

# Performance of the Chinese Stock Market against the Backdrop of the COVID-19 Pandemic—Based on Baidu Index

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**Abstract:** *As of the end of 2022, there were approximately 9.3 million confirmed cases of COVID-19 in China. The epidemic has brought direct negative impacts to the Chinese economy from both the demand and supply sides. Given the enormous impact of COVID-19, it is important to explore the performance of the Chinese stock market under the background of the epidemic. As an indicator of the national economy, the stock market has always been of interest to scholars. However, there has been limited research from the perspective of behavior finance that focuses on the impact of the psychological fear caused by the COVID-19 pandemic. Using the Baidu daily search index between February 24, 2020 and November 17, 2022 as a proxy variable for measuring investor fear, the daily return of the Shanghai Composite Index is used to describe the performance of the stock market. The results show that investors' fear of the epidemic significantly affects the performance of the stock market in a negative way. The Baidu index, as an internet tool, can be widely used in behavioral finance to establish more accurate models.*

**Keywords:** *COVID-19 epidemic; Baidu index; stock market performance*

## 1. Introduction

The outbreak of the Corona Virus Disease 2019 (hereinafter referred to as the "COVID-19"), like a huge "black swan", broke the weak stabilization of the Chinese economy at the end of 2019. Despite the government's timely and effective control measures, the impact of the epidemic has caused considerable downward pressure on the economy. It is particularly important to analyze whether the erupt of the epidemic and the fear of investors have had an impact on China's stock market, so as to analyze the basic conditions of the capital market and further predict the development and trend of the market in the future.

But how can investor fear be quantified? As the main information acquisition channel on the Internet, search engines are widely used by investors to obtain daily news and mining stock information.<sup>[1]</sup> And according to the report of Baidu's Vientiane Conference held on September 23, 2022, the number of active users of Baidu App has reached 628 million, occupying an unshakable monopoly position in China's search field. Therefore, using Baidu index instead of Google index as proxy variable of investors' fear value has a better representation in China. The more searches for coronavirus terms in Baidu, the higher the fear of the epidemic. In addition, the Shanghai Composite Index (000001) is the most historic, unified, authoritative and representative, which can be used to reflect China's stock market performance, according to He Qiang, a member of the CPPCC National Committee and director of the Securities and Futures Institute of the Central University of Finance and Economics. Therefore, the research in this paper is effective and feasible.

Compared with previous studies, this paper is unique in that: (1) From the perspective of research, it focuses more on micro individuals and explores the volatile performance of stock market caused by investor health risks brought by the epidemic from the perspective of behavioral finance, which conducts a more in-depth and credible study on the relationship between investor behavior characteristics and stock market performance. (2) In terms of the research content, it is confirmed that the fear of Chinese investors has negative price pressure on the stock market from both theoretical and empirical levels. The combination of behavioral finance theory and real stock market provides useful reference for financial practitioners to use behavioral finance theory to formulate effective investment strategies. (3) In terms of variable selection, it adopts the method of big data and uses Baidu Search index, an Internet tool, to measure investors' fear, which solves the problem that fear index is difficult to be directly quantified in previous studies. At the same time, it also verifies the feasibility of Baidu Index as a proxy variable of

investors' feared state of mind, which provides a basis for subsequent scholars to establish a more accurate measurement model.

## **2. Theoretical analysis and research hypothesis**

### ***2.1. The impact of the pandemic on China's economy***

The COVID-19 pandemic is not the first large-scale epidemic experienced by human beings. Studies have shown that large-scale infectious diseases in history can cause serious damage to social economy in a short period of time, and also have a huge impact on government finances.<sup>[2]</sup> By comparing the 1997 East Asian financial crisis with the SARS epidemic, it can be found that the pandemic has a greater impact on China's national economy than pure economic events.<sup>[3]</sup> In addition, compared with traditional risk events, the geographical effect of financial risk transmission under the background of public health emergencies is more obvious.<sup>[4]</sup> Therefore, it's crucial to analyze the specific performance of the impact of COVID-19 on the Chinese stock market. However, current studies mostly explore the impact of the epidemic on China's economy from the supply-side and demand-side,<sup>[5]</sup> or domestic and international.<sup>[6]</sup> The research on stock market performance is mostly conducted from the perspective of listed companies<sup>[7]</sup> or global risk spillover,<sup>[8]</sup> which seldom focuses on the influence of investors' behavior characteristics on stock market performance. So this paper attempts to remedy the above deficiency.

### ***2.2. The impact of investor sentiment on the stock market***

With the continuous opening and development of Chinese financial market, a large number of anomalies in stock market cannot be explained by traditional financial theory. The research on behavioral finance theory makes up for the defects of traditional financial theory to a certain extent.<sup>[9]</sup> Previous studies have found that there is a positive feedback effect between investor sentiment and stock market returns, and the stocks that get more attention from investors, the more sensitive their returns are to changes in investor sentiment.<sup>[10]</sup> For China's securities market, which is in transition and still dominated by retail investors, stock market volatility caused by investor sentiment is not uncommon.<sup>[11]</sup> In addition, health risks are positively correlated with risk aversion,<sup>[12]</sup> and investors are part of society. Therefore, when an emergency occurs, the increased fear and risk aversion of investors caused by increased health risks will lead to a decline in stock market prices.<sup>[13]</sup>

### ***2.3. Financial research based on big data technology***

According to the 51st Statistical Report on China's Internet Development released by CNNIC, by December 2022, the number of netizens in China had reached 1.067 billion, and the Internet penetration rate reached 75.6%. The era of big data has accelerated the flow of information, and the big data information represented by the search volume of Internet search engines has become the focus of research domestic and international. Foreign studies, such as Da et al. (2015), built FEARS index to describe investor sentiment by analyzing search data related to people's livelihood on the Internet, and successfully predicted short-term reversals and increased volatility of stock market returns from 2004 to 2011.<sup>[14]</sup> In domestic studies, for example, Song Shuangjie et al. (2011) used the Google search index of a company's name as a proxy variable of attention to explain the IPO anomalies in China's capital market. Using big data technology to reasonably quantify investors' fear is a key step to carry out analysis. With the help of the new generation of information technology and Internet tools, this paper will also take Baidu index as the proxy variable of investors' fear and discuss on this basis.

Based on the above analysis, this study proposes the hypothesis that, other conditions remain unchanged, investor fear caused by the epidemic will have a significant negative impact on the performance of China's stock market.

## **3. Research Design**

### ***3.1. Data sources***

This article used data from the Baidu Index, the CSMAR database and the daily update on COVID-19 released by the National Health Commission, PRC. In the process of calculating the core explanatory variables, this paper converts the Baidu search index according to the following data processing methods.

Also note that since the stock market is not open on a weekday, this article uses the vlookup method to match the data between the two worksheets.

### 3.2. Variable selection and descriptive statistics

#### (1) Core explanatory variable -- investor fear

Considering that the number of searches for "COVID-19" on Baidu was zero before February 24, 2020, this paper selects the period from February 24, 2020 to November 17, 2022. The sum of the search index of Baidu on pc and mobile terminals is the proxy variable of investors' fear. In terms of data processing, the first step is to use code to convert the form of the raw data to between 0 and 100. Secondly, in order to eliminate the seasonality and stationarity of the original data set, the seven-day moving average of the values was adopted and the first-order difference was performed (denoted as d7MAB).

#### (2) The explained variable -- stock market performance

This paper selects the Shanghai Composite Index, which takes all the stocks listed on the Shanghai Stock Exchange (including A shares and B shares) as samples, takes the issuance as the weight (including the circulating and non-circulating share capital), and calculates the daily return rate of the stock price index by weighted average method (denoted as Retind) to describe stock market performance. The time period is also from February 24, 2020 to November 17, 2022.

The formula for calculating the index rate of return is:

$$R_{n,t} = \frac{I_{n,t}}{I_{n,t-1}} - 1$$

where  $R_{n,t}$  represents the return of index  $n$  on day  $t$ ;  $I_{n,t}$  represents the closing index of index  $n$  on day  $t$ ;  $I_{n,t-1}$  is the closing index of index  $n$  on  $t-1$ .

The descriptive statistics of the two variables are listed in Table 1:

Table 1: Descriptive statistics

	Retindex	d7MAB
Mean	0.00971%	-0.0266235
Median	0.03155%	-0.0951426
Maximum	5.7113%	9.894578
Minimum	-5.1316%	-7.079141
Std. Dev.	1.09661%	1.655933

### 3.3. Control variables

In order to more accurately assess the stock market's response to investor fear caused by the pandemic, the paper controls for the impact of other major events on stock prices. Given that holiday effects (such as higher interest rates before the holiday) can cause volatility in financial markets and cause stock markets to plunge on the first day after the holiday. This paper deals with the stock market returns at specific time points (such as the Spring Festival) to avoid the impact of outliers on the regression results.

## 4. Model setting and result analysis

### 4.1. Stationarity test

In order to avoid the phenomenon of spurious regression in the results, the stationarity test of the two main variables in this paper is required. The detection method adopted in this paper is ADF test. The lag order obtained by calculating AIC is 2, and the test results are shown in Table 2. The results show that the ADF test of both variables rejects the null hypothesis of the existence of unit root at the significance level of 1%, indicating that the time series variables selected by us are stable.

Table 2: Stationarity test result

Variable	Inspection part	P-values	Inspection result
Retindex	Intercept and Lag difference term	0.0000	Steady ***
d7MAB	Intercept and Lag difference term	0.0000	Steady ***

\*, \*\*and\*\*\*denote significance at the 10%, 5%, and 1% levels, respectively.

4.2. Correlation analysis

The results of Shapiro-Wilkerson test show that the main variables refuse to obey the original hypothesis of normal distribution under the significance level of 1%. Therefore, in order to avoid the influence of outliers and ensure the accuracy of test results, Spearman correlation coefficient is used in this paper to measure the correlation between variables. The results are shown in Table 3.

Table 3: Correlation test

	Retindex	d7MAB
Retindex	1	
d7MAB	-0.0844**	1

\*, \*\*and\*\*\*denote significance at the 10%, 5%, and 1% levels, respectively.

According to the test results, the investor fear constructed in this paper has a negative correlation with the stock yield at a significant level of 5%. The reason may be that when a new virus spreads, increased health risks contribute to investor pessimism, helping to drive stock prices lower.

In addition, through BG test results and the autocorrelation graph of residual term in Figure 1 below, it can be seen that there is no autocorrelation in random interference term.

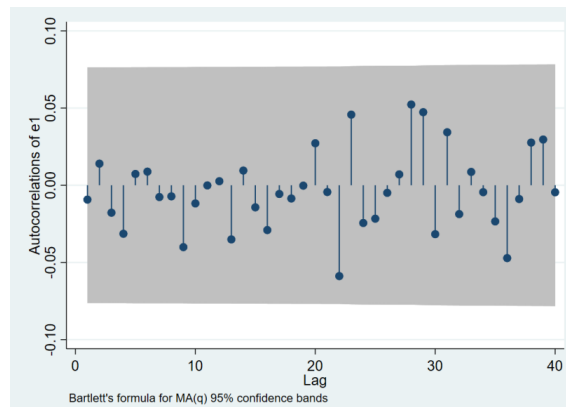


Figure 1: Autocorrelation graph

4.3. Model building

According to the above analysis results, the following benchmark regression model is established:

$$\text{Retindex} = \alpha + \beta \text{d7MAB} + \text{ME} + \epsilon_t$$

Among them, Retindex is the daily return rate of Shanghai Composite Index; d7MAB is the first-order difference form of seven-day moving average of Baidu index;  $\alpha$  is the intercept term;  $\beta$  is the coefficient of d7MAB (representing the extent to which every 1 unit increase of Baidu search index has an impact on the daily return of Shanghai Composite Index); ME represents the fixed effect of the month, which is used to control the abnormal returns caused by the change of the month in the stock market, and  $\epsilon_t$  is the random error term.

4.4. Regression analysis

The regression results are shown in Table 4. The variable d7MAB is significant at the 1% level, indicating that the Baidu index provides significant information about the stock market performance during the epidemic. That is, when the number of Baidu searches for coronavirus-related terms increased,

the degree of investor fear represented by it increased and further caused the stock market to decline. Our results support Decker and Schmitz (2016) et al.'s theory that increased health fears lead to market declines. What's more, it shows that investors' fear caused by the COVID-19 pandemic can predict the decline of stock prices.

Table 4: Econometric analysis

Variable	Retindex
d7MAB	-0.0007*** (-2.81)
Monthly fixed effect	yes
N	659
R <sup>2</sup>	0.0119
Adj R <sup>2</sup>	0.0104

\*, \*\*and\*\*\*denote significance at the 10%, 5%, and 1% levels, respectively.

## 5. Robust test

To make the conclusion more reliable, this paper adopts the supplementary variable method to test the robustness. In view of the fact that National Health Commission of the People's Republic of China publishes the daily number of new infections, and high growth of cases means high health risks, the resulting "Announcement Effect" will bring a cumulative negative impact on the stock market.<sup>[15]</sup> Therefore, we added the variable of new daily confirmed cases to construct the new model. Considering the low amount of nucleic acid testing during non-working days, in order to eliminate seasonal problems, the daily number of confirmed cases published by the National Health Commission during the period from February 24, 2020 to November 17, 2022 was similarly calculated using a seven-day moving average. Considering the stationarity of data, the first order difference form is adopted (denoted as d7NCP).

Construct a new regression model:

$$\text{Retindex} = \beta_0 + \beta_1 \text{d7MAB} + \beta_2 \text{d7NCP} + \text{ME} + \epsilon_t$$

Among them, Retindex is the daily return rate of Shanghai Composite Index; d7MAB is the first-order difference form of seven-day moving average of Baidu index; d7NCP represents the first-order difference form of the seven-day moving average of daily newly confirmed cases.  $\beta_0$  is the intercept term;  $\beta_1$  is the coefficient of d7MAB;  $\beta_2$  is the coefficient of d7NCP (represents the impact of every 1 unit increase in daily confirmed cases on the daily return of the Shanghai Composite Index); ME represents the monthly fixed effect;  $\epsilon_t$  is the random error term.

The regression results are shown in Table 5 below. After the robustness test with the addition of new variables, it is found that while R<sup>2</sup> improves, d7MAB is still significant at the 5% level, and is still negatively correlated with the daily return of the stock market, which is consistent with the conclusions above. At the same time, we found that the regression result of dNCP was significant at the 1% level, and the regression coefficient was negative. This suggests that the "Announcement Effect" brought about by daily confirmed cases has an equally significant and negative effect on stock market performance.

Table 5: Econometric analysis

Variable	Retindex
d7MAB	-0.0055** (-2.18)
d7NCP	-0.00032*** (-2.73)
Monthly fixed effect	yes
N	659
R <sup>2</sup>	0.023
Adj R <sup>2</sup>	0.02

\*, \*\*and\*\*\*denote significance at the 10%, 5%, and 1% levels, respectively.

## 6. Conclusions

This paper uses the research method of big data analysis, through keyword sorting of hot events and

applying Baidu index as a proxy variables of investor fear, to more truly and accurately measure the impact of the background of COVID-19 on the performance of China's stock market. Finally, the following conclusions are reached.

Firstly, investors' fear of the epidemic has a significant negative impact on Chinese stock market performance. This paper first describes how pandemics have impacted national economies in the past, and then explains how investor sentiment affects stock market performance from the perspective of behavioral finance. Taking the search volume of Internet search engine as the information source, we construct the investor fear sentiment composite index, and find that the increment of the index has a significant negative impact on the stock yield. In addition, the robustness test results suggest that investors' fear of COVID-19 can independently exert negative price pressure on the stock market.

Secondly, this paper provides empirical evidence that Baidu Index can be used as a useful tool to assess people's fear of COVID-19 in the current period, which can help scholars exploring market performance factors to build more accurate measurement models. More importantly, through this article, readers can more personally and specifically understand the negative impact of the epidemic disaster. At the same time, it will also serve as a warning to the regulatory authorities, while further improving the IPO system and improving the stock quality of our capital market, strengthening the emergency work for all kinds of emergencies.

There are also defects and deficiencies in the study of this paper. Due to the multi-faceted impact of the epidemic, it will not only trigger the fear of investors, but also lead to the government has to take corresponding economic stimulus programs. Meanwhile, the impact of the epidemic on China's stock market is multidimensional, including liquidity and volatility. Subsequent studies can dig deeper into this issue to more accurately measure and grasp the impact on the stock market.

## References

- [1] Yu Qingjin, Zhang Bing. (2012). *Investors' Limited Attention and Stock Returns--An Empirical Study on Baidu Index*. *Financial Research* (08), 153-165.
- [2] Chen Bingzheng. (2020). "Pandemic Disease" Should be Considered a Catastrophe Risk. *China Insurance* (03), 5.
- [3] Li Zhengquan. (2003). *The Short and Long Term Analysis of SARS Influence on National Economy*. *Economic Science* (03), 25-31.
- [4] Yang Zihui, Wang Shudai. (2021). *Systemic Financial Risk Contagion of Global Stock Market under Public Health Emergency: Empirical Evidence from COVID19 Epidemic*. *Economic Research* (08), 22-38.
- [5] Zhang Youguo, Sun Bowen, Xie Rui. (2021). *Study on Decomposition and Countermeasures of the Economic Impact of Covid-19*. *Statistical Research* (08), 69-82.
- [6] Tong Jiadong, Sheng Bin, Jiang Dianchun, et al. (2020). *Global Economy amid the COVID-19 Outbreak and Challenges for China*. *International Economic Review* (03), 9-29.
- [7] Chen Lin, Qu Xiaohui. (2020). *Market Response to Contagious Public Health Events--A Research Based on COVID-19's Impact on Chinese Stock Market*. *Finance Forum* (07), 25-65.
- [8] Yuan Mengyi, Hu Di. (2021). *Study of Risk Spillover Effect of Global Stock Market against Background of COVID-19 Impact*. *Finance Forum* (09), 36-48.
- [9] Feng Zhenhua, Tang Mingkun. (2021). *Steady State Equilibrium of Stock Investment Behavior in Information Shocks: Theoretical Analysis based on Behavioral Finance and MCMC Simulation Verification*. *Financial Economic Research* (05), 148-160.
- [10] Liu Weiqi, Liu Xinxin. (2014). *Individual/institutional investor sentiment and stock returns: Shanghai A-share market*. *Management Sciences in China* 17(03), 71-87.
- [11] Liu Y-J, Zhang Z, Zhao L. (2015). *Speculation Spillovers*. *Management Science* 61(03), 649-64.
- [12] S Decker, H Schmitz. (2016). *Health Shocks and Risk Aversion*. *Health Economics* 50, 156-170.
- [13] E Vasileiou. (2021). *Explaining stock markets' performance during the COVID-19 crisis: Could Google searches be a significant behavioral indicator?* *Intelligent Systems in Accounting, Finance and Management* 28(03), 173-181.
- [14] Z Da, J Engelberg, P Gao. (2015). *The Sum of All FEARS Investor Sentiment and Asset Prices*. *Review of Financial Studies* 28(01), 1-32.
- [15] Xu Hong, Pu Hongxia. (2021). *The Impact of COVID-19 on China's Stock Market--Based on Event Study*. *Finance Forum* (07), 70-80.