



## Impact of COVID-19 Attention on Pharmaceutical Stock Prices Based on Internet Search Data

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### Abstract

To date, according to the latest data on the World Health Organization's website, the COVID-19 outbreak has killed more than 2.65 million people worldwide. In this study, 223 pharmaceutical stocks in the CSI 300 Index from November 1, 2019 to June 8, 2020 were selected as the research samples to study the impact of investors' attention to COVID-19 on the pharmaceutical stock market. Based on Baidu index, this paper uses Fama-French three-factor model and panel regression analysis to explain the impact of investors' increasing fear of the epidemic on the pharmaceutical stock market from the three dependent variables of return rate, trading volume and range. The results show that the degree of investors' attention to COVID-19 has a significant positive impact on the yield, volume and range of the pharmaceutical stock market in the same period.

**Keywords:** COVID-19; Baidu Index; Investor Attention

### Introduction

In recent years, the academic research on behavioral finance has gradually focused on the perspective of investors' attention, because the research finds that the increase of investors' attention will cause the change of stock prices. Malkiel and Fama (1970) proposed and deepened the efficient market hypothesis, believing that under the premise of market efficiency, all valuable information can be timely, effective and fully reflected in stock price changes [1]. However, Huberman and Regev (2001) believed that stock price changes were based on investors' attention to stock information and that stock prices would change only when new information was received [2]. Hirshleifer, *et al.* (2003) proposed that the necessary condition for stock trading is investors' attention to stocks, and only when they pay attention to stock information will they have subsequent information processing, and finally form investment decisions [3]. Generally, investors don't necessarily buy all

the stocks they care about, but they do buy stocks they care about. With the development of information technology, the attention of economic individuals has gradually become a scarce resource. Simon (1955) proposed that excessive information would lead to poor attention [4]. When faced with a large amount of information, the main body's attention to the emergency information will inevitably reduce the attention to other information, so the emergency that attracts investors' attention will inevitably cause changes in the financial market, and the stock market will also be affected to different degrees.

The first case of COVID-19 occurred in Wuhan on December 12, 2019, and 136 new cases were reported in the two days from January 18 to 19, 2020. Since then, COVID-19 has attracted wide attention nationwide. With the sudden events, the attention of network information increases. Investors will make their investment judgment based on their high attention to the market.

Attention to Internet information comes from investors' search for Internet data. With the rapid development of Internet search engines and big data era, Internet search index has gradually become a direct proxy indicator to measure investors' attention. The relationship between Internet search index and stock market has been confirmed by many researches. In the past few years, starting from Da's research on Google search index, Internet data has been widely used in the financial market [5]. Compared with traditional metrics, web search metrics can objectively reflect investors' concerns. Therefore, this article, based on the investors pay close attention to as a proxy variable of baidu index, based on baidu index of investor attention and CSI 300 pharmaceutical shares market yields, volume, and the relationship between the amplitude, so as to better measure the majority of investors of the emergency attention to the influence of the stock market, help investors more rational investment decisions.

### Theoretical basis and research hypothesis

There is a dynamic relationship between investors' attention and the stock market. Investors' attention directly affects the stability of the market and is closely related to the decision investor make in the financial market. According to previous studies, changes in the stock market can be reflected to some extent by investors' attention to the information market. Therefore, in recent years, how to choose the appropriate measurement index to make a reasonable analysis of the changes in the financial market becomes particularly important.

Foreign scholars have observed that investor attention has an impact on the stock market and there are more mature measures for investor attention. Early on, Earl found that Wall Street Journal sales were higher when earnings were announced, and the stock price changed significantly over the same period. As a popular research direction of behavioral finance, Chinese scholars have also studied investors to a certain extent and achieved certain results. Wang Chun and Xu Binglong (2009) divided investors' attention indicators into "attention" "limited attention" and believed that investors would have different reactions when receiving different news, which would also have different influences on the stock market [6].

In terms of measuring investors' attention, Da., *et al.* (2011) initially used Google search frequency as a measure of investors' attention, while domestic scholars tend to use Baidu index search

frequency as a measure of investors' attention. Yu Qingjin and Zhang Bing (2012) studied the influence of investors' attention as a proxy variable on stock return based on Baidu Index [7].

When Studying the impact of economic news and political news on stock price volatility, Clive found that economic news and political news brought different degrees of changes to stock returns [8]. News can increase investors' attention to an event. On January 20, General Secretary Xi Jinping issued the highest instruction on COVID-19. After Zhong nan shan confirmed the human-to-human transmission of COVID-19 and the occurrence of a large number of cases, investors' attention to the COVID-19 epidemic increased, leading to the soaring of medical stocks such as protective equipment. Scholar found in their research that investors tend to prefer stocks that can attract their attention when making decisions, thus making the stock price show an upward trend in the short term [9]. As can be seen from the Baidu index, the attention of online names to "pneumonia" surged from 8,446 times on January 18, 2020 to 28,447 times on January 19 and reached the peak of 760,000 times on January 25, 2020. Due to the increased investor interest in COVID-19, the following hypothesis is proposed:

- **H1:** Investor attention to the COVID-19 epidemic is in direct proportion to the profitability of pharmaceutical stocks. Kahneman first put forward the concept of "limited attention" and believed that limited attention would lead to the reduction of investors' efficiency in information processing. In fact, concerns can be divided into "concerns" and "limited concerns". The former refers to investors' overreaction to the corresponding stocks deviated from the fundamentals when a specific event occurs [10], while the latter refers to investors' inadequate response to the information affecting the fundamentals when they cannot fully process and absorb all available information. Da., *et al.* used Google search volume (SVI) to measure the attention level of individual investors to stocks and found that there was a direct link between SVI and trading activity of individual investors. Berry studied the British stock market and found that the number of news releases by Reuters was correlated with the stock turnover in the same period.

As public awareness of COVID-19 has increased, people have realized the need for self-protection. At the same time, temporary hospitals have been set up in each epidemic area, which is affected

by the cause of the epidemic in a short period of time and the demand for medical equipment, protective equipment and viral drugs has increased significantly. Such information will also influence investors' investment decisions. Therefore, the following hypotheses are proposed:

- **H2:** Investors' attention to the COVID-19 epidemic will lead to an increase in the trading volume of pharmaceutical stocks in the short term.

There is some uncertainty about the extent to which the COVID-19 epidemic will affect the economy until it is effectively contained. Looking back at the short-term impact of SARS on the domestic stock market in 2003, its impact on the stock market was short and limited. Zhang Yi (2003) study medicine plate is affected by SARS, one of the biggest plate, and the cumulative excess return in a few days before the incident to rise faster, pharmaceutical stocks, on average, the cumulative excess yield reached 10%, and the end of the event a few growing degree decline, this is due to the information about SARS, opaque, and investors do not understand the new disease, produced to chase after hold in both hands pharmaceutical stocks [11].

Therefore, with the rapid transmission of information in the era of big data, as well as the surge of information search by online names, investors will pay more attention to pharmaceutical stocks during the epidemic. Therefore, the following hypotheses are proposed:

- **H3:** Increased investor concern over COVID-19 will increase the volatility of the pharmaceutical stock market.

## Data source and variable description

### Data source

The first case of COVID-19 was discovered on December 12, 2019, so the sample selected 234 pharmaceutical stocks in the CSI 300 index from November 1, 2019 to June 8, 2020 as study subjects. In order to avoid the impact of noise from data sources, the sample selection in this paper has excluded ST listed companies and stocks with more data missing. 223 stocks are finally selected as samples and missing samples of Baidu search data are also excluded. Investors pay attention to the data from Baidu index, and use Python3.7 constructed web crawler code to capture the data, while the stock market transaction data are all from wind database.

## Variable description and descriptive statistics

In this paper, terms such as virus, pneumonia and COVID-19 were used to measure the degree of concern of investors on COVID-19 through baidu Index. Due to the difference of investors' attention ability and access to information in different periods, this paper selects the weighted average of three attention nouns as the media index. Baidu index is corresponding to the Google index commonly used in foreign literature, which is based on the search volume of a certain keyword to measure the public's attention to a certain keyword. In this paper, baidu index is the respective search volume of keywords including epidemic, pneumonia and COVID-19 concept.

Based on the Fama-French three-factor model, this paper selects the RET per share, MRET, BM and Size of the CSI 300 index as explanatory variables. Stock return (SY), stock turnover (Turn) and stock amplitude (SA) are explained variables. Because the absolute number of search volume is large, the baidu index and media index of the keywords used in this paper are processed by natural logarithm. Based on the above analysis, the regression model of this paper is set as follows:

$$RET_{i,t} = \alpha_0 + \beta_1 \times MRET_{i,t} + \beta_2 \times Size_{i,t} + \beta_3 \times BM_{i,t} + \beta_4 \times SVI_{i,t} \epsilon_{i,t}, \dots (1)$$

## Model setting and regression analysis

Firstly, based on model (1), descriptive statistics, correlation analysis and effect model selection are carried out. Then, the regression is carried out from the Angle of three dependent variables.

## The impact of investors' attention on the profitability of pharmaceutical stocks

In order to test the impact of theoretical investors' attention on the return rate of pharmaceutical stocks, this study replaced explained variables on the basis of model (1) and established the following model:

$$SY_{i,t} = \alpha_0 + \beta_1 \times MRET_{i,t} + \beta_2 \times Size_{i,t} + \beta_3 \times BM_{i,t} + \beta_4 \times SVI_{i,t} + \epsilon_{i,t}, \dots (2)$$

In the regression of model (2), the return rate of a single stock is taken as the dependent variable and investors' attention is taken as the independent variable. The results show that the attention of investors under the epidemic situation has a significant positive impact on the return rate of stocks ( $P < 0.01$ ), indicating that the increase of investors' attention to the epidemic situation will increase the return rate of pharmaceutical stocks. Hypothesis one is true.

SY	Coef.	St.Err.	t- value	p-value	95% Conf	Interval	Sig
Ln SVI	0.028	0.009	2.93	0.003	0.046	0.009	***
MRET	-0.010	0.014	-0.75	0.453	-0.038	0.017	
Ln BM	2.027	0.553	3.66	0.000	0.943	3.111	***
Ln Size	-0.193	0.160	-1.21	0.226	-0.506	0.120	
Constant	6.869	3.632	1.89	0.059	-0.250	13.988	*
<b>Mean dependent var</b>	<b>2.822</b>		<b>SD dependent var</b>		<b>4.165</b>		
R-squared	0.002		Number of obs		29600.000		
F-test	11.816		Prob > F		0.000		
Akaike crit. (AIC)	156342.042		Bayesian crit. (BIC)		156383.520		

**Table 1:** Descriptive statistical results of variable SY.

**The impact of investor attention on the volume of pharmaceutical shares**

In order to test the impact of theoretical investors' attention on the turnover of pharmaceutical stocks, this study replaced exp-

lained variables on the basis of model (1) and established the following model:

$$Turn_{i,t} = \alpha_0 + \beta_1 \times MRET_{i,t} + \beta_2 \times Size_{i,t} + \beta_3 \times BM_{i,t} + \beta_4 \times SVI_{i,t} + \epsilon_{i,t} \dots (3)$$

Turn	Coef.	St. Err	t- value	p- value	95% Conf	Interval	Sig
Ln SVI	0.027	0.008	3.18	0.001	0.010	0.043	***
MRET	0.028	0.012	2.27	0.023	0.004	0.052	**
Ln BM	0.530	0.487	1.09	0.276	-0.424	1.484	
Ln Size	-0.042	0.140	-0.30	0.766	-0.317	0.234	
Constant	0.583	3.195	0.18	0.855	-5.680	6.845	
<b>Mean dependent var</b>	<b>0.108</b>		<b>SD dependent var</b>		<b>2.995</b>		
R-squared	0.001		Number of obs		29600.000		
F-test	3.832		Prob > F		0.000		
Akaike crit. (AIC)	148756.436		Bayesian crit. (BIC)		148797.914		

**Table 2:** Descriptive statistical results of the variable turn.

In the regression model (3), the individual stocks trading volume as the dependent variable, investors pay close attention to as independent variables, the results found that investors concerned about the outbreak of COVID - 19 will lead to increase in the short term medical volume (p < 0.01), the higher the investor attention of epidemic diseases, it affects the production of pharmaceutical company, the ability of the company, lead to higher stock trading volume, hypothesis H2 was established.

**The effect of investor attention on the amplitude of pharmaceutical shares**

In order to test the influence of theoretical investors' attention on the amplitude of pharmaceutical stocks, this study replaced explained variables on the basis of model (1) and established the following model:

$$SA_{i,t} = \alpha_0 + \beta_1 \times MRET_{i,t} + \beta_2 \times Size_{i,t} + \beta_3 \times BM_{i,t} + \beta_4 \times SVI_{i,t} + \epsilon_{i,t} \dots (4)$$

SA	Coef.	St.Err.	t-value	p-value	95% Conf	Interval	Sig
Ln SVI	0.003	0.000	43.53	0.000	0.003	0.003	***
MRET	-0.003	0.000	-27.57	0.000	-0.003	-0.002	***
Ln BM	-0.081	0.004	-21.50	0.000	-0.089	-0.074	***
Ln Size	0.030	0.001	27.09	0.000	0.027	0.032	***
Constant	-0.632	0.025	-25.46	0.000	-0.680	-0.583	***
<b>Mean dependent var</b>	<b>0.040</b>		<b>SD dependent var</b>		<b>0.028</b>		
R-squared	0.204		Number of obs		29600.000		
F-test	1884.395		Prob > F		0.000		
Akaike crit. (AIC)	-138839.587		Bayesian crit. (BIC)		-138798.109		

**Table 3:** Descriptive statistical results of variable SA.

In the regression of model (4), the amplitude of an individual stock is taken as the dependent variable and investors' attention is taken as the independent variable. The results show that investors' attention to COVID-19 epidemic has a significant positive impact on the amplitude of the stock ( $P < 0.01$ ). It is assumed that H3 is true.

### Conclusion

This paper studies the changes of medical stock market based on investors' attention under emergencies. The research results show that: First, Baidu Index can reflect investors' attention to a certain extent. Compared with traditional proxy variables and media proxy variables, Baidu Index can reflect investors' attention more accurately and instantly. Second, the research results show that the increase of investor attention is accompanied by the increase of stock market volatility, which will also have a positive impact on investor attention. The increase of investors' attention has a significant positive impact on the stock market yield, volume and amplitude in a short time. Third, the COVID-19 outbreak has had an impact on the overall stock market, but the virus outbreak has had the most significant impact in the pharmaceutical sector.

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