

Figure 3
The daily investor sentiment index vs daily VIX index

The figure 3 plot the time series of daily investor sentiment (cumulative individual stock sentiment) vs VIX index. The sample period is from 2019.08.05-2020.04.22.

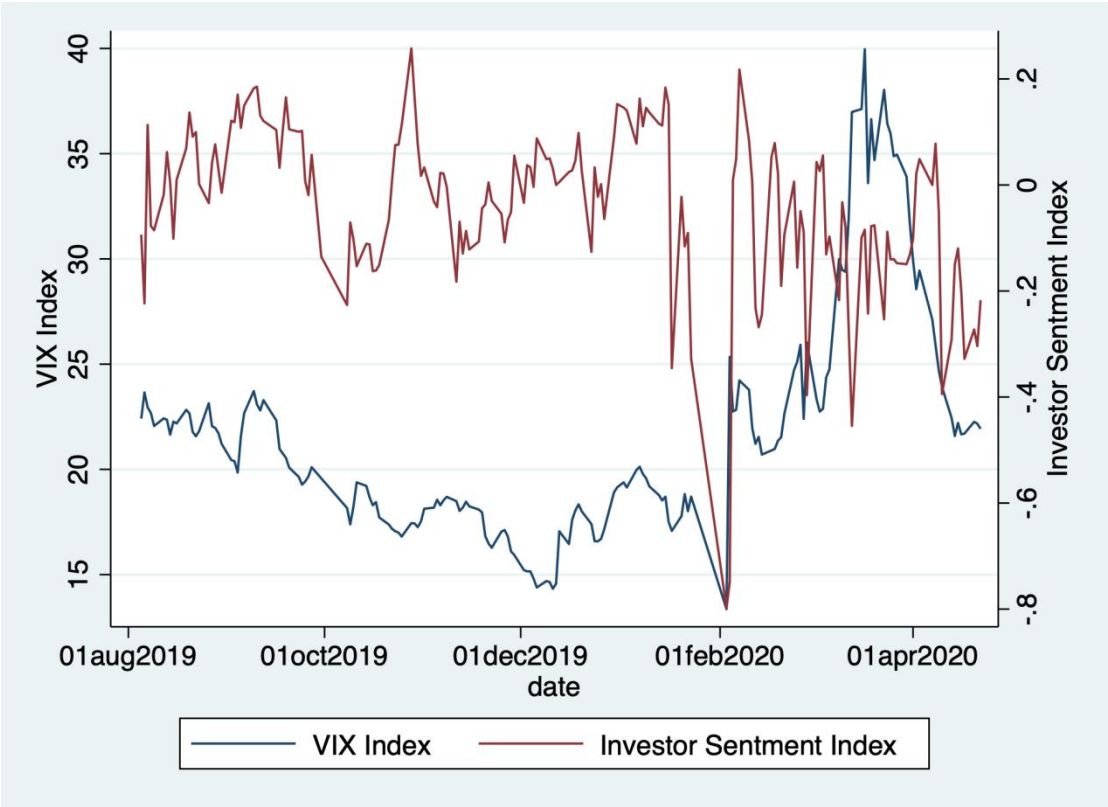

Table 1
Industry classification

In my paper, the stock samples are all A-share listed companies, excluding stocks with ST and stocks with missing values. According to the 2012 industry classification standard of China Securities Regulatory Commission, this paper first removes the financial industry stocks and reclassifies the industry. I combine some industries and the final stock sample contains 12 industries. The table shows the number of stocks in each industry and the SFC industry code of the industry involved.

	Industry	Obs.	Industry code
1	Properties	204	E47 E48 E49 K70
2	Pharmaceutical Manufacturing	292	C27
3	Manufacturing of chemical raw materials and chemical products	314	C26
4	Electricity, heat, gas and water production and supply industries	130	D44 D45 D46
5	Public Utility	255	L71 L72 M73 M74 M75 M77 M78 O80 Q83
6	Rubber and plastic products industry	105	C29
7	Transportation, warehousing and postal industry; hotel and catering industry	127	G53 G54 G55 G56 G58 G59 G60 H61 H62
8	Culture, Sports and Entertainment Industry	75	P82 R85 R86 R87 R88
9	Computer communication and other electronic equipment manufacturing	486	C39
10	Information transmission, software and information technology services	388	I63 I64 I65
11	Other industrial	1953	B06 B07 B08 B09 B10 B11 C13 C14 C15 C17 C18 C19 C20 C21 C22 C23 C24 C25 C28 C30 C31 C32 C33 C34 C35 C36 C37 C38 C40 C41 C42
12	Other business service industries	199	F51 F52

Table 2
Summary statistics

This table reports summary statistics for investor sentiment and the average daily excess return for market and individual stock in estimation window period and 4 event window periods. The sample period include five time periods form 2019.08.05-2020.04.22. The estimation window contains 100 trading days of data, and each event window covers 10 trading days of data. SENT is a daily indicator of investor sentiment for individual stocks constructed from textual information. MKT is the market excess return.

Estimation Window				
Variable	Mean	Std. Dev.	25%	75%
Stock Return	0.096	2.866	-1.120	1.091
MKT	0.078	0.835	-0.460	0.620
SENT	0.002	0.688	-0.470	0.480
Event window 1				
Variable	Mean	Std. Dev.	25%	75%
Stock Return	0.519	2.633	-0.881	1.478
MKT	0.281	0.809	-0.300	1.040
SENT	0.136	0.726	-0.693	0.693
Event window 2				
Variable	Mean	Std. Dev.	25%	75%
Stock Return	-0.028	6.298	-1.819	2.137
MKT	0.005	2.821	0.300	1.750
SENT	-0.368	0.719	-0.693	0.000
Event window 3				
Variable	Mean	Std. Dev.	25%	75%
Stock Return	-0.147	3.462	-2.083	1.708
MKT	-0.019	1.731	-0.700	1.450
SENT	-0.139	0.716	-0.693	0.336
Event window 4				
Variable	Mean	Std. Dev.	25%	75%
Stock Return	0.107	3.147	-1.411	1.279
MKT	0.152	0.932	-0.600	0.710
SENT	-0.248	0.698	-0.693	0.201

Table 3
The CAR and t-statistics for event windows

Table 2 reports event study result including the CAR and t-value for different event windows.The date of Event 1 is 2019.12.31, which is the first official document released by China; the date of event 2 is 2020.01.23, which is the closure of Wuhan; the date of event 3 is 2020.03.18, which is the unblocking of Wuhan; the date of event 4 is 2020.04.08 is the first time the number of confirmed cases in China has been cleared. Each event includes two time windows (0,3] and (0,10] respectively. The calculation formula is as follows:

$$AR_{i,t} = R_{i,t} - (\hat{\alpha} + \widehat{\beta_1}MKT_t + \widehat{\beta_2}SMB_t + \widehat{\beta_3}VMG_t)$$

$$AR_t = \frac{\sum AR_{i,t}}{N}$$

$$CAR_t = \sum_{t=1}^{n} AR_t$$

The CAR of individual stock i is the sum of AR of stock i in the window period. The CAR in the table is the average value of the CAR of the equal-weight portfolio of stock samples. Details of the CAR statistics for the 12 industries during the window period are in the Appendix 1.

CAR+T statistic						
Event window 1						
	CAR	Std. Err.	t	P>t	[95% Conf. Interval]	
(0,3]	-0.42***	0.07	-6.38	0.00	-0.55	-0.29
(0,10]	-1.26***	0.07	-18.04	0.00	-1.40	-1.12
Event window 2						
	CAR	Std. Err.	t	P>t	[95% Conf. Interval]	
(0,3]	-0.99***	0.14	-6.93	0.00	-1.26	-0.71
(0,10]	-1.17***	0.09	-12.63	0.00	-1.35	-0.99
Event window 3						
	CAR	Std. Err.	t	P>t	[95% Conf. Interval]	
(0,3]	-0.45***	0.10	-4.61	0.00	-0.63	-0.26
(0,10]	-0.90***	0.09	-10.01	0.00	-1.08	-0.73
Event window 4						
	CAR	Std. Err.	t	P>t	[95% Conf. Interval]	
(0,3]	-0.37***	0.07	-5.09	0.00	-0.51	-0.22
(0,10]	-0.29***	0.07	-9.83	0.00	-1.42	-1.17

*, **, *** represent the significance levels of 10%, 5%, and 1%, respectively.

Table 4
The regression result for pre-epidemic and post-epidemic period

Table 3 reports the regression result for the following model:

$$AR_{i,t} = R_{i,t} - (\hat{\alpha} + \widehat{\beta_1}MKT_t + \widehat{\beta_2}SMB_t + \widehat{\beta_3}VMG_t)$$
$$AR_{i,t} = \alpha_i + \gamma_{i,1}Sent_{i,t} + \epsilon_{i,t}$$
$$AR_{i,t} = \alpha_i + \gamma_{i,1}Sent_{i,t} + \gamma_{i,2}L_i + \epsilon_{i,t}$$

$R_{i,t}$ represents the income of stock i at time t; $AR_{i,t}$ is the abnormal return for each stock at time t; α_i is the firm-fixed effects. $Sent_{i,t}$ represents the investor sentiment status of stock i at time t; L_i represents the registration place of stock i. If the registered place of the company to which the stock belongs is Wuhan, then L_i=1, otherwise it is 0. I first use investor sentiment ($Sent_{i,t}$) to regression to test the sentiment effect; then add the location(L_i) variable to test the region effect. The time period of the samples in the regression includes two stages before and after the epidemic. The test is the difference in the overall market situation before and after the outbreak of the epidemic. The sample period is from 2019.08.05-2020.04.22. I use event 1 as the starting point of the epidemic, that is, 2019.12.31, to distinguish the pre-epidemic and post-epidemic stages.

	Estimation Window		Event Period	
	Sentiment Effect	Region Effect	Sentiment Effect	Region Effect
Sent	0.72***	0.72***	0.87***	0.87***
	(65.42)	(65.42)	(60.65)	(60.65)
L		-0.09***		0.18
		(-2.96)		(1.09)
α	0.07***	0.07***	0.04*	0.03
	(6.63)	(6.66)	(1.7)	(1.55)

*, **, *** represent the significance levels of 10%, 5%, and 1%, respectively.

Table 5
The regression result for four events

Table 4 reports the regression result for four different periods after the pandemic:

$$AR_{i,t} = R_{i,t} - (\hat{\alpha} + \widehat{\beta_1}MKT_t + \widehat{\beta_2}SMB_t + \widehat{\beta_3}VMG_t)$$
$$AR_{i,t} = \alpha_i + \gamma_{i,1}Sent_{i,t} + \epsilon_{i,t}$$
$$AR_{i,t} = \alpha_i + \gamma_{i,1}Sent_{i,t} + \gamma_{i,2}L_i + \epsilon_{i,t}$$

$R_{i,t}$ represents the income of stock i at time t; $AR_{i,t}$ is the abnormal return for stock i at time t; α_i is the firm-fixed effects. $Sent_{i,t}$ represents the investor sentiment status of stock i at time t; L_i represents the registration place of stock i. If the registered place of the company to which the stock belongs is Wuhan, then L_i =1, otherwise it is 0.

Using the above regression model, we test the sentiment effect and the region effect respectively. Here, regressions are performed at different stages before and after the epidemic to detect the impact of the epidemic. The sample period is from 2019.08.05-2020.04.22. Each event contains a 10-day window period, (0,10]. The date of Event 1 is 2019.12.31; the date of event 2 is 2020.01.23; the date of event 3 is 2020.03.18; the date of event 4 is 2020.04.08.

	Event 1		Event 2		Event 3		Event 4	
	2019.12.31		2020.01,23		2020.03.18		2020.04,08	
	Sentiment Effect	Region Effect	Sentiment Effect	Region Effect	Sentiment Effect	Region Effect	Sentiment Effect	Region Effect
Sent	0.50***	0.50***	1.00***	1.00***	0.94***	0.94***	0.90***	0.90***
	(5.44)	(5.48)	(6.65)	(6.67)	(13.09)	(13.1)	(15.93)	(15.95)
L		0.12		-0.20		0.01		0.17
		(0.54)		(-0.61)		(0.03)		(1.03)
α	0.02	0.02	0.31*	0.30**	0.06	0.06	0.12***	0.11***
	(0.22)	(0.24)	(1.85)	(1.95)	(1.25)	(1.21)	(2.64)	(2.62)

*, **, *** represent the significance levels of 10%, 5%, and 1%, respectively.

Table 6
The regression result for sentiment and industry effect

The results presented in Table 5 are estimated from the following models:

$$AR_{i,t} = R_{i,t} - (\hat{\alpha} + \widehat{\beta_1}MKT_t + \widehat{\beta_2}SMB_t + \widehat{\beta_3}VMG_t)$$
$$AR_{i,t} = \alpha_i + \gamma_{i,1}Sent_{i,t} + \epsilon_{i,t}$$

α_i is the industry-fixed effects; $AR_{i,t}$ represents the industry i at time t. $Sent_{i,t}$ is the individual investor sentiment of stock i at time t. Among them, industries are reclassified based on the Chinese securities industry classification standard, a total of 12 industries.

		Estimation Window	Event Period	Event-1	Event-2	Event-3	Event-4
Properties	Sent	0.50***	0.57***	-0.09	0.69***	0.64***	0.67***
		(13.17)	(12.49)	(-0.43)	(2.87)	(7.25)	(8.42)
	α	-0.04*	-0.02	-0.29	0.10	-0.20	0.09
		(-1.66)	(-0.20)	(-1.34)	(0.26)	(-1.15)	(0.50)
Pharmaceutical Manufacturing	Sent	0.63***	0.86***	0.09	1.12***	0.96***	1.29***
		(14.52)	(9.70)	(0.48)	(2.76)	(4.51)	(10.27)
	α	0.06**	0.28	-0.08	0.61	0.34	0.49
		(2.22)	(1.28)	(-0.61)	(0.54)	(0.72)	(1.23)
Manufacturing of chemical raw materials and chemical products	Sent	0.58***	0.82***	0.76***	1.51***	0.71***	0.87***
		(18.11)	(13.70)	(2.76)	(4.01)	(6.68)	(8.36)
	α	0.04*	0.11	-0.03	0.87***	0.10	0.19
		(1.73)	(1.48)	(-0.18)	(2.37)	(0.52)	(1.24)
Electricity, heat, gas and water production and supply industries	Sent	0.45***	0.41***	0.48***	0.19***	0.52***	0.50***
		(8.51)	(11.26)	(3.10)	(2.33)	(6.00)	(6.40)
	α	-0.04	-0.06	-0.26**	-0.15	-0.10	0.14
		(-1.10)	(-0.95)	(-2.06)	(-0.40)	(-1.62)	(0.84)
Public Utility	Sent	0.74***	0.80***	0.70***	0.95***	0.77***	0.94***
		(14.07)	(16.79)	(2.62)	(3.14)	(7.84)	(7.03)
	α	0.06	0.03	0.03	0.12	0.02	0.26**
		(1.50)	(0.48)	(0.12)	(0.36)	(0.13)	(2.28)
Rubber and plastic products industry	Sent	0.62***	0.97***	0.20	0.92***	1.53***	1.17***
		(10.65)	(8.64)	(0.65)	(3.50)	(7.53)	(8.11)
	α	0.07*	0.12	0.14	0.53*	0.09	0.22
		(1.89)	(1.31)	(0.35)	(1.85)	(0.40)	(0.94)
Transportation, warehousing and postal industry; hotel and catering industry	Sent	0.43***	0.40***	0.15	0.24*	0.49***	0.61***
		(11.54)	(9.19)	(0.91)	(1.79)	(6.42)	(8.11)
	α	-0.08***	-0.09	-0.52***	-0.62	-0.09	0.03
		(-4.72)	(-0.94)	(-3.19)	(-1.47)	(-0.67)	(0.22)
Culture, Sports	Sent	0.74***	0.71***	1.27*	0.46	0.79***	0.77***

and Entertainment Industry		(9.54)	(9.19)	(1.74)	(1.11)	(7.02)	(8.82)
	α	0.03	-0.16	0.11	0.27	-0.06	-0.05
		(0.85)	(-1.48)	(0.24)	(0.50)	(-0.29)	(-0.31)
Computer communication and other electronic equipment manufacturing	Sent	1.05***	0.96***	0.43***	1.06***	0.89***	0.83***
		(25.89)	(17.06)	(2.17)	(4.60)	(9.15)	(12.76)
	α	0.15***	-0.05	0.22	0.09	-0.19	-0.19
		(7.18)	(-0.60)	(1.42)	(0.25)	(-1.01)	(-1.48)
Information transmission, software and information technology services	Sent	1.02***	0.82***	0.42*	1.34***	0.73***	0.80***
		(22.85)	(9.39)	(1.70)	(4.41)	(3.36)	(9.51)
	α	0.26***	-0.22**	0.16	0.52	-0.37	-0.13
		(5.56)	(-2.08)	(0.72)	(1.10)	(-1.62)	(-0.58)
Other industrial	Sent	0.66***	0.86***	0.49***	1.03***	1.02***	0.88***
		(41.87)	(26.30)	(4.07)	(7.51)	(13.47)	(20.02)
	α	0.06***	0.08*	-0.05	0.26	0.16	0.15**
		(3.00)	(1.81)	(-0.52)	(1.62)	(1.33)	(2.07)
Other business service industries	Sent	0.56***	0.79***	0.41*	0.73***	1.19***	0.92***
		(13.83)	(13.70)	(1.69)	(3.37)	(9.19)	(6.48)
	α	-0.05**	0.10*	0.07	-0.08	0.37**	0.14
		(-2.29)	(1.69)	(0.37)	(-0.37)	(2.08)	(1.61)

*, **, *** represent the significance levels of 10%, 5%, and 1%, respectively.

Table 7
The regression result for pre-epidemic and post-epidemic period

Table 6 reports the regression result for the following model：

$$AR_{i,t} = R_{i,t} - (\hat{\alpha} + \widehat{\beta_1}MKT_t + \widehat{\beta_2}SMB_t + \widehat{\beta_3}VMG_t)$$
$$AR_{i,t} = \alpha_i + \gamma_{i,1}Sent\_b_t + \epsilon_{i,t}$$
$$AR_{i,t} = \alpha_i + \gamma_{i,1}Sent\_b_t + \gamma_{i,2}L_i + \epsilon_{i,t}$$
$$Sent\_b_t = -VIX_t$$

$AR_{i,t}$ is the abnormal return for stock i at time t; a_i is the firm-fixed effects; $Sent\_b_t$ represents the investor sentiment status at time t; L_i represents the registration place of stock i. If the registered place of the company to which the stock belongs is Wuhan, then L_i=1, otherwise it is 0. In the robustness check, I use $-VIX_t$ to represent the investor sentiment for stock i at time t. First, use investor sentiment ($Sent\_b_t$) to regression to test the sentiment effect; then add the location (L_i) variable to test the region effect. The test interval of the samples in the regression includes two stages before and after the epidemic. The test is the difference in the overall situation of the market before and after the outbreak of the epidemic. The sample period is from 2019.08.05-2020.04.22. I use event 1 (2019.12.31) as the starting point of the epidemic, to distinguish the pre-epidemic and post-epidemic stages.

	Estimation Window		Event Period	
	Sentiment Effect	Region Effect	Sentiment Effect	Region Effect
Sent_b	0.002	0.002	-0.003***	-0.003***
	(0.88)	(0.88)	(-2.33)	(-2.33)
L		-0.086***		0.196
		(-3.78)		(1.29)
α	0.103***	0.104***	-0.181***	-0.184***
	(2.96)	(2.99)	(-4.59)	(-4.65)

*, **, *** represent the significance levels of 10%, 5%, and 1%, respectively.

Table 8
The regression result for four events

Table 4 reports the regression result for four different periods after the pandemic:

$$AR_{i,t} = R_{i,t} - (\hat{\alpha} + \widehat{\beta_1}MKT_t + \widehat{\beta_2}SMB_t + \widehat{\beta_3}VMG_t)$$
$$AR_{i,t} = \alpha_i + \gamma_{i,1}Sent\_b_t + \epsilon_{i,t}$$
$$AR_{i,t} = \alpha_i + \gamma_{i,1}Sent\_b_t + \gamma_{i,2}L_i + \epsilon_{i,t}$$
$$Sent\_b_t = -VIX_t$$

α_i is the industry-fixed effects; $AR_{i,t}$ represents the industry i at time t. $Sent\_b_t$ represents the investor sentiment status at time t; L_i represents the registration place of stock i. If the registered place of the company to which the stock belongs is Wuhan, then L_i=1, otherwise it is 0. I use $-VIX_t$ to represent the investor sentiment.

Using the above regression model, we test the sentiment effect and the region effect respectively. Here, regressions are performed at different stages before and after the epidemic to detect the impact of the epidemic. The sample period is from 2019.08.05-2020.04.22.

	Event 1		Event 2		Event 3		Event 4	
	2019.12.31		2020.01,23		2020.03.18		2020.04,08	
	Sentiment Effect	Region Effect	Sentiment Effect	Region Effect	Sentiment Effect	Region Effect	Sentiment Effect	Region Effect
Sent_b	-0.032	-0.032	-0.083***	-0.083***	-0.006	-0.006	0.012	0.012
	(-0.8)	(-0.8)	(-7.37)	(-7.37)	(-0.29)	(-0.29)	(0.52)	(0.52)
L		0.124		-0.008		-0.015		0.181
		(1.42)		(-0.03)		(-0.06)		(1.00)
α	-0.729	-0.731	-1.875***	-1.875***	-0.282	-0.282	0.157	0.154
	(-0.95)	(-0.95)	(-7.6)	(-7.58)	(-0.39)	(-0.39)	(0.30)	(0.29)

*, **, *** represent the significance levels of 10%, 5%, and 1%, respectively.

Table 9
The regression result for sentiment and industry effect

The results presented in Table 5 are estimated from the following models:

$$AR_{i,t} = R_{i,t} - (\hat{\alpha} + \widehat{\beta_1}MKT_t + \widehat{\beta_2}SMB_t + \widehat{\beta_3}VMG_t)$$
$$AR_{i,t} = \alpha_i + \gamma_{i,1}Sent\_b_t + \epsilon_{i,t}$$
$$Sent\_b_t = -VIX_t$$

$AR_{i,t}$ represents the industry i at time t. α_i is the industry-fixed effects. $Sent\_b_t$ is the individual investor sentiment at time t. I use $-VIX_t$ to represent investor sentiment. Among them, industry is reclassified based on the Chinese securities industry classification standard, a total of 12 industries.

		Estimation Window	Event Period	Event-1	Event-2	Event-3	Event-4
Properties	Sent_b	0.015***	-0.009	0.143**	-0.056	0.012	0.019
		(2.73)	(-0.75)	(2.13)	(-0.48)	(0.18)	(0.11)
	α	0.280***	-0.316	2.457*	-1.360	0.205	0.378
		(2.35)	(-1.01)	(1.91)	(-0.55)	(0.10)	(0.10)
Pharmaceutical Manufacturing	Sent_b	-0.034***	0.002	0.186	0.469*	-0.170	-0.569**
		(-3.26)	(0.06)	(0.75)	(1.79)	(-0.99)	(-2.02)
	α	-0.593***	0.165	3.348	10.393**	-5.667	-12.564**
		(-3.02)	(0.16)	(0.70)	(1.99)	(-1.01)	(-1.96)
Manufacturing of chemical raw materials and chemical products	Sent_b	0.017***	0.001	0.235	-0.184***	0.047	0.169**
		(3.33)	(0.07)	(1.40)	(-5.00)	(0.47)	(1.96)
	α	0.334***	-0.063	4.383	-3.841***	1.591	3.750
		(3.20)	(-0.20)	(1.34)	(-4.62)	(0.46)	(1.91)
Electricity, heat, gas and water production and supply industries	Sent_b	-0.009	-0.012	-0.034	-0.213***	-0.019	-0.015
		(-1.58)	(-1.16)	(-0.18)	(-3.50)	(-1.25)	(-0.12)
	α	-0.206*	-0.388	-0.828	-4.870***	-0.789	-0.296
		(-1.93)	(-1.30)	(-0.23)	(-3.81)	(-1.57)	(-0.10)
Public Utility	Sent_b	-0.011*	-0.001	0.144	-0.111**	-0.010	-0.123***
		(-1.82)	(-0.15)	(0.55)	(-2.04)	(-0.24)	(-2.50)
	α	-0.161	-0.155	2.710	-2.730***	-0.412	-2.708***
		(-1.41)	(-0.67)	(0.54)	(-2.60)	(-0.29)	(-2.35)
Rubber and plastic products industry	Sent_b	0.019	0.016	-0.190	-0.201***	0.128	0.284***
		(1.38)	(1.10)	(-1.09)	(-8.34)	(1.18)	(3.05)
	α	0.425	0.331	-3.758	-4.377***	4.312	6.374***
		(1.56)	(0.89)	(-1.13)	(-7.70)	(1.17)	(2.94)
Transportation, warehousing and postal industry; hotel and catering	Sent_b	0.018***	-0.017*	0.041	0.003	-0.005	-0.071
		(3.92)	(-1.78)	(0.31)	(0.03)	(-0.06)	(-0.57)
	α	0.310***	-0.501**	0.553	-0.382	-0.246	-1.696

industry		(3.43)	(-2.27)	(0.21)	(-0.18)	(-0.09)	(-0.61)
Culture, Sports and Entertainment Industry	Sent_b	0.021*	-0.019	-0.824	-0.158*	-0.057	-0.192**
		(1.72)	(-1.58)	(-1.36)	(-1.93)	(-1.53)	(-2.11)
	α	0.484**	-0.713**	-15.735	-3.493**	-2.119	-4.502**
		(1.98)	(-2.05)	(-1.37)	(-2.08)	(-1.61)	(-2.16)
Computer communication and other electronic equipment manufacturing	Sent_b	0.018***	0.014	0.232	-0.015	0.035	0.204***
		(2.75)	(1.30)	(0.89)	(-0.29)	(0.28)	(2.97)
	α	0.483***	0.145	4.445	-0.540	0.851	4.162***
		(3.94)	(0.53)	(0.88)	(-0.44)	(0.19)	(2.67)
Information transmission, software and information technology services	Sent_b	-0.015	0.002	-0.038	-0.042	-0.125	-0.042
		(-1.44)	(0.15)	(-0.10)	(-0.35)	(-1.00)	(-0.20)
	α	-0.024	-0.303	-0.909	-0.923	-4.858	-1.276
		(-0.12)	(-0.87)	(-0.12)	(-0.38)	(-1.10)	(-0.26)
Other industrial	Sent_b	0.007***	-0.004	-0.161	-0.164***	0.019	0.061
		(2.92)	(-0.46)	(-1.16)	(-6.16)	(0.38)	(1.27)
	α	0.169***	-0.174	-3.207	-3.627***	0.661	1.291
		(3.50)	(-0.74)	(-1.21)	(-6.63)	(0.41)	(1.13)
Other business service industries	Sent_b	0.000	-0.019**	-0.001	0.029	-0.094	-0.090
		(0.03)	(-2.22)	(-0.01)	(1.47)	(-1.03)	(-1.45)
	α	-0.019	-0.483***	0.023	0.439	-3.003	-2.110
		(-0.13)	(-2.36)	(0.01)	(1.14)	(-0.95)	(-1.46)

*, **, *** represent the significance levels of 10%, 5%, and 1%, respectively.

Appendix

Appendix 1. The CAR and t-statistics for industries

Panel A to Panel H report the event study result including the CAR and t-value for the 12 industries.The date of Event 1 is 2019.12.31, which is the first official document released by China; the date of event 2 is 2020.01.23, which is the closure of Wuhan; the date of event 3 is 2020.03.18, which is the unblocking of Wuhan; the date of event 4 is 2020.04.08 is the first time the number of confirmed cases in China has been cleared. Each event includes two time windows (0,3] and (0,10] respectively. The calculation formula is as follows:

$$AR_{i,t} = R_{i,t} - (\hat{\alpha} + \widehat{\beta_1}MKT_t + \widehat{\beta_2}SMB_t + \widehat{\beta_3}VMG_t)$$

$$AR_t = \frac{\sum AR_{i,t}}{N}$$

$$CAR_t = \sum_{t=1}^{n} AR_t$$

The CAR of individual stock i is the sum of AR of stock i in the window period. The CAR in the table is the average value of the CAR of the equal-weight portfolio of stock samples.

Panel A:

Event Window-1-(0,3]						
	CAR	Std. Err.	t	P>t	[95% Conf. Interval]	
Properties	-1.05***	0.18	-5.91	0.00	-1.39	-0.70
Pharmaceutical Manufacturing	-0.82***	0.32	-2.57	0.01	-1.45	-0.19
Manufacturing of chemical raw materials and chemical products	-0.45***	0.16	-2.85	0.01	-0.76	-0.14
Electricity, heat, gas and water production and supply industries	0.23**	0.13	1.82	0.07	-0.02	0.47
Public Utility	-0.57***	0.22	-2.52	0.01	-1.01	-0.13
Rubber and plastic products industry	-0.84***	0.24	-3.45	0.00	-1.31	-0.36
Transportation, warehousing and postal industry; hotel and catering industry	-1.12***	0.13	-8.56	0.00	-1.37	-0.86
Culture, Sports and Entertainment Industry	1.49***	0.35	4.22	0.00	0.80	2.18
Computer communication and other electronic equipment manufacturing	-0.92***	0.13	-7.29	0.00	-1.17	-0.67
Information transmission, software and information technology services	-1.47***	0.32	-4.64	0.00	-2.09	-0.85
Other industrial	-0.22*	0.13	-1.77	0.08	-0.47	0.02
Other business service industries	0.40**	0.19	2.10	0.04	0.03	0.77

Panel B:

Event Window-1-(0,10]

	CAR	Std. Err.	t	P>t	[95% Conf. Interval]	
Properties	-2.80***	0.25	-11.18	0.00	-3.29	-2.31
Pharmaceutical Manufacturing	-0.53*	0.30	-1.76	0.08	-1.13	0.06
Manufacturing of chemical raw materials and chemical products	-1.60***	0.17	-9.17	0.00	-1.94	-1.26
Electricity, heat, gas and water production and supply industries	-1.63***	0.11	-14.32	0.00	-1.86	-1.41
Public Utility	-0.77***	0.25	-3.02	0.00	-1.26	-0.27
Rubber and plastic products industry	-1.36***	0.41	-3.31	0.00	-2.17	-0.56
Transportation, warehousing and postal industry; hotel and catering industry	-2.36***	0.12	-19.87	0.00	-2.60	-2.13
Culture, Sports and Entertainment Industry	1.43***	0.31	4.62	0.00	0.82	2.04
Computer communication and other electronic equipment manufacturing	-1.16***	0.14	-8.48	0.00	-1.43	-0.89
Information transmission, software and information technology services	-2.49***	0.44	-5.67	0.00	-3.36	-1.63
Other industrial	-1.07***	0.12	-8.64	0.00	-1.31	-0.83
Other business service industries	0.60***	0.18	3.27	0.00	0.24	0.96

Panel C:

Event Window-2-(0,3]						
	CAR	Std. Err.	t	P>t	[95% Conf. Interval]	
Properties	-4.24***	0.39	-10.77	0.00	-5.01	-3.47
Pharmaceutical Manufacturing	14.01***	0.51	27.35	0.00	13.01	15.02
Manufacturing of chemical raw materials and chemical products	-1.79***	0.44	-4.08	0.00	-2.65	-0.93
Electricity, heat, gas and water production and supply industries	-3.15***	0.23	-13.51	0.00	-3.60	-2.69
Public Utility	-3.10***	0.41	-7.53	0.00	-3.90	-2.29
Rubber and plastic products industry	-1.94***	0.76	-2.54	0.01	-3.45	-0.44
Transportation, warehousing and postal industry; hotel and catering industry	-3.29***	0.28	-11.56	0.00	-3.85	-2.73
Culture, Sports and Entertainment Industry	0.85	0.64	1.33	0.18	-0.41	2.11
Computer communication and other electronic equipment manufacturing	-2.93***	0.41	-7.10	0.00	-3.74	-2.12
Information transmission, software and information technology services	1.01	0.68	1.49	0.14	-0.32	2.35
Other industrial	-1.80***	0.27	-6.67	0.00	-2.33	-1.27
Other business service industries	-0.50	0.43	-1.15	0.25	-1.35	0.35

Panel D:

Event Window-2-(0,10]

	CAR	Std. Err.	t	P>t	[95% Conf. Interval]	
Properties	-1.69***	0.36	-4.72	0.00	-2.39	-0.99
Pharmaceutical Manufacturing	3.74***	0.28	13.35	0.00	3.19	4.29
Manufacturing of chemical raw materials and chemical products	0.95***	0.28	3.44	0.00	0.41	1.50
Electricity, heat, gas and water production and supply industries	-2.36***	0.18	-13.15	0.00	-2.71	-2.01
Public Utility	-3.62***	0.27	-13.47	0.00	-4.14	-3.09
Rubber and plastic products industry	-0.70	0.64	-1.10	0.27	-1.95	0.55
Transportation, warehousing and postal industry; hotel and catering industry	-4.12***	0.20	-20.93	0.00	-4.51	-3.74
Culture, Sports and Entertainment Industry	-1.41***	0.50	-2.81	0.01	-2.40	-0.43
Computer communication and other electronic equipment manufacturing	-2.44***	0.29	-8.45	0.00	-3.00	-1.87
Information transmission, software and information technology services	-0.40	0.52	-0.76	0.45	-1.42	0.62
Other industrial	-0.98***	0.17	-5.83	0.00	-1.31	-0.65
Other business service industries	-2.17***	0.24	-8.90	0.00	-2.65	-1.69

Panel E:

Event Window-3-(0,3]						
	CAR	Std. Err.	t	P>t	[95% Conf. Interval]	
Properties	-2.07***	0.30	-6.83	0.00	-2.66	-1.47
Pharmaceutical Manufacturing	3.33***	0.29	11.64	0.00	2.77	3.89
Manufacturing of chemical raw materials and chemical products	-0.15	0.32	-0.46	0.65	-0.77	0.48
Electricity, heat, gas and water production and supply industries	0.04	0.24	0.15	0.88	-0.43	0.51
Public Utility	-0.16	0.28	-0.56	0.57	-0.70	0.39
Rubber and plastic products industry	-1.87***	0.65	-2.87	0.00	-3.14	-0.59
Transportation, warehousing and postal industry; hotel and catering industry	0.20	0.23	0.87	0.39	-0.25	0.65
Culture, Sports and Entertainment Industry	0.14	0.24	0.59	0.55	-0.33	0.62
Computer communication and other electronic equipment manufacturing	-0.64***	0.23	-2.77	0.01	-1.10	-0.19
Information transmission, software and information technology services	-0.71	0.60	-1.19	0.23	-1.88	0.46
Other industrial	-0.94***	0.18	-5.35	0.00	-1.29	-0.60
Other business service industries	1.21***	0.25	4.80	0.00	0.72	1.71

Panel F:

Event Window-3-(0,10]

	CAR	Std. Err.	t	P>t	[95% Conf. Interval]	
Properties	-2.46***	0.28	-8.78	0.00	-3.01	-1.91
Pharmaceutical Manufacturing	3.18***	0.25	12.90	0.00	2.70	3.67
Manufacturing of chemical raw materials and chemical products	-0.36	0.28	-1.31	0.19	-0.90	0.18
Electricity, heat, gas and water production and supply industries	-1.25***	0.18	-6.92	0.00	-1.61	-0.90
Public Utility	-1.02***	0.29	-3.52	0.00	-1.59	-0.45
Rubber and plastic products industry	-1.62**	0.78	-2.08	0.04	-3.14	-0.09
Transportation, warehousing and postal industry; hotel and catering industry	-0.63***	0.16	-3.87	0.00	-0.94	-0.31
Culture, Sports and Entertainment Industry	-1.78***	0.26	-6.71	0.00	-2.30	-1.26
Computer communication and other electronic equipment manufacturing	-4.04***	0.20	-20.40	0.00	-4.43	-3.65
Information transmission, software and information technology services	-5.29***	0.56	-9.51	0.00	-6.38	-4.20
Other industrial	-0.13	0.16	-0.80	0.43	-0.45	0.19
Other business service industries	2.33***	0.24	9.65	0.00	1.86	2.81

Panel G:

Event Window-4-(0,3]						
	CAR	Std. Err.	t	P>t	[95% Conf. Interval]	
Properties	-0.21	0.21	-0.97	0.33	-0.62	0.21
Pharmaceutical Manufacturing	4.09***	0.24	17.03	0.00	3.62	4.56
Manufacturing of chemical raw materials and chemical products	-0.31	0.25	-1.25	0.21	-0.80	0.18
Electricity, heat, gas and water production and supply industries	0.70***	0.17	4.19	0.00	0.37	1.03
Public Utility	0.89***	0.27	3.29	0.00	0.36	1.42
Rubber and plastic products industry	-0.50	0.67	-0.75	0.46	-1.82	0.82
Transportation, warehousing and postal industry; hotel and catering industry	0.13	0.20	0.67	0.51	-0.26	0.53
Culture, Sports and Entertainment Industry	-0.58**	0.24	-2.44	0.02	-1.05	-0.11
Computer communication and other electronic equipment manufacturing	-1.70***	0.17	-10.17	0.00	-2.02	-1.37
Information transmission, software and information technology services	-2.08***	0.44	-4.75	0.00	-2.94	-1.22
Other industrial	-0.43***	0.12	-3.46	0.00	-0.67	-0.19
Other business service industries	-0.08	0.21	-0.40	0.69	-0.50	0.33

Panel H:

Event Window-4-(0,10]

	CAR	Std. Err.	t	P>t	[95% Conf. Interval]	
Properties	-0.57**	0.26	-2.17	0.03	-1.09	-0.05
Pharmaceutical Manufacturing	2.53***	0.24	10.74	0.00	2.07	2.99
Manufacturing of chemical raw materials and chemical products	-0.65***	0.22	-3.02	0.00	-1.07	-0.23
Electricity, heat, gas and water production and supply industries	0.64***	0.20	3.26	0.00	0.25	1.02
Public Utility	0.86***	0.30	2.84	0.00	0.27	1.46
Rubber and plastic products industry	-0.74	0.58	-1.27	0.21	-1.89	0.41
Transportation, warehousing and postal industry; hotel and catering industry	-0.41**	0.19	-2.16	0.03	-0.79	-0.04
Culture, Sports and Entertainment Industry	-2.21***	0.23	-9.72	0.00	-2.65	-1.76
Computer communication and other electronic equipment manufacturing	-3.60***	0.15	-23.87	0.00	-3.90	-3.30
Information transmission, software and information technology services	-3.80***	0.42	-9.09	0.00	-4.62	-2.98
Other industrial	-1.02***	0.10	-9.83	0.00	-1.23	-0.82
Other business service industries	-1.01***	0.21	-4.85	0.00	-1.42	-0.60

Appendix 2. The impact of the COVID-19 on the Chinese market

Figure 2.1
The time series for growth rate of GDP (Quarterly)

The figure 1 plot the time series of quarterly GDP, including primary, secondary and tertiary industries GDP. The period is from 2012q1-2020q3.

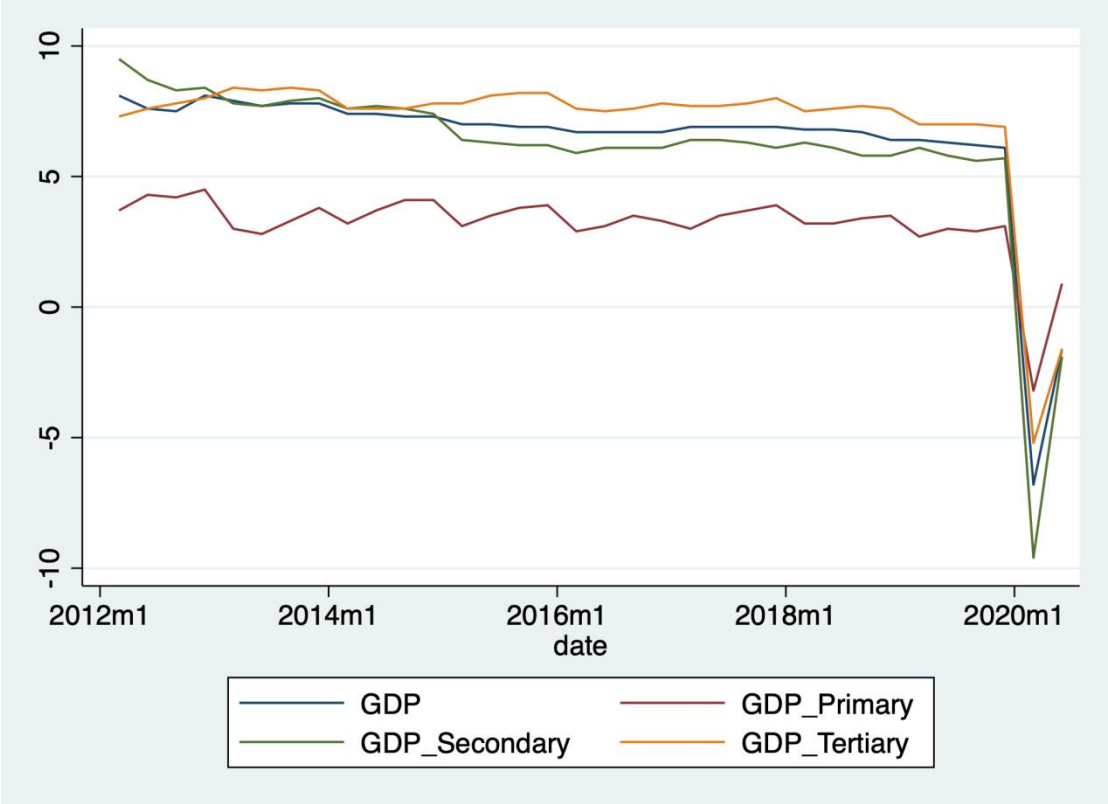

Figure 2.2
The 10-year Treasury bond yield

The figure 1 plot the time series of the 10-year Treasury bond yield (daily). The period is from 2019.06.01-2020.06.30.

Figure 2.3
The number of new confirmed and death case during COVID-19

The figure 1 plot the number of new confirmed and death case. The period is from 2020.01.10-2020.06.30.

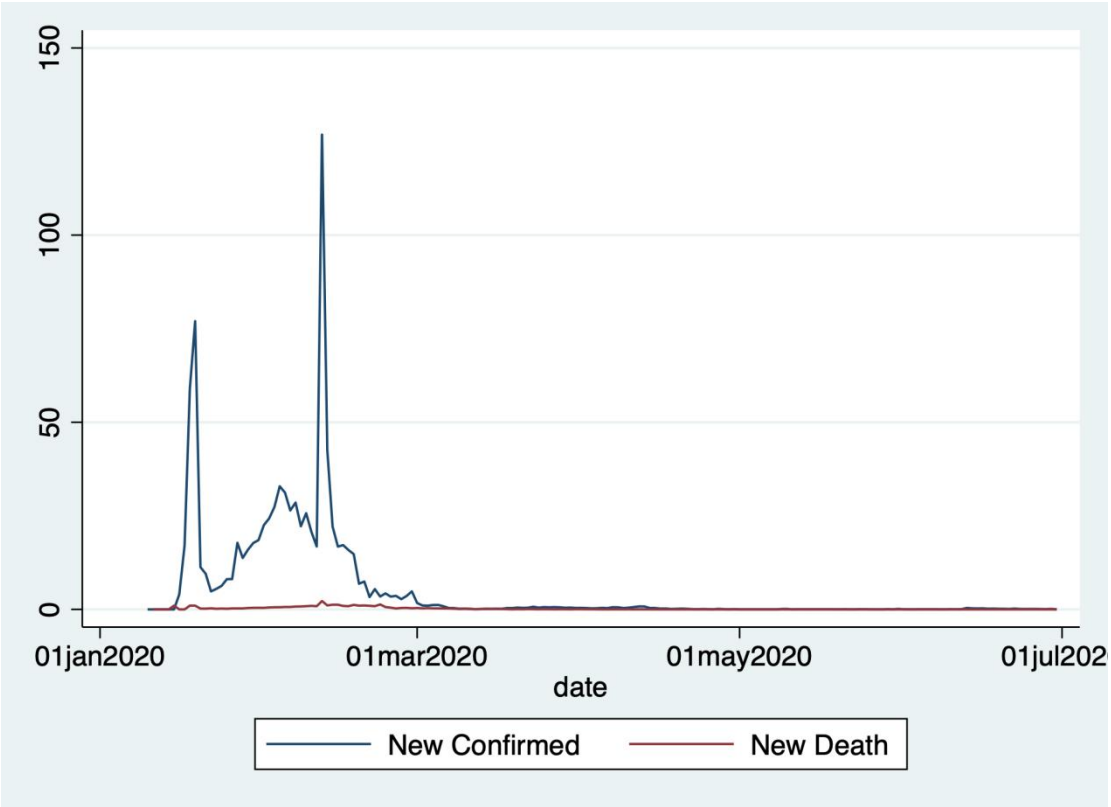

Figure 2.4
The exchange rate for RMB

The figure 1 plot the exchange rate for RMB. The period is from 2019.06.01-2020.06.30.

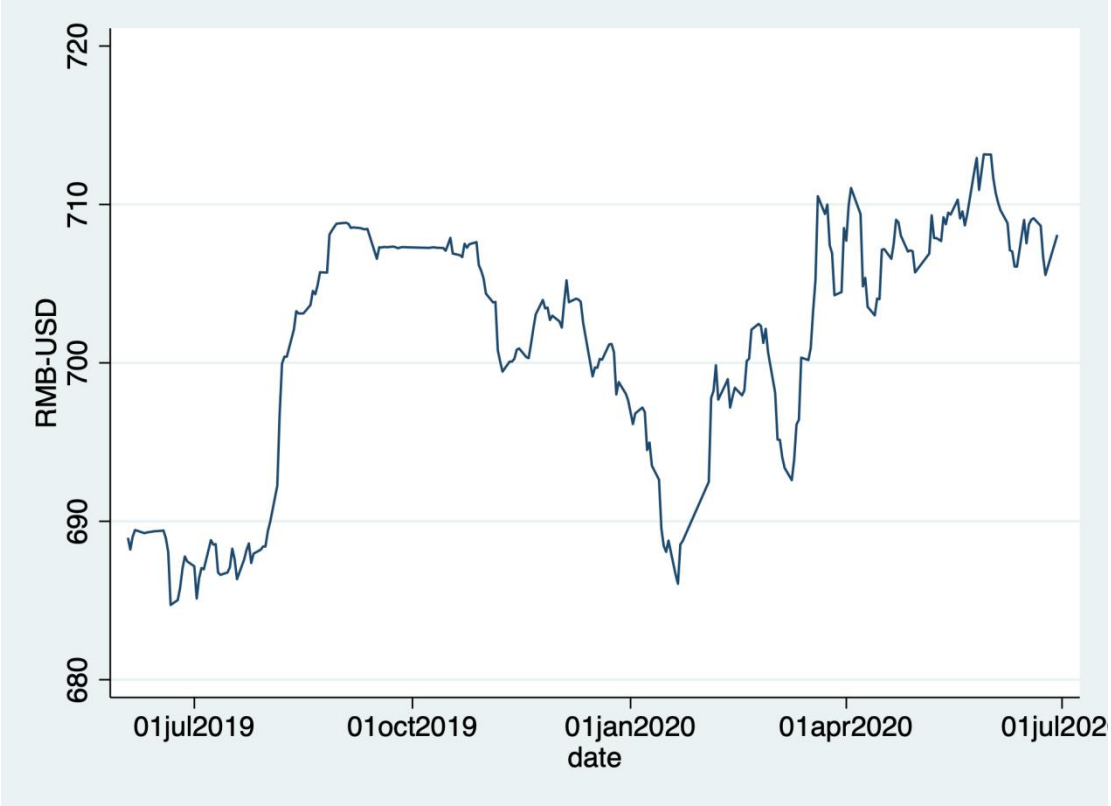

Figure 2.5

The price of gold and the value of crude oil In the Chinese market

The figure 1 plot the price of gold and the index value of crude oil in the Chinese market. The period is from 2019.06.01-2020.06.30.