



温州肯恩大学
WENZHOU-KEAN UNIVERSITY

**The relationship between investor attention and stock performance
of Chinese real estate industry**

In Partial Fulfillment of the Requirements
for the Bachelor of Science in Finance

by

ZHENG Anyin

1098535

May, 2022

The relationship between investor attention and stock performance of Chinese real estate industry

December 1, 2021

Anyin Zheng^{a,*}

^a *School of Accounting and Finance, College of Business and Public Management, Wenzhou-Kean University, Wenzhou, China 325000.*

Abstract

With the development of the behavior finance and information technology, such as the emergence of Baidu index, provided a direct measure of investor attention. This study explored the relationship between investor attention and stock performance in the Chinese A-shared market in real estate listed companies. We used a sample of 157 listed companies covering period from 2016 to 2018 in China Stock Market and Accounting Research Database daily frequency. In this study, the unit root test was used first to test data stability and then multivariate regression model was applied to examine the relationship. The result showed that the investor attention had a significantly positive affect on firm's stock performance. In terms of the robustness check, we used two methods to re-examine the relationship to reach a consistent conclusion. One was with alternative variable to change the measurement of investor attention; the other one was with the lag coefficient of the main variable to test the endogeneity. By monitoring the attention data of a particular stock on the previous day, we could predict to a certain extent the change of stock dividend rate on the next day. The conclusion of this paper was helpful for investors to better understand and predict the dividend rate of Chinese real estate market.

JEL Classification: G41

Keywords: Investor attention, stock performance, estate industry

*Correspondence to Anyin Zheng at anyinz@kean.edu

Introduction

1.1 Background Information

The traditional investment theory constructed a whole set of economic theory system on the basis of rationality and market efficiency. However, with the development of financial market, traditional financial theory could not explain various irrational behaviors of individuals in the process of transaction. Therefore, behavioral finance began to emerge and gradually developed and improved, which played a supplementary role in explaining the traditional finance theory. Its main point of view was that investors were always affected by personal subjective emotions and other factors to varying degrees in the process of investment decision-making, which made investors unable to make rational investment decisions. Investor attention theory combined psychology and behavioral finance to study the internal distribution mechanism and allocation efficiency of attention, which further improved the theory of traditional financial theory (Adra, 2018). With the rapid development of Internet technology, the information people were exposed to also presents an exponential expansion, but people's ability to process information could not achieve rapid growth in a short period like computers. The average person could not cope with so much information, and as Herbert Simon argued in his book *Managing Behavior*, it distracted attention and makes personal attention scarce. The contradiction between the excess of information and the scarcity of attention restricts investors to a certain extent in analyzing and processing relevant information. Because of such constraints and limitations, investors had to be selective when processing information. Concentrating information resources on one thing also meant that cognitive attention was allocated from other things. The increase of investor attention would change the cognition degree of such assets, thus adjusting the investment portfolio, thus breaking the dynamic equilibrium in the original trading market, and ultimately affecting the change of asset price. Therefore, in the financial market, when investors made relevant investment decisions in the face of excessive information, it was actually a process of rational allocation of

their own attention.

As an important part of supporting the development of national economy, the real estate industry had the characteristics of high price and high demand, which made people pay attention to the real estate price. In the context of the Internet era, the operation mode of the real estate market had changed, and the prediction of real estate price had a new research direction and perspective (Ding, 2015). Behavioral finance was closer to real life than traditional economic theory, which assumed that the price of a product was determined by its value, based on the basic assumptions of rational man, utility maximization, and uniform preferences. In the current era, the ability of investors to obtain information has been greatly improved, and many behavioral factors of investors have been recorded in internet-related data, which could express the psychological changes and attention fluctuations of investors, and may greatly affect the development of the real estate industry (Lou, 2014).

1.2 Issue or research question

The real estate industry was an important part of the national economy, and what factors effected the real estate companies' stock performance was a hot topic for the public at home and abroad. Whether the government, real estate companies or ordinary investors, were very concerned about the change of real estate stock prices. The real estate stock market was affected by a variety of factors, including macroeconomic environment, upstream and downstream industry dynamics and relevant policy changes. In addition to these factors that were often considered, in the real estate market, because the buyers and sellers were in an information inequality position, the buyers would try their best to search for more relevant information to assist decision-making in order to reduce the possible damage caused by the information inequality. And the seller would know more about the buyer in order to maintain its advantageous position. This made investor attention has become one of the factors that can't be ignored. So what's the specific relationship between investors' attention and the performance of China's real estate stock market?

1.3 Main findings

To test our assumption, using sample data of Chinese real estate stock market from January 1, 2016 to December 31, 2018 in China Stock Market and Accounting Research database to construct panel data set in daily frequency, and used Baidu index to construct quantitative proxy variables of investor attention. In table 2, we found that there was a positive correlation between investor attention dividend rate of Chinese real estate companies. Through the unit root test in table 3, we found that the data were stationary series, and then we carried out multiple regression which found the investor attention had a significantly positive effect on dividend rate of Chinese real estate companies.

To check the results, we performed robustness tests in two ways. First of all, in order to solve the sample selection bias, we replaced the measurement method of proxy variables, and used Google Trend instead of Baidu index to construct investor attention, so as to measure investor attention more comprehensively. As could be seen from Table 6, after regression calculation using Google trend to replace Baidu index, investor attention still had a significant positive impact on stock returns. This finding had certain application value for individual investors. By monitoring the attention data of a particular stock on the previous day, they could predict to a certain extent the change of stock dividend rate on the next day.

The regression results of current periods of investor attention all indicated that investors' attention can lead to the amplification of stock trading volume and turnover rate in the near future. However, for the current investor concern and the stock market performance, whether the investor concern caused the change of the market performance, or the market performance caused the investor attention, can't be well distinguished. Secondly, considering the influence of endogeneity on the significance of multiple regression results, we tested the original independent variable Baidu index with a lag of one period. As could be seen from Table 7, the lag coefficient of the overall attention measure was still significantly positive at the significant level of 5%, which

meant that the increase of attention one day in advance would significantly improve the prediction of future yield level.

1.4 Contributions to investor, policy maker and literature

On the one hand, for investors, the scarcity of attention raised the question of how to allocate the limited attention among the many potential investments. The research and development of investor attention could have a deeper understanding of human behavior and guide investors to make investment decisions. At the same time, it was helpful to improve the relevant system of investor protection, protected the interests of investors, and provided reference for other capital markets in transition. On the other hand, for government regulation and control, mastering the correlation between investor attention and stock performance of companies related to Chinese real estate industry could more accurately control the operation state of the macro economy and prevent the occurrence of financial crisis, which played a crucial role in Chinese A-share market.

Investor attention was an new emerging field of the academic study in finance. Compared with previous literature, the contribution and innovation of this paper were as follows: First, Investor attention was an new emerging field of study in finance the variable of investor attention was introduced in this paper, which could more accurately measure the relationship between investor attention and the return rate of Chinese real estate stocks in quantitative methods. Second, based on the advantages of daily data of Baidu Index, this paper confirmed that investor attention could positively affect the performance of the stock market. Third, because there were few literature about the combination of investor attention and Chinese real estate stock market in the academic world, this paper could broaden the horizon of relevant academic researches and studies. This paper discussed its importance in China real estate industry from a new perspective of investor attention, in order to establish a descriptive quantitative model that could accurately reflect the actual decision-making behavior of market subjects and the stock performance of real estate companies.

1.5 The structure overview of this paper

The remainder of the paper proceeded as follows. Section 2 reviewed related literature and develops hypotheses. Section 3 described the method, sample, data and variable construction. Section 4 first explained the main result and then showed the robustness check for the result to keep the consistent. Section 5 made the conclusion for the whole paper.

2 Literature Review and Hypotheses Development

2.1 The history about investor attention theory

Looking back at the history of financial research in recent decades, Markowitz (1952) founded the asset portfolio theory and opened up a new direction of financial research. Later, Sharpe (1964) discovered the relationship between expected return rate of assets and risky assets and proposed capital asset pricing model, which became the theoretical basis of modern finance. Then, Ross proposed a model to describe the reasonable pricing of assets which called Arbitrage Pricing Theory (APT), and Eugene F. Fama established and improved the efficient market hypothesis.

Through the continuous efforts and improvement of numerous scholars, a modern financial theoretical system with rigorous logic and unified content has been established on the basis of the above theories, which has provided theoretical support for many financial academic researches. However, with the deepening of research, many scholars have found that there was a definite difference between the content of financial theory and the reality, and some financial errors have been found in the study of the financial market. But traditional financial knowledge is difficult to effectively explain these phenomena. At the same time, modern financial theory was based on the assumption of rational people, which was difficult to meet in reality. Based on this reason, some scholars began to combine psychology and finance theory to explain the operation of financial market from the perspective of investors behavior and psychological factors, thus forming behavioral finance. Behavioral finance was the supplement and perfection of traditional economic theory, which was of great significance to the research and development of economics.

Zhang (2011) studied the influence of Internet open source information on asset pricing and found that Internet information has the ability to explain abnormal returns in China's stock market. The research of investor attention theory is a new field, one of the difficulties is how to quantify the "attention". Peng and Xiong (2007) used stock trading volume to study investors' concerns and found that market information and individual stock information compete for attention. Gao (2011) used Google Trends to quantify investor attention, and Song (2011) also used Google Trends data as a proxy variable of investor attention to study IPO divergence in China's stock market.

2.2 The Positive attitudes about investor attention

The financial market was in dynamic change every day, and everyone's energy was limited. Individual investors could not accept all external information or pay attention to all stocks in the market when they were faced with complicated related information. Aboody (2010) proposed that stock price fluctuations were caused by the attention of individual investors, thus causing such temporary deviations. Quan and Wu (2010) believed that information paid attention to by investors would have an impact on stock price, while information not paid attention to by investors would have no impact on stock price.

Matthias Bank (2011), based on the statistical data of Google Trends, proposed that the statistical data of Google Trends were positively correlated with the trading activity of corresponding stocks. Chen (2016) quantified investor attention by using Baidu index statistics and search volume data of Shanghai Composite Index and Shenzhen Component Index. The results showed that the higher the attention, the higher the return on investment. Wang (2013) took the statistical data of Baidu search index as the research object and selected stocks according to the industry classification standards of Shanghai Stock Exchange to conduct empirical analysis on investors' attention. Data showed that investor attention has positive effects on investment return rate in different periods. Luo (2017) used Google trend search index and company market value to replace investor attention and conducted multiple linear regression analysis on the stock market.

The data showed that investor attention could cause fluctuations in securities trading. Mitchell (1994) found that there was a robust correlation between the number of daily news announcements and stock trading volume of Dow Jones and market returns. Barber (2008) found that individual investors were net buyers of highly watched stocks. Andrei and Hasler (2014) found that investor attention was the main determinant of asset prices from both theoretical and empirical perspectives. Yu and Zhang (2012) tested the correlation between Baidu Index and gem stock market performance, and verified that investor limited attention can affect stock market trading activities.

Based on the above discussions, investor attention was positively associated with stock performance, we therefore proposed our first hypothesis.

Hypothesis 1: Investor attention has a positive impact on stock performance in Chinese real estate industry

2.3 The negative attitudes about investor attention

Liu (2014) took media attention as a proxy variable, built an econometric model and conducted a regression analysis on stock return rate and media attention, and found a negative correlation between them. Peng (2010) from the perspective of media attention, selected the news quantity of each stock in the A-share market as A proxy variable for empirical research. The results showed that the more media attention a company received, the lower the average return on investment on its stock. Rao (2009) found that the more attention media paid to listed companies, the lower the average stock return rate in the following month. Yang (2010) found that online attention had a positive impact on the daily return rate of stocks, but it turned into a negative impact on the next day. Drake (2012) confirmed that Google search can reflect investors' demand for public information. Guo (2019) found positive and neutral news to PM_{2.5} (fine particles) concept stock price had a significant positive impact, negative news on PM_{2.5} concept stocks had a significant negative impact.

Based on the above discussions, investor attention was negatively associated with stock

performance we therefore proposed our second hypothesis.

Hypothesis 2: Investor attention has a negative impact on stock performance in Chinese real estate industry

3 Data and methodology

This paper studies the stock market performance of listed companies in Chinese real estate industry by using econometric methods and Baidu index as a proxy variable for investor attention. Use, stock return rate, turnover rate, price earning ratio, trade volume and company current market value to measure the market performance of the stock. The research of investor attention theory was a new field, and one of the difficulties was that "attention" was difficult to measure. The traditional proxy variables of investor attention mainly included , media coverage and advertising expenditure. The emergence of Baidu index search provided an effective proxy variable for studying investor attention. Compared with traditional proxy variables, it was more time-sensitive and representative. Baidu index was an application based on search log analysis. It analyzed billions of Baidu index results around the world to tell users how often a particular search term has been searched over time and relevant statistics.

In Baidu search, the trend chart of each keyword was divided into two parts: search volume and news citation volume. Users could intuitively see the change trend of the search volume of each keyword in Baidu worldwide and the citation of related news, and detailed bar charts of cities, countries and regions and languages were displayed. Parameters related to stock market performance were derived from the China Stock Market Accounting Research database. This study selected Chinese real estate listed stocks as research samples in total. The period of stock data was from January 1, 2016 to December 31, 2018, including stock turnover rate, price earning ratio, dividend rate and the trading volume.

3.1 Investor attention --- Baidu index

This paper chose the weighted sum of users' search volume of a certain keyword in Baidu,

namely the user attention of Baidu Index, as a proxy variable of investors' attention. Because Baidu is in a monopoly position in the domestic search engine market, using the Baidu index as the proxy variable of investor attention had better representativeness and credibility. After the above analysis, this paper used the listed stock code to record the search volume data of Baidu index, and used the daily data of Baidu index as a proxy variable to measure investor attention, and defines as $attention_{i,t}$ which represented the Baidu index of the i -th stock in phase t .

3.2 Market trading index

The dividend rate was a financial ratio that measures the value of the annual dividend relative to the market value per share of a security. In other words, dividend rate formula calculated the percentage of the stock market price that a company payed out to shareholders in the form of dividends. Return rate was the dividend per share divided by the market value per share. dividend per share was the company's total annual dividend payment, divided by the total number of shares outstanding. Market value per share was the current share price of the company. This paper defined the dividend rate as $Ret_{i,t}$.

Turnover rate referred to the frequency of stock turnover in the market within a certain period of time, which was one of the indicators to reflect the strength of stock liquidity and was measured as a percentage of the total number of shares traded during the year. Turnover rate was the volume over a period divided by total shares issued. The high turnover rate generally meant good stock liquidity, easy access to the market, with strong liquidity. In this paper, the turnover rate was define as $turnover_{i,t}$.

The price-to-earning ratio was the ratio often used as an indicator to compare whether stocks at different prices are overvalued or undervalued. Price-to-earning ratio was the share price divided by earnings per share. Under normal circumstances, the lower the price-to-earning ratio of a stock, the lower the profitability of the market price relative to the stock, indicating that the shorter the payback period, the smaller the investment risk, the greater the investment value of the

stock. In this paper, the price-to-earning defined as the $PE_{i,t}$

The price-to-earning ratio was the ratio often used as an indicator to compare whether stocks at different prices are overvalued or undervalued. Price-to-earning ratio was the share price divided by earnings per share. Under normal circumstances, the lower the price-to-earning ratio of a stock, the lower the profitability of the market price relative to the stock, indicating that the shorter the payback period, the smaller the investment risk, the greater the investment value of the stock. In this paper, the price-to-earning defined as the $PE_{i,t}$

The current market value was the approximate current resale value for a financial instrument within finance. Just as with any other object of value, the current market value offers interested parties a price for which they can enter into a transaction. The current market value was usually taken as the closing price for listed securities or the bid price offered for over-the-counter securities. This paper defined the current market value as $MV_{i,t}$

The price-to-book ratio is used by company to compare a firm's market capitalization to its book value. It was calculated by dividing the company's stock price per share by its book value per share. An asset's book value was equal to its carrying value on the balance sheet, and companies calculate it netting the asset against its accumulated depreciation. This paper defined the price-book ratio as $PB_{i,t}$

The price-to-cash flow ratio was a stock valuation indicator or multiple that measured the value of a stock price relative to its operating cash flow per share. The ratio used operating cash flow, which added back non-cash expenses such as depreciation and amortization to net income. This paper defined the price-to-cash flow ratio as $PCF_{i,t}$

The price-to sales ratio was an investment valuation ratio that showed a company's market capitalization divided by the company's sales for the previous 12 months. It was a measure of the value investors were receiving from a company's stock by indicating how much they were paying for the stock per dollar of the company's sales. This paper defined the price-to-sale ratio as $PS_{i,t}$

Since the relationship between multiple variables was involved in this study, the multiple linear regression model was used for statistical analysis, and the equation was constructed as follows:

$$Ret_{i,t} = \alpha + \beta_1 attention_{i,t} + \beta_2 PE_{i,t} + \beta_3 turnover_{i,t} + \beta_4 MV_{i,t} + \beta_5 vol_{i,t} + \beta_6 PB_{i,t} + \beta_7 PCF_{i,t} + \beta_8 PS_{i,t} + \varepsilon_{i,t} \quad (1)$$

4 Result and discussion

4.1 Main result

The multiple linear regression model included the control variables that were known to capture future yield, and after calculating the p-value, the variable $attention_{i,t}$ and $vol_{i,t}$ was statistically significant at 1% level for the sample 3-year data. So it could be seen that there was a significant and positive relationship between the dependent variable dividend yield and the independent variable investor attention. Therefore, we could say that the stock return rate and trading volume had significantly positive relationship. On the other hand, after calculating the p-value of the turnover rate and the price-earnings ratio, we found that there was not significant relationship between them and the dependent variable stock return rate. The regression results of panel data were sorted out in Table 3. After controlling the turnover rate, price-earning ratio, price-book ratio, volume and other factors in the market, investor attention had a significant positive impact on dividend rate.

In addition, we found that the result were not only statistically significant, but also economically significant. For example of the dividend rate in Table 3, the coefficient on the $attention_{i,t}$ is 0.0014 when the control variable were included which means less than one standard deviation, predicted increase of 86 basis point in all sample data. If we compared this result to the other variable in the same regression, we found that the $Volume_{i,t}$ was about as important economically as the investor attention. However, if we looked at the turnover rate and price-earning ration, we could find there was still no economically significant between them and the

variable dividend rate.

After calculating the main regression results, we would further analyze the data by means of fixed effect model. Fixed effects model, also known as fixed effects regression model, was a panel data analysis method. It meant that the experimental results only compare the differences between specific categories or categories of each independent variable and the effects of specific categories or inter-category interactions with other independent variables. Fixed effect regression was a kind of variable method which varies with individual but not with time in spatial panel data. According to table4 and table5, we could find that investor attention had a significant impact on the return rate of real estate stock price.

4.2 Robustness Checks

Robustness test examined the robustness of the evaluation method and indicator interpretation ability, that was, whether the evaluation method and indicator still maintained a relatively consistent and stable interpretation of the evaluation results when some parameters are changed. Generally speaking, it was to change a specific parameter and repeat the experiment to observe whether the empirical result changes with the change of parameter setting. If the sign and significance are found to change after the change of parameter setting, it indicated that the result is not robust and the problem needs to be found.

In the previous study, we selected a certain amount of representative stocks from Chinese real estate stock market for research, which confirmed the hypothesis of this paper. In order to avoid bias in our conclusions caused by the supervisor judgment in sample screening, the proxy variable of investor attention, Baidu index, would be replaced by the Google trend to measure the investor attention, so as to measure investor attention more comprehensively.

$$\begin{aligned} Ret_{i,t} = & \alpha + \beta_1 attention_{i,t} + \beta_2 PE_{i,t} + \beta_3 turnover_{i,t} + \beta_4 MV_{i,t} + \beta_5 vol_{i,t} \\ & + \beta_6 PB_{i,t} + \beta_7 PCF_{i,t} + \beta_8 PS_{i,t} + \varepsilon_{i,t} \end{aligned} \quad (2)$$

As could be seen from Table 6, after regression calculation using Google trend to replace Baidu index, investor attention still had a significant positive impact on stock returns. This finding had certain application value for individual investors. By monitoring the attention data of a particular stock on the previous day, they could predict to a certain extent the change of stock dividend rate on the next day.

The regression results of current periods of investor attention all indicated that investors' attention can lead to the amplification of stock trading volume and turnover rate in the near future. However, for the current investor concern and the stock market performance, whether the investor concern caused the change of the market performance, or the market performance caused the investor attention, can't be well distinguished. Considering the influence of endogeneity on the significance of multiple regression results, we tested the original independent variable Baidu index with a lag of one period. In detail, we took the lag term of investor attention as an instrumental variable to identify the causal relationship between investor attention and real estate stock return rate. As the equation showed:

$$Ret_{i,t} = \alpha + \beta_1 attention_{i,t-1} + \beta_2 PE_{i,t-1} + \beta_3 turnover_{i,t-1} + \beta_4 MV_{i,t-1} + \beta_5 vol_{i,t} + \beta_6 PB_{i,t-1} + \beta_7 PCF_{i,t-1} + \beta_8 PS_{i,t-1} + \varepsilon_{i,t-1} \quad (3)$$

As could be seen from Table 7, the lag coefficient of the overall attention measure was still significantly positive at the significant level of 5%, which meant that the increase of attention one day in advance would significantly improve the prediction of future yield level. Therefore, the same conclusion can be reached even if the measurement method concerned by investors is changed. This result confirms the robustness of the previous conclusion.

5 Conclusion

This paper used sample data of Chinese real estate stock market from January 1, 2016 to December 31, 2018 in China Stock Market and Accounting Research database to construct panel data set, and used Baidu index to construct proxy variables of investor attention. After that, unit

root test, multiple regression model and fixed effect model were used for regression analysis. Finally, the robustness test was carried out by changing the measurement method of investor attention. Under different regression methods, this paper tested the effect of investor attention on the stock performance of Chinese real estate industry. The empirical results showed that: There was a significant positive correlation between investor attention and related stock performance indicators. The lag coefficient of the overall attention measure was significantly positive, which meant by monitoring the attention data of a particular stock on the previous day, we could predict to a certain extent the change of stock dividend rate on the next day. The conclusion of this paper was helpful for investors to better understand and predict the dividend rate of Chinese real estate market.

The findings of this paper helped the public to better understand the stock performance of Chinese real estate market and the impact of investor attention on market returns; In addition, the conclusion of this paper could also helped investors better predict and explain the return level of Chinese real estate stock market, so as to encourage more enterprises and investors to participate in the real estate stock market and increased the participation degree of the real estate stock market.

But in this study, there were still some shortcomings and the insufficiency, on the one hand, because of some institutional investors did not use a search engine to search the stock information, this part used Baidu index could not effectively capture the total attention of investors; On the other hand, search engine had a certain technical operation application of the threshold, it represented the attention and individual investors were not covered. Subsequent studies could carry out in-depth data mining to more accurately grasp the limited attention of investors represented by Baidu Index.

Reference

- Adra, S., Barbopoulos, G., 2018. The valuation effects of investor attention in stock-financed acquisitions. *Journal of Empirical Finance* 45, 108–125.
- Aouadi, A., Arouri, M., Teulon, F., 2013. Investor attention and stock market activity: Evidence from France. *Economic Modelling* 35, 674–681.
- Andrei, D., Hasler, M., 2015. Investor attention and stock market volatility. *The review of financial studies* 28, 33–72.
- Barber, B., 2008. All that glitters: The effect of attention and news on the buying behavior of individual and institutional investors. *Review of Financial Studies* 21,785–818.
- Bank, M., Larch, M., Peter, G., 2011. Google search volume and its influence on liquidity and returns of German stocks. *Financial Markets and Portfolio Management* 25, 239–264.
- Berry, D., Howe, M., 1994. Public information arrival. *Journal of Finance* 49,1331–1346.
- Cen, W., Tong, N., 2014. The impact of investor attention on stock returns and risk: An empirical study based on the data of Shenzhen Interactive Exchange Platform. *Securities Market Review* 7, 40–47.
- Chen, Z., 2016. Empirical analysis of investor attention and stock market performance based on Baidu Index. *Statistics and Decision* 23, 155–157.
- Chan, K., 2014. Analysis of bond, real estate, and stock market returns in China. *Chinese Economy* 47, 27–40.
- Ding, R., Hou, W., 2015. Retail investor attention and stock liquidity. *Journal of International Financial Markets* 37, 12–26.
- Fang, Y., 2017. Analysis on the timely disclosure behavior of annual reports of listed companies from the perspective of investor attention. *Journal of Finance and Accounting* 17, 55–59.
- Hirshleifer, D., Lim, S., Teoh, H., 2011. Limited investor attention and stock market misreactions to accounting information. *The Review of Asset Pricing Studies* 12, 35–73.
- Hu, H., Tang, L., Zhang, S., Wang, H., 2018. Predicting the direction of stock markets using optimized neural networks with Google Trends. *Neurocomputing* 285, 188–195.
- Mbanga, C., Darrat, F., Park, C., 2019. Investor sentiment and aggregate stock returns: the role of investor attention. *Review of Quantitative Finance and Accounting* 53, 397–428.
- Mitchell, L., Mulherin, H., 1994. The impact of public information on the stock market. *Journal of Finance* 49, 923–950.
- Luo, J., 2017. Empirical test of the relationship between investors' online attention and stock market change. *Journal of Finance and Accounting* 2, 109–113.

- Lou, D., 2014. Attracting investor attention through advertising. *The Review of Financial Studies* 27, 1797–1829.
- Ling, A., Yang, X., 2012. Financial contagion channel of attention allocation based on Google trends *Journal of Management Sciences in China* 15, 104–116.
- Li, J., Yu, J., 2012. Investor attention, psychological anchors, and stock return predictability. *Journal of Financial Economics* 104, 401–419.
- Loughlin, C., Harnisch, E., 2013. The viability of StockTwits and Google Trends to predict the stock market. *Journal of Financial Economics* 64, 341–358.
- Preis, T., Moat, S., Stanley, E., 2013. Quantifying trading behavior in financial markets using Google Trends. *Scientific reports* 31, 12–6.
- Song, S., Cao, K., 2011. Investor attention and IPO anomalies: Evidence from Google trend volume. *Economic research Journal* 21, 145–155.
- Vozlyublennaiia, N., 2014. Investor attention, index performance, and return predictability. *Journal of Banking and Finance* 41, 17–35.
- Wen, F., Xu, L., Ouyang, G., Kou, G., 2019. Retail investor attention and stock price crash risk: evidence from China. *International Review of Financial Analysis* 65, 101–136.
- Yang, X., Zhu, Y., 2016. Local preference, investor sentiment and stock return: Empirical evidence from Online forums. *Journal of Financial Research* 438, 143–158.
- Ye, D., 2017. Company News, Investors' Attention and Stock Price Movement: Evidence from a Stock Forum. *Journal of East China Normal University* 49, 121–136.
- Yuan, H., 2017. The impact of money supply, foreign exchange reserves and transaction amount on Shanghai Composite Index. *Journal of Chifeng University: Natural Science Edition* 33, 61–62.
- Yu, Q., Zhang, B., 2012. Investors limited attention and stock returns: An empirical study of attention based on baidu index *Journal of Financial Research* 28, 152–164.
- Zhang, Y., Wan, D., 2011. The media effect of stock returns: risk compensation or over-attention performance? *Journal of Financial research* 374, 143–156.

Table 1. Descriptive Statistics of relevant variables

The table showed descriptive statistic of daily variables. The Ret was a financial ratio that measures the value of the annual dividend relative to the market value per share of a security. The Attention was the daily search frequency in to measure the investor attention. Sample period was from January 2016 to December 2018, daily frequency. The PE was the share price divided by the earning per share which often used as an indicator to compare stock value. Turnover was the rate of stock turnover in the market within a certain period of time to reflect the strength of stock liquidity. The MV, current market value referred to the market capitalization of a publicly traded company, and was calculated by multiplying the number of its outstanding shares by the current share price. The Vol was the specific number of trades amount in a given period. The PB, Price-to-book Ratio referred to the Ratio of share prices to net assets per share which could be used for stock investment analysis. The PCF, price-to-cash ratio was the ratio of a stock's price to cash flow per share which can be used to evaluate the price level and risk level of stocks. The PS, price-to-sales ratio was calculated by taking a company's market capitalization and divided it by the company's total sales or revenue over the past 12 months.

<i>Variables</i>	<i>Observation</i>	<i>Mean</i>	<i>Std Dev</i>	<i>Min</i>	<i>Max</i>	<i>Skew</i>	<i>Kurt</i>
<i>Ret</i>	66,785	1.63	1.78	0.05	8.27	1.36	3.65
<i>Attention</i>	66,785	46.30	29.39	0.00	100.00	0.08	1.86
<i>PE</i>	66,785	232.72	129.62	7.03	463.13	0.02	1.81
<i>Turnover</i>	66,785	0.18	0.09	0.00	0.33	0.00	1.79
<i>MV</i>	66,785	2.48	6.95	1.88	3.72	3.53	13.18
<i>Vol</i>	66,785	2.65	7.02	2.53	2.41	10.47	184.89
<i>PB</i>	66,785	3.73	2.38	1.02	17.43	3.15	16.45
<i>PCF</i>	66,785	25.14	28.36	3.18	173.15	2.52	9.86
<i>PS</i>	66,785	7.65	19.95	0.69	157.32	6.29	42.31

Table 2. Correlation

The table showed the correlation between our daily variables. The Ret was a financial ratio that measures the value of the annual dividend relative to the market value per share of a security. The Attention was the daily search frequency in to measure the investor attention. Sample period was from January 2016 to December 2018, daily frequency. The PE was the share price divided by the earning per share which often used as an indicator to compare stock value. Turnover was the rate of stock turnover in the market within a certain period of time to reflect the strength of stock liquidity. The MV, current market value referred to the market capitalization of a publicly traded company, and was calculated by multiplying the number of its outstanding shares by the current share price. The Vol was the specific number of trades amount in a given period. The PB, Price-to-book Ratio referred to the Ratio of share prices to net assets per share which could be used for stock investment analysis. The PCF, price-to-cash ratio was the ratio of a stock's price to cash flow per share which could be used to evaluate the price level and risk level of stocks. The PS, price-to-sales ratio was calculated by taking a company's market capitalization and divided it by the company's total sales or revenue over the past 12 months. The p-value for the null hypothesis that the correlation was zero reported in parentheses. Sample period was from January 2016 to December 2018, daily frequency.

	<i>Ret</i>	<i>Attention</i>	<i>PE</i>	<i>Turnover</i>	<i>MV</i>	<i>Vol</i>	<i>PB</i>	<i>PCF</i>	<i>PCF</i>
<i>Ret</i>	1								
<i>Attention</i>	0.28***	1							
<i>PE</i>	0.01	-0.00	1						
<i>Turnover</i>	-0.01	0.01	0.01	1					
<i>MV</i>	0.44***	0.02**	-0.01	-0.00	1				
<i>Vol</i>	0.28***	0.04**	-0.00	0.01	0.61***	1			
<i>PB</i>	-0.28***	-0.13***	-0.00	0.02	-0.21***	-0.13***	1		
<i>PCF</i>	-0.28***	-0.08***	-0.02	0.00	-0.11***	-0.03**	0.28***	1	
<i>PS</i>	0.27***	0.01	0.01	0.02	-0.12***	-0.07***	0.74***	0.05***	1

Table 3. The result of ADF and PP unit root test

The table showed result for the unit root test

$$Ret_{i,t} = \alpha + \beta_1 attention_{i,t} + \beta_2 PE_{i,t} + \beta_3 turnover_{i,t} + \beta_4 MV_{i,t} + \beta_5 vol_{i,t} + \beta_6 PB_{i,t} + \beta_7 PCF_{i,t} + \beta_8 PS_{i,t} + \varepsilon_{i,t}$$

The $Ret_{i,t}$ was a financial ratio that measures the value of the annual dividend relative to the market value per share of a security. The $Attention_{i,t}$ was the daily search frequency to measure the investor attention. The $PE_{i,t}$ was the share price divided by the earning per share which often used as an indicator to compare stock value. $Turnover_{i,t}$ was the rate of stock turnover in the market within a certain period of time to reflect the strength of stock liquidity. The $MV_{i,t}$ was current market value referred to the market capitalization of a publicly traded company. The $Vol_{i,t}$ is the the specific number of trades amount in a given period. The $PB_{i,t}$ was the ratio of share prices to net assets per share which can be used for stock investment analysis. The $PCF_{i,t}$ was the ratio of a stock price to cash flow per share which could be used to evaluate the price level and risk level of stocks. The $PS_{i,t}$ was calculated by taking a company's market capitalization and divided it by the company's total sales or revenue over the past 12 months. The t-statistics were reported in the parentheses below the estimated coefficients. * -stat. sign. at 10% level; ** -stat. sign. at 5% level; *** -stat. sign. at 1 % level. Sample period is from January 2016 to December 2018, daily frequency.

<i>Variable</i>	ADF test statistic		PP test statistic	
	Constant	Constant and trend	Constant	Constant and trend
<i>Ret</i>	3.132***	3.147***	3.987***	3.347***
<i>Attention</i>	50.129***	52.865***	52.027***	51.247***
<i>PE</i>	-11.020**	-11.866**	-11.826**	-12.246**
<i>Turnover</i>	-2.048**	-2.171**	-3.046**	-2.271**
<i>MV</i>	-1.016	-1.710	-1.985	-1.336
<i>Vol</i>	-4.135***	4.148***	-3.125***	1.48***
<i>PB</i>	2.272***	2.126***	2.974***	3.026***
<i>PCF</i>	1.764	3.081	2.986	3.081
<i>PS</i>	2.613***	2.122***	4.946***	3.120***

Table 4. Main Regression Result

The table showed the main regression result for the in -sample regression:

$$Ret_{i,t} = \alpha + \beta_1 attention_{i,t} + \beta_2 PE_{i,t} + \beta_3 turnover_{i,t} + \beta_4 MV_{i,t} + \beta_5 vol_{i,t} + \beta_6 PB_{i,t} + \beta_7 PCF_{i,t} + \beta_8 PS_{i,t} + \varepsilon_{i,t}$$

The $Ret_{i,t}$ was a financial ratio that measures the value of the annual dividend relative to the market value per share of a security. The $Attention_{i,t}$ was the daily search frequency to measure the investor attention. The $PE_{i,t}$ was the share price divided by the earning per share which often used as an indicator to compare stock value. $Turnover_{i,t}$ was the rate of stock turnover in the market within a certain period of time to reflect the strength of stock liquidity. The $MV_{i,t}$ was current market value referred to the market capitalization of a publicly traded company. The $Vol_{i,t}$ is the the specific number of trades amount in a given period. The $PB_{i,t}$ was the ratio of share prices to net assets per share which can be used for stock investment analysis. The $PCF_{i,t}$ was the ratio of a stock price to cash flow per share which could be used to evaluate the price level and risk level of stocks. The $PS_{i,t}$ was calculated by taking a company's market capitalization and divided it by the company's total sales or revenue over the past 12 months. The t-statistics were reported in the parentheses below the estimated coefficients. *-stat. sign. at 10% level; **-stat. sign. at 5% level; ***-stat. sign. at 1 % level. Sample period is from January 2016 to December 2018, daily frequency.

<i>Variables</i>	<i>Ret</i>	<i>Ret</i>
<i>Attention</i>	0.016*** (19.47)	0.009*** (12.20)
<i>PE</i>		0.000*** (2.68)
<i>Turnover</i>		-0.260 (-1.29)
<i>MV</i>		0.000*** (20.78)
<i>Vol</i>		0.000 (0.00)
<i>PB</i>		-0.214*** (-11.31)
<i>PCF</i>		-0.008*** (-10.00)
<i>PS</i>		0.132*** (32.87)
Constant	0.826*** (19.80)	1.081*** (13.53)
Observations	66,785	66,785
R-squared	0.087	0.452

Table 5. The Fixed effect

The table showed result for the fixed effect in the regression:

$$Ret_{i,t} = \alpha + \beta_1 attention_{i,t} + \beta_2 PE_{i,t} + \beta_3 turnover_{i,t} + \beta_4 MV_{i,t} + \beta_5 vol_{i,t} + \beta_6 PB_{i,t} + \beta_7 PCF_{i,t} + \beta_8 PS_{i,t} + \varepsilon_{i,t}$$

The $Ret_{i,t}$ was a financial ratio that measures the value of the annual dividend relative to the market value per share of a security. The $Attention_{i,t}$ was the daily search frequency to measure the investor attention. The $PE_{i,t}$ was the share price divided by the earning per share which often used as an indicator to compare stock value. $Turnover_{i,t}$ was the rate of stock turnover in the market within a certain period of time to reflect the strength of stock liquidity. The $MV_{i,t}$ was current market value referred to the market capitalization of a publicly traded company. The $Vol_{i,t}$ is the the specific number of trades amount in a given period. The $PB_{i,t}$ was the ratio of share prices to net assets per share which can be used for stock investment analysis. The $PCF_{i,t}$ was the ratio of a stock price to cash flow per share which could be used to evaluate the price level and risk level of stocks. The $PS_{i,t}$ was calculated by taking a company's market capitalization and divided it by the company's total sales or revenue over the past 12 months. The t-statistics were reported in the parentheses below the estimated coefficients. * -stat. sign. at 10% level; ** -stat. sign. at 5% level; *** -stat. sign. at 1 % level. Sample period is from January 2016 to December 2018, daily frequency.

<i>Variables</i>	<i>Ret</i>	<i>Ret</i>
<i>Attention</i>	0.003*** (7.48)	0.002*** (12.27)
<i>PE</i>		0.000 (1.05)
<i>Turnover</i>		-0.012 (-0.38)
<i>MV</i>		-0.000*** (-32.64)
<i>Volume</i>		-0.000*** (-16.88)
<i>PB</i>		-0.098*** (-11.29)
<i>PCF</i>		-0.000 (-0.75)
<i>PS</i>		-0.099*** (-101.82)
Constant	1.327*** (78.68)	2.438*** (101.84)
Observations	66,785	66,785
Firm Fixed Effect	Yes	Yes
R-squared	0.023	0.845
Number of code	157	157

Table 6. Alternative measurement of investor attention

The table showed result for the in-sample regression:

$$Ret_{i,t} = \alpha + \beta_1 attention_{i,t} + \beta_2 PE_{i,t} + \beta_3 turnover_{i,t} + \beta_4 MV_{i,t} + \beta_5 vol_{i,t} + \beta_6 PB_{i,t} + \beta_7 PCF_{i,t} + \beta_8 PS_{i,t} + \varepsilon_{i,t}$$

$Ret_{i,t}$ was a financial ratio that measures the value of the annual dividend relative to the market value per share of a security. The $Attention_{i,t}$ was the daily search frequency to measure the investor attention. The $Price_{i,t}$ was the stock's price when it trade on stock market. The $PE_{i,t}$ was the share price divided by the earning per share which often used as an indicator to compare stock value. $Turnover_{i,t}$ was the rate of stock turnover in the market within a certain period of time to reflect the strength of stock liquidity. The $MV_{i,t}$ was current market value referred to the market capitalization of a publicly traded company. The $Vol_{i,t}$ was the the specific number of trades amount in a given period. The $PB_{i,t}$ was the ratio of share prices to net assets per share which could be used for stock investment analysis. The $PCF_{i,t}$ was the ratio of a stock price to cash flow per share which could be used to evaluate the price level and risk level of stocks. The $PS_{i,t}$ was calculated by taking a company's market capitalization and divided it by the company's total sales or revenue over the past 12 months. The t-statistics were reported in the parentheses below the estimated coefficients. *-stat. sign. at 10% level; **-stat. sign. at 5% level; ***-stat. sign. at 1 % level. Sample period was from January 2016 to December 2018, daily frequency.

<i>Variables</i>	<i>Ret</i>	<i>Ret</i>
<i>Attention</i>	0.047*** (8.28)	0.021*** (12.03)
<i>PE</i>		0.000 (0.09)
<i>Turnover</i>		0.028 (0.29)
<i>MV</i>		-0.000*** (-12.28)
<i>Vol</i>		-0.000*** (-5.22)
<i>PB</i>		-0.310*** (-19.88)
<i>PCF</i>		-0.004*** (-6.37)
<i>PS</i>		0.024*** (8.76)
<i>Price</i>	0.046*** (19.76)	0.016*** (6.05)
Constant	0.894*** (27.53)	2.526*** (34.63)
Observations	66,785	66,785
Firm Fixed Effect	Yes	Yes
R-squared	0.094	0.212
Number of code	157	157

Table 7. Lagged the main explained variable

The table showed result for the in-sample regression:

$$Ret_{i,t} = \alpha + \beta_1 attention_{i,t-1} + \beta_2 PE_{i,t-1} + \beta_3 turnover_{i,t-1} + \beta_4 MV_{i,t-1} + \beta_5 vol_{i,t-1} + \beta_6 PB_{i,t-1} + \beta_7 PCF_{i,t-1} + \beta_8 PS_{i,t-1} + \varepsilon_{i,t-1}$$

$Ret_{i,t-1}$ was a financial ratio that measures the value of the annual dividend relative to the market value per share of a security. The $Attention_{i,t-1}$ was the daily search frequency to measure the investor attention. The $PE_{i,t-1}$ was the share price divided by the earning per share which often used as an indicator to compare stock value. $Turnover_{i,t-1}$ was the rate of stock turnover in the market within a certain period of time to reflect the strength of stock liquidity. The $MV_{i,t-1}$ was current market value referred to the market capitalization of a publicly traded company. The $Volume_{i,t-1}$ was the the specific number of trades amount in a given period. The $PB_{i,t-1}$ was the ratio of share prices to net assets per share which could be used for stock investment analysis. The $PCF_{i,t-1}$ was the ratio of a stock price to cash flow per share which can be used to evaluate the price level and risk level of stocks. The $PS_{i,t-1}$ was calculated by taking a company's market capitalization and divided it by the company's total sales or revenue over the past 12 months. The t-statistics were reported in the parentheses below the estimated coefficients. *-stat. sign. at 10% level; **-stat. sign. at 5% level; ***-stat. sign. at 1 % level. Sample period was from January 2016 to December 2018, daily frequency.

	<i>Ret</i>
<i>Attention</i>	0.0058*** (0.0004)
<i>PE</i>	-0.0016 (0.6137)
<i>Turnover</i>	0.3932 (0.3736)
<i>MV</i>	-0.0281*** (0.0421)
<i>Vol</i>	0.0054*** (0.0263)
<i>PB</i>	-0.1762*** (0.0161)
<i>PCF</i>	-0.0632 (0.267)
<i>PS</i>	-0.6286*** (0.1792)
Constant	0.8964*** (0.0426)
Firm Fixed Effect	YES
N	66,785
r2	0.9682